

K.S.Rangasamy College of Technology

(Autonomous)



Curriculum & Syllabus of M.E. Industrial Safety Engineering

(For the batch admitted in 2021 – 2022)

R 2018

**Courses Accredited by NBA, Accredited by NAAC with 'B⁺⁺' Grade,
Approved by AICTE, Affiliated to Anna University, Chennai.**

**KSR Kalvi Nagar, Tiruchengode – 637 215.
Namakkal District, Tamil Nadu, India.**

R4/ w.e.f.23.08.2021

Passed in the BoS Meeting Held on 03.03.2021

Approved in Academic Council Meeting held on 26/06/2021

Academic Council Convener Signature

Chairman,BoS/MCT

VISION

To create industrial safety professionals and make them lead the safety team for achieving the goals of zero accident and excellence in the field of industrial safety management for the benefit of all the stake holders.

MISSION

To enrich the industrial safety knowledge, safety statues and effective safety management skills and techniques in the minds of young engineering professionals by imparting training, workshops, role play, seminars, group discussions, guest lectures, case studies, industrial visits and in-plant training by undertaking live industrial projects.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

- PEO1 :** Graduates of the programme will become professionally competent in the field of Safety, Health and Environment issues, expertise in all sorts of hazard evaluation, risk assessment and safety management systems.
- PEO2** Graduates of the programme will become principal auditors in pinpointing vulnerable areas, therefore suggesting corrective/preventive actions to industries. They are also highly proficient enough in handling emergency scenario, disaster mitigation and extremely knowledgeable in developing emergency preparedness plan.
- PEO3:** Graduates of the programme will have adequate skill in investigating accidents thereby preventing accident in proactive and reactive approach. They will adhere to Indian and International standards in handling Safety, Health and Environment aspects enhancing lifelong learning and engineering ethical behaviour.

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

- PO1: **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- PO2: **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- PO3: **Design /development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- PO4: **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- PO5: **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations
- PO6: **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- PO7: **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- PO8: **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- PO9: **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- PO10: **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- PO11: **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- PO12: **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

Engineering Graduates will be able to:

- PSO1:** Design and implement safety measures and practices pertaining to industrial activities for enhancing safety culture.
- PSO2:** Apply modern techniques, tools and devices to provide effective solutions for issues concerning safety in industries.

MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES (PEOs) WITH PROGRAMME OUTCOMES (POs)

The M.E. Industrial Safety Engineering Programme outcomes leading to the achievement of the objectives are summarized in the following Table.

Programme Educational Objectives	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PEO 1	3	1	3	2	2	1	1	1	2	2	3	1
PEO 2	3	3	3	2	2	1	1	1	2	2	3	1
PEO 3	3	2	3	2	2	1	1	1	3	2	3	1

Contributions: 1- low, 2- medium, 3- high

SEMESTER I

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	50 PIS 101	Probability and Statistics	PC	5	3	2	0	4
2.	50 PIS102	Safety Management	PC	3	3	0	0	3
3.	50 PIS 103	Research Methodology and IPR	PC	2	2	0	0	2
4.	50 PIS E1*	Elective I	PE	3	3	0	0	3
5.	50 PIS E2*	Elective II	PE	3	3	0	0	3
6.	50 AT 00*	Audit Course I	AC	2	2	0	0	0
PRACTICALS								
7.	50 PIS1P1	Industrial Hygiene and Environmental Laboratory	PC	4	0	0	4	2
8.	50 PIS1P2	Industrial Safety Laboratory	PC	4	0	0	4	2
Total				26	16	2	8	19

SEMESTER II

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	50 PIS 201	Fire Engineering and Explosion Control	PC	3	3	0	0	3
2.	50 PIS 202	Industrial Safety, Health and Environment (SHE) Acts	PC	5	3	2	0	4
3.	50 PIS E3*	Elective III	PE	3	3	0	0	3
4.	50 PIS E4*	Elective IV	PE	3	3	0	0	3
5.	50 AT 00*	Audit Course II	AC	2	2	0	0	0
PRACTICALS								
6.	50 PIS 2P1	Industrial Visit Report Preparation and Presentation	EEC	4	0	0	4	2
7.	50 PIS 2P2	Ergonomics Laboratory	PC	4	0	0	4	2
8.	50 PIS 2P3	Mini Project	EEC	6	0	0	6	3
Total				30	14	2	14	20

SEMESTER III

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	50 PIS E5*	Elective V	PE	3	3	0	0	3
2.	50 PIS E6*	Elective VI	PE	3	3	0	0	3
3.	50 AT 009	Research Ethics	AC	1	1	0	0	0
PRACTICALS								
4.	50 PIS 3P1	Project Work Phase – I	EEC	20	0	0	20	10
Total				27	7	0	20	16

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SEMESTER IV

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
PRACTICALS								
1.	50 PIS 4P1	Project Work Phase – II	EEC	32	0	0	32	16
Total				32	0	0	32	16

TOTAL NUMBER OF CREDITS TO BE EARNED FOR AWARD OF THE DEGREE = 71

Note: HS- Humanities and Social Sciences including Management Courses, BS- Basic Science Courses, ES-Engineering Science Courses, PE-Professional Core Courses, PE-Professional Elective Courses, OE- Open Elective Courses, EEC-Employ Enhancement Courses &AC- Audit Courses

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BASIC SCIENCE (BS)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
-	-	-	-	-	-	-	-	-

ENGINEERING SCIENCES (ES)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
-	-	-	-	-	-	-	-	-

PROFESSIONAL CORE (PC)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	50 PIS 101	Probability and Statistics	PC	5	3	2	0	4
2.	50 PIS102	Safety Management	PC	3	3	0	0	3
3.	50 PIS 103	Research Methodology and IPR	PC	2	2	0	0	2
4.	50 PIS1P1	Industrial Hygiene and Environmental Laboratory	PC	4	0	0	4	2
5.	50 PIS1P2	Industrial Safety Laboratory	PC	4	0	0	4	2
6.	50 PIS 201	Fire Engineering and Explosion Control	PC	3	3	0	0	3
7.	50 PIS 202	Industrial Safety, Health and Environment (SHE) Acts	PC	5	3	2	0	4
8.	50 PIS 2P2	Ergonomics Laboratory	PC	4	0	0	4	2

PROFESSIONAL ELECTIVES (PE)**SEMESTER I, ELECTIVE I**

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	50 PIS E11	Industrial Health and Hygiene	PE	3	3	0	0	3
2.	50 PIS E12	Industrial Noise and Vibration Control	PE	3	3	0	0	3
3.	50 PIS E13	Material Handling and Personal Protective Equipment	PE	3	3	0	0	3

SEMESTER I, ELECTIVE II

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	50 PIS E21	Safety in Chemical Industries	PE	3	3	0	0	3
2.	50 PIS E22	Safety in Engineering Industries	PE	3	3	0	0	3
3.	50 PIS E23	Mechanical Integrity Assessment	PE	3	3	0	0	3

SEMESTER II, ELECTIVE III

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	50 PIS E31	Computer Aided Hazard Analysis	PE	3	3	0	0	3
2.	50 PIS E32	Electrical Safety	PE	3	3	0	0	3
3.	50 PIS E33	Nuclear Engineering and Safety	PE	3	3	0	0	3

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SEMESTER II, ELECTIVE IV

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	50 PIS E41	Human Factors Engineering	PE	3	3	0	0	3
2.	50 PIS E42	Cognitive Ergonomics	PE	3	3	0	0	3
3.	50 PIS E43	Behaviour Based Safety and Safety Culture	PE	3	3	0	0	3

SEMESTER III, ELECTIVE V

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	50 PIS E51	Safety in Construction	PE	3	3	0	0	3
2.	50 PIS E52	Dock Safety	PE	3	3	0	0	3
3.	50 PIS E53	Hazardous goods Transportation	PE	3	3	0	0	3

SEMESTER III, ELECTIVE VI

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	50 PIS E61	Environmental Safety	PE	3	3	0	0	3
2.	50 PIS E62	Reliability Engineering	PE	3	3	0	0	3
3.	50 PIS E63	Integrated Management System	PE	3	3	0	0	3

AUDIT COURSES (I / II / III) (AC)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	50 AT 001	English for Research Paper Writing	AC	2	2	0	0	0
2.	50 AT 002	Disaster Management	AC	2	2	0	0	0
3.	50 AT 003	Sanskrit for Technical Knowledge	AC	2	2	0	0	0
4.	50 AT 004	Value Education	AC	2	2	0	0	0
5.	50 AT 005	Pedagogy Studies	AC	2	2	0	0	0
6.	50 AT 006	Stress Management by Yoga	AC	2	2	0	0	0
7.	50 AT 007	Personality Development through Life Enlightenment Skills.	AC	2	2	0	0	0
8.	50 AT 008	Constitution of India	AC	2	2	0	0	0
9.	50 AT 009	Research Ethics	AC	1	1	0	0	0

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	50 PIS 2P1	Industrial Visit Report Preparation and Presentation	EEC	4	0	0	4	2
2.	50 PIS 2P3	Mini Project	EEC	6	0	0	6	3
3.	50 PIS 3P1	Project Work Phase – I	EEC	20	0	0	20	10
4.	50 PIS 4P1	Project Work Phase –II	EEC	32	0	0	32	16

SUMMARY

S.No.	Category	Credits Per Semester				Total Credits	Percentage %
		I	II	III	IV		
1.	HS	-	-	-	-	-	-
2.	BS	-	-	-	-	-	-
3.	ES	-	-	-	-	-	-
4.	PC	13	9	-	-	22	30.9
5.	PE	6	6	6	-	18	25.4
6.	OE	-	-	-	-	-	-
7.	EEC	-	5	10	16	31	43.7
8.	AC	AC I	AC II	AC III		-	-
Total		19	20	16	16	71	100

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50 PIS 101- Probability and Statistics								
PIS: M.E. Industrial Safety Engineering								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P			C	CA	ES
I	3	2	0	60	4	50	50	100
Objective(s)	<ul style="list-style-type: none"> To study the basics of probability to understand the concepts of correlation and regression. To explain about reliability and probability distributions. To provide information about testing of hypothesis and non-parametric methods. To design and analyse the statistical experiments To introduce a variety of statistical models for time series that are applicable in the field of industrial safety engineering. 							
Course Outcomes	<p>At the End of the course, the student will be able to</p> <ol style="list-style-type: none"> Recognize statistical methods and probability models as powerful decision-making tools. Apply the concept of reliability and standard distributions in their field. Use statistical tests in testing hypotheses on data. List the guidelines for designing experiments and recognize the key historical figures in Design of Experiments. Differentiate between various time series models and application of these models appropriately to engineering problems. 							
<p>Probability and Random Variable Probability – Random Variables – Moments – Moment Generating function – Two-dimensional Random variables – Correlation and Regression. [9]</p> <p>Reliability and Distributions Concepts of Reliability – Failure rate – Hazard rate – Mean time between failures (MTBF) – Mean time to failure (MTTF) – Standard distributions – Binomial, Poisson, Normal, Exponential, Uniform and Geometric distributions – Moment generating function, Mean and Variance – Problems. [9]</p> <p>Testing of Hypothesis Test based on Normal, t-distribution, chi-square and F-distributions. Non-parametric Methods: the sign test for paired data, Mann-Whitney U test, Kruskal-Wallis test (H-test), Sampling distribution of V-statistic- Problems. [9]</p> <p>Design of Experiments Analysis of variance- One-way classification – Completely randomized design – Two-way classification – Randomized block design – Latin square Design – 2² Factorial designs. [9]</p> <p>Time Series Components of Time series – Method of Least Squares – Moving averages method (3 years and 5 years) – Exponential trend – Parabolic trend – Seasonal variations: Method of simple averages – Ratio to trend method – Ratio to moving average method – Link relative method. [9]</p>								
						Total Hours [45 +15(Tutorial)] 60		
Text Book(s):								
1	Arora P N, Arora , “Statistics for Management”, S. Chand & Company Ltd, 1 st Edition, 2003.							
2	Veerarajan T, “Probability, Statistics and Random Process”, 3 rd Edition, Tata Mc-Graw Hill Publications, New Delhi, 2008.							
Reference(s):								
1	Johnson, R A, Miller I and Freund J, “Miller and Freund’s Probability and Statistics for Engineers”, Pearson Education, Asia, 8 th Edition, 2015.							
2	Trivedi K S, “Probability and Statistics with Reliability, Queuing and Computer Science Applications”, John Wiley & Sons, New Delhi, 2008.							
3	Anderson O D, “Time Series Analysis: Theory and Practice”, North – Holland, Amsterdam, 1982							
4	Montgomery D C and Johnson L A, “Forecasting and Time Series Analysis”, McGraw Hill, 1976.							

50 PIS 102 - Safety Management

PIS: M.E. Industrial Safety Engineering

Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P			C	CA	ES
I	3	0	0	45	3	50	50	100
Objective(s)	<ul style="list-style-type: none"> To describe the general principles and objectives of safety. To give exposure on safety management and safe operating practices within the industry. To explain the basic practices in industries in regard with industrial process. To provide guidance on accident investigation and reporting. To know the statutory requirements pertaining to safety management. 							
Course Outcomes	<p>At the end of the course, the student will be able to</p> <ol style="list-style-type: none"> Advise legal functions and techniques for effective management of safety practices. Conduct safety audit for identifying strength and weakness of safety practices. Investigate accidents and notify potential causes of accidents in the report. Monitor and measure safety performance of the industry as per Indian standards Inculcate safety through Behaviour Based Safety among workers for promoting safety culture. 							

Concepts and Techniques Evolution of modern safety concept- Safety Management functions- Safety as an integral part of business- Safety Organization- Safety Committee-budgeting for safety-safety policy- Statutory Provisions for safety management.

Incident Recall Technique (IRT)- Job Safety analysis(JSA)/Job Hazard Analysis (JHA), safety survey, safety inspection, safety sampling, evaluation of performance of supervisors on safety. [10]

Safety Audit – Introduction Audit Standards ILO- OSH – 2001, IS 14489 1998 and ISO 45001 - Components of safety audit, types of audit, audit methodology, non conformity reporting (NCR) - Electrical Safety 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. [8]

Accident, Investigation & Reporting Root cause analysis-RCA process-tools-cause effect diagram-corrective and preventive action-(CAPA).Basic Principle of Accident & Prevention concept of an accident, reportable and non reportable accidents, Near Miss Reporting and Analysis, At- Risk Behaviour Analysis - reporting to statutory authorities – principles of accident prevention – accident investigation and reporting – Response to Accidents -4P's Evidences- Accident analysis-based on causes & injury-Problem solving tools for accident analysis -records for accidents, departmental accident reports, documentation of accidents – unsafe act and condition – Accident causation theories- domino sequence – supervisory role – role of safety committee –cost of accident - Accident Case Studies. [10]

Safety Performance Monitoring Proactive & Reactive Performance Monitoring – permanent total disabilities, permanent partial disabilities, temporary total disabilities – IS 3786:1984 Calculation of accident indices, frequency rate, severity rate, frequency severity incidence, incident rate, accident rate, safety “t” score, safety activity rate – problems. [8]

Safety Education and Training Importance of training-identification of training needs-training methods such as hands on training and table top exercise – Programme, 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 – Ethical Responsibilities -Domestic Safety and Training. Behaviour Based Safety(BBS) and safety culture: Pinpointing of unsafe behaviour-Positive reinforcement-observation and feedback. Evolution of Safety culture, Transformation requirement from reactive to proactive culture – Ethical responsibility for safety professional. [9]

Total Hours 45

Text Book(s):

1. Ray Asfahl C “Industrial Safety and Health Management” ,Pearson Prentice Hall, 2003.
2. John V Grimaldi and Rollin H Simonds, “Safety Management”, All India Travellers Book Seller, New Delhi, 5th Edition, 2001.

Reference(s) :

1. Heinrich H W ,“Industrial Accident Prevention”, McGraw-Hill Company, New York, 1980.
2. Philip Hagan, “Accident Prevention Manual for Business and Industry”, N.S.C.Chicago, 13th Edition, 2009
3. Roger L Brauer, “Safety and Health for Engineers”, Wiley, 3rd Edition, 2016
4. “Accident Prevention Manual” – National Safety Council, Chicago, 1982.

50 PIS 103 - Research Methodology and IPR

PIS: M.E. Industrial Safety Engineering

Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P			C	CA	ES
I	2	0	0	30	2	50	50	100
Objective(s)	<ul style="list-style-type: none"> To provide an exposure and to understand facts about research and literature study To educate the art of report writing. To understand the role of IPR contributing to the growth of individuals as well as nation. To kindle the ideas, concepts and creativity among students from any stream. To impart the significance of patent rights. 							
Course Outcomes	<p>At the end of the course, the student will be able to</p> <ol style="list-style-type: none"> Understand the formulation of research problem. Associate literatures pertaining to the research problem. Devise research report and proposal writing. Explain the process of Intellectual property rights. Understand the process of patent. 							
<p>Overview of Research Meaning of research problem - sources of research problem - criteria characteristics of a good research problem - errors in selecting a research problem -scope and objective of research problem. Approaches of investigation of solutions for research problem - data collection – analysis - interpretation and necessary instrumentations. [7]</p>								
<p>Literature Study Effective literature studies approaches, analysis plagiarism and research and publication ethics. [4]</p>								
<p>Report Writing Effective technical writing - how to write report - paper developing a research proposal -format of research proposal - a presentation and assessment by a review committee. [5]</p>								
<p>Intellectual Property Rights Nature of Intellectual Property: patents, designs, trade and copyright. Process of patenting and development: technological research –innovation – patenting - development. International Scenario: International cooperation of intellectual property -Procedure for grants of patents, patenting under PCT. [7]</p>								
<p>Patents Patent Rights: scope of patent rights -licensing and transfer of technology - patent information and databases - Geographical indications. New developments in IPR: administration of patent system. IPR of biological systems, computer software etc. traditional knowledge - case studies, IPR and IITS. [7]</p>								
Total Hours 30								
Text Book(s):								
1.	Stuart Melville and Wayne Goddard, "Research Methodology: An Introduction For Science & Engineering Students", Juta & Company, 1996.							
2.	Robert P Merges, Peter S Menell and Mark A Lemley, "Intellectual Property in New Technological Age", 2016.							
Reference(s) :								
1.	Ranjit Kumar, "Research Methodology: A Step by Step Guide for Beginners" SAGE Publications Ltd, 2 nd Edition, 2011.							
2.	Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.							
3.	Richard W Stim, " Intellectual Property Patents, Trademarks and Copyrights", Cengage Learning,2 nd Edition, 2013							
4.	C R Kothari, "Research Methodology –Methods and Techniques", New Age Publications, New Delhi, 2009.							

Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P			C	CA	ES
I	0	0	4	60	2	60	40	100
Objective(s)	<ul style="list-style-type: none"> To monitor illumination and noise level. To know how to measure and analyze ambient air and the exhaust gas from the stack or chimney. To measure particulate matter in exhaust gas and ambient air. To assess temperature extremities. To estimate the effluent characteristic using volumetric analysis. 							
Course Outcomes	<p>At the end of the course, the student will be able to</p> <ol style="list-style-type: none"> Measure and determine the Light intensity level at workplace. Measure and determine the noise level at workplace. Compute the percentage exhaust gas and particulate matters in emission Determine the temperature extremities at workplace. Determine the characteristics of the given effluent using DO,COD,BOD TDS,TSS, Hardness, turbidity and pH test. 							
<p>Illumination Testing Measurement of lux level using lux meter</p> <p>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</p> <p>Exhaust Gas Measurement And Analysis Measurement of SO_x, NO_x, CO_x, and hydrocarbons Measurement of Particulate matter</p> <p>Measurement of DBT and WBGT</p> <p>Effluent Characteristics Estimation of DO,BOD,COD, Estimation TDS and TSS Estimation of pH and Turbidity Estimation of Hardness</p>								
References:								
1	Industrial Hygiene and Environmental Laboratory Manual.							

50 PIS 1P2 - Industrial Safety Laboratory

PIS: M.E. Industrial Safety Engineering

Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P			C	CA	ES
I	0	0	4	60	2	60	40	100
Objective(s)	<ul style="list-style-type: none"> To expose learner to an industrial atmosphere during the lab session. To understand the selection and usage of Personal Protective Equipment. To identify types of fire extinguisher and its usage. To know the significance of gas detectors, electrical insulation, machine guarding. To train the learner and make them to apply, analyse evaluate and create safe methodologies in industries. 							
Course Outcomes	<p>At the end of the course, the student will be able to</p> <ol style="list-style-type: none"> Study and train in use of the respiratory, non-respiratory personal protective equipment, safety signals, warnings and identify classes of fire with suitable fire extinguisher. Compute the presence of obnoxious gases present in confined spaces and determine thermal stability. Calculate the insulation, earth resistance and test the earth continuity. Identify suitable machine guarding and LOTO systems. Determine the tearing strength of paper, cardboard, corrugated board using bursting strength tester. 							
<p>Training in usage of Personal Protective Equipment (PPE) Respiratory and non-respiratory-demonstration-self-contained breathing apparatus. Safety helmet, Safety Harness, 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.</p> <p>Leak Detection Monitoring of obnoxious gas level using Multi gas detectors.</p> <p>Electrical Safety Insulation resistance for motors and cables Estimation of earth resistance Earth continuity test, Sensitivity test for ELCB LOTO system</p> <p>Machine guard interlocking devices Identification of Interlocking devices –Kit</p> <p>Microcalormetric studies Differential Thermal Analyser, Differential Scanning Calorimetry - thermal stability studies</p> <p>Fire Extinguishers and Its Operations Water CO₂, Foam, Carbon dioxide (CO₂), Dry chemical power and ABC type.</p> <p>Bursting Strength Tester: Paper & Cardboard</p> <p>Study of Emergency Kits ,First – aid, road safety signs and signals -Safety Software Demo</p>								
References:								
1	Industrial Safety Laboratory Manual.							

50 PIS 201 - Fire Engineering and Explosion Control

PIS: M.E. Industrial Safety Engineering

Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P			C	CA	ES
II	3	0	0	45	3	50	50	100
Objective(s)	<ul style="list-style-type: none"> To provide a clear illustration with principles of fire management systems. To provides an overview of fire accidents and accident analysis as a means of improving performance in order to have a fire hazard free environment. To determine the hazards of fire and control measures. To determine the fire load of industrial as well as domestic occupancy. To understand about the Industrial Fire protection System. 							
Course Outcomes	<p>At the end of the course, the student will be able to</p> <ol style="list-style-type: none"> Understand the basic science behind fire. Devise methodology for fire prevention and protection Identify suitable fire protection system for industrial setup. Devise installation and maintenance fire safety systems as per statues. Associate basic principles of fire and explosion protection systems 							

Physics and Chemistry of Fire

Fire properties of solid, liquid and gases – Flammability limits-Minimum Ignition energy (MIE)- 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 and spontaneous ignition – Boiling Liquid Expanding Vapour Explosion (BLEVE)– case studies – Flixborough, Mexico disaster, BP Texas, Piper Alpha, Peterborough & Bombay Victoria dock ship explosions - Buncefield fire – Jaipur oil fire 2009- Bombay high-vizag. [10]

Fire Prevention and Protection

Sources of ignition – fire triangle – fire tetrahedron - principles of fire extinguishing – active and passive fire protection systems – various classes of fires – A, B, C, D – types of fire extinguishers – fire stoppers – hydrant pipes – hoses – monitors – designing of fire station– maintenance of fire trucks – foam generators – escape from fire rescue operations – fire drills – notice-first aid for burns. [9]

Industrial Fire Protection Systems

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 – server room and tank farms safety – indices of inflammability- firefighting systems – Relevant standards - Oil Industry Safety Directorate(OISD),American Petroleum Institute & other standards. [10]

National Building Code

Introduction to National Building Codes (NBC)-Objectives of fire safe building design, fire load and calculation, fire resistant material and fire testing – fire water requirements-structural fire protection – structural integrity – concept of egress design – exits width calculations - fire certificates – fire safety requirements for high rise buildings – snookers- National Fire Protection Administration (NFPA) -Life code. [8]

Explosion Protecting Systems

Principles of explosion-Explosion Pentagon- 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-.Explosion protection for flammable, toxic and compressed gases and liquid storages-Qualifying Standards and approving agencies. [8]

Total Hours 45**Text Book(s):**

- Jain V K, "Fire Safety in Buildings", New Age International (P) Limited Publishers, New Delhi, 2nd Edition, 2015.
- Derek James, "Fire Prevention Hand Book", Butterworth-Heinemann, London, 1986.

Reference(s) :

- Gupta R S, "Hand Book of Fire Technology", Orient Longman, Bombay, 2nd Edition, 2010.
- Dinko Tuhtar, "Fire and Explosion Protection" – A system approach, Ellis Horwood Ltd, 1999.
- Arthur E Cote, " Fire Protection Handbook", Vol I, II and III, National Fire Protection Association, 2008
- National Building Code of India, BIS, 2016.

50 PIS 202 - Industrial Safety, Health and Environment(SHE) Acts

PIS: M.E. Industrial Safety Engineering

Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P			C	CA	ES
II	3	2	0	60	4	50	50	100
Objective(s)	<ul style="list-style-type: none"> To lay the foundation for industrial safety engineers. To provide indispensable guidance regarding statutory requirements of SHE Acts. To familiarize the powers of Directorate of Industrial Safety and Health. To know the significance of regulations pertaining to Factories and Environment. To offer assistance for processing Indian and International certification. 							
Course Outcomes	<p>At the end of the course, the student will be able to</p> <ol style="list-style-type: none"> Exercise legal provisions of factories act, Tamil Nadu factories rules and Tamil Nadu safety officer's rule and its amendments. Execute legal provisions of Environment act and allied rules. Devise and execute Offsite and Onsite emergency preparedness. Practise legal provisions pertaining to transport and handling of hazardous materials, boilers, explosive, motor, mines electricity and other acts. Apply for Indian and International Certification standards based on industrial requirement. 							
<p>Factories Act – 1948 Constitutional Background, chapters-sections-schedules –powers of 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. [11]</p> <p>Environment Act (protection) 1986 with allied rules Constitutional Background, General powers of the central government, prevention, control and abatement of environmental pollution- Biomedical Waste Management Rules, 2016-The Noise Pollution (Regulation and control) Rules, 2000-The Batteries (Management and Handling Rules) 2001 – E-waste regulations- Classification of industries, consent order from pollution control board. Air Act 1981 and Water Act 1974: powers and functions of Pollution control boards - Central and state boards for the prevention and control of air pollution— prevention and control of air pollution and water pollution—penalties and procedures. [12]</p> <p>Manufacture, Storage and Import of Hazardous Chemical Rules 1989 and Major Accident Hazard Control Rules and Amendment 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. [10]</p> <p>Other Acts and Rules Indian Boiler Act 2007, Static and Mobile Pressure Vessel Rules (SMPV), Motor Vehicle Rules, Mines Act 1952, Workman Compensation Act, Rules – Electricity Act and rules 2003 – Petroleum Rules 2002, Gas cylinder rules 2010-Explosives Act and rules 2008-Pesticides Act, Dock workers (Safety Health and welfare) Act 1986 and regulations 1990, Introduction to Labour codes 2020 - Industrial Relations, Social Security and occupational safety ,health and working condition-Disaster Management Act 2005.- Ammonium nitrate rules. [15]</p> <p>International Acts and Standards International Labour Organisation (ILO) Conventions and Recommendations, OSHA Regulations – Health and Safety At Work Act (HASAWA 1974, UK) – Elements and benefits of OSHAS 18001 – ISO 14001 –, 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). [12]</p>								
Total Hours [45 +15(Tutorial)] 60								
Text book(s):								
1.	Srinivasan S, "The Factories Act 1948 with Tamil Nadu Factories Rules 1950" Madras Book Agency, Chennai, 28 th Edition, 2017.							
2.	The Environment Act (Protection) 1986, Commercial Law Publishers (India) Pvt. Ltd., Allahabad.							
Reference(s) :								
1.	The Indian boilers act 1923, Commercial Law Publishers (India) Pvt. Ltd., Allahabad.							
2.	The Mines Act 1952, Commercial Law Publishers (India) Pvt. Ltd., Allahabad.							
3.	Bakshi P M , "The Constitution of India" , Lexis Nexis, 17 th Edition ,2020							
4.	Srinivasan S , "The Tamil Nadu Safety Officers Rules 2005" Madras Book Agency, Chennai, 28 th Edition, 2017.							

50 PIS 2P1 - Industrial Visit Report Preparation and Presentation

PIS: M.E. Industrial Safety Engineering

Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P			C	CA	ES
II	0	0	4	45	2	100	00	100
Objective(s)	<ul style="list-style-type: none"> To emphasize the effects of hazardous unit processes and health issues. To highlight the safety measures and standard operating procedures in practice at industries. To know-how the statutory requirements are put into practice in the process and engineering industries To make the pupil competent enough in pinpointing the risk. To develop auditing and documenting skills among learners. 							
Course Outcomes	<p>At the end of the course the student will be able to</p> <ol style="list-style-type: none"> Understand the industrial process, safety management systems, policies, education and training about the concern industry. Investigate accident and find the root cause analysis. Interpret personal protective equipment, communication, employee behaviour emergency preparedness and planning, problems faced on implementing safety in industry by safety engineers etc Document the report of the industrial visit undergone. Present the report of the documentation. 							
Methodology	<ul style="list-style-type: none"> Industrial Visit is compulsory for every student. At least one faculty must accompany the students during industrial visit. Before the day of industrial visit, the student should furnish the undertaking form and he/she must have a sound knowledge of the process whatever is going on in the visiting industry. The student has to submit the walk through survey / plant safety inspection report pertaining to the industrial Visit within 3 working days to the faculty Incharge. The student has to collect accident data, investigate on it and perform a root cause analysis The student must undergo first aid and firefighting training in this phase. The student must undergo Internal Auditor training course. The student must undergo ergonomics training course and be aware of material handling and posture evaluation tools. The faculty incharge will evaluate the report and award marks in the basis of the content. The content should have a manufacturing process, process flow diagram, safety management systems, identified gaps, accident investigation, root cause analysis, trainings undergone, suggestions and recommendations. The evaluated report has to be submitted to the professor incharge and HOD. A final presentation will be there to sum up the entire activity undergone. 							
Execution	Week				Activity			
	I				Planner			
	II				Industrial Visit –I and report submission			
	III				Industrial Visit –II and report submission			
	IV				Industrial Visit –III and report submission			
	V				Mid semester Presentation			
	VI				Industrial Visit –IV and report submission			
	VII				Industrial Visit –V and report submission			
	VIII				Final Presentation			
IX				Final Report submission				
Evaluation	100% by Continuous Assessment and 2 credits							
	Component				Weightage			
	Attendance				10%			
	Training Undergone (attach evidence in report)				10%			
	Report (for each Industrial visit 10 Marks)				50%			
	Presentation (Mid semester and Final)				30 %			
Total				100%				
References:								
1	Guidelines for Industrial Visit Report Preparation and Presentation.							

K.S.Rangasamy College of Technology – Autonomous							R 2018	
50 PIS 2P2 - Ergonomics Laboratory								
PIS: M.E. Industrial Safety Engineering								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P			C	CA	ES
II	0	0	4	60	2	60	40	100
Objective(s)	<ul style="list-style-type: none"> To understand the ergonomic concepts and tools. To know the significance of anthropometric survey. To analyse and evaluate the industrial workplace using the ergonomic tools. To find the suitability of ergonomic tools pertaining to industrial process and work nature. To enable the learner to create an ergo workstation. 							
Course Outcomes	<p>At the end of the course, the student will be able to</p> <ol style="list-style-type: none"> 1. Conduct anthropometric survey for the given population. 2. Carry out body discomfort survey for the given study. 3. Perform ergonomic intervention study for static and dynamic work. 4. Execute ergonomic evaluation for material handling. 5. Design an ergonomic work station. 							
<p>Anthropometric survey Body discomfort survey</p> <p>Ergonomic intervention study for workstation Static work and dynamic work using posture evaluation tool RULA, REBA, OCRA, OWAS and PLIBEL</p> <p>Material handling intervention study NIOSH Lifting equation</p> <p>Designing an ergonomic work station Simulation or model</p>								
References:								
1	Ergonomics Laboratory Manual.							

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Passed in the BoS Meeting Held on 03.03.2021

Approved in Academic Council Meeting held on 26/06/2021

Academic Council Convener Signature



Chairman,BoS/MCT

50 PIS 2P3 - Mini project

PIS: M.E. Industrial Safety Engineering

Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P			C	CA	ES
II	0	0	5	40	3	60	40	100
Objective(s)	<ul style="list-style-type: none"> To offer a platform where a learner can carry out a mini project. To make the learner, to take up a real time scenario and suggest suitable solution. To build up the confidence of the learner to indulge themselves in the project. To bring out the learner's creativity ,novel idea and solution for the problem identified. To enhance the learner's presenting and report writing skill. 							
Course Outcomes	<p>At the End of the course, the student will be able to</p> <ol style="list-style-type: none"> Get an opportunity to work in actual industrial environment if they opt for internship. Solve live problem using software/ analytical /computational tools. Learn to write technical reports. Develop the skill to present their work Defend their work in front of technically qualified audience 							
Methodology	<p>Students can take up small problems in the field of industrial safety engineering or societal safety issues as mini project. It can be related to solution to an industrial or societal problem, verification and analysis of experimental data available, conducting experiments or simulation on various subjects pertaining to safety issues, hazard / risk characterization, studying a software tool for the solution of the problem identified etc.</p> <ul style="list-style-type: none"> Three reviews have to be conducted by the committee of minimum of three members one of which should be the guide Final viva voce will be done by the committee that consists of minimum of three members one of which should be the guide (if possible include one external expert examiner – can be chosen from inter department of the institution). 							
Execution	Week			Activity				
	I			Allotment of Faculty Guide by the HoD				
	II			Finalizing the topic with the approval of Faculty Guide				
	III-IV			Identification of problem and methodology to develop protoype/simulation				
	IV			First Presentation				
	V-VI			Mid semester presentation				
	VII-VIII			Report writing				
	IX –X			Report submission				
	X			Final presentation				
Evaluation	❖ 60% by Continuous Assessment , 40% by Viva Voce, 5 Hrs/week							
	Component			Weightage				
	Presentation I			25 %				
	Presentation II			25 %				
	Report Preparation and Submission			30 %				
	Final Presentation			20 %				
Total			100 %					

50 PIS 3P1 - Project Work Phase – I

PIS: M.E. Industrial Safety Engineering

Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P			C	CA	ES
III	0	0	20	60	10	75	25	100
Objective(s)	<ul style="list-style-type: none"> To impart the practical knowledge to the students pertaining to industrial safety. To emphasize the current safety practices and risk assessment procedures adopted by industries. To provide an exposure to the students to refer, read and review the research articles, journals and conference proceedings. To relate the project work with the collected research article. To enhance their problem solving and critical thinking skills. 							
Course Outcomes	<p>At the end of the course, the student will be able to</p> <ol style="list-style-type: none"> Select problems prevailing in industries/ societal by EHS audit and confirm the title. Understands the Literature review process and technical writing. Explain and prepare a project report for the stated problem. Present and justify the work done for the identified problem. Write and publish a journal review paper. 							
Methodology	<ul style="list-style-type: none"> Three reviews have to be conducted by the committee of minimum of three members one of which should be the guide Each review has to be evaluated for 100 marks. Attendance is compulsory for all reviews. If a student fails to attend review for some valid reason, one or two chance may be given. Problem should be selected through EHS audit in the concerned industries. Students have to collect journal papers related to their work minimum of 25 journals. Report has to be prepared by the students as per the then format by the institution Preliminary implementation can be done if possible Internal evaluation and external evaluation is allotted 75 marks and 25 marks respectively. 							

50 PIS 4P1 - Project Work Phase – II

PIS: M.E. Industrial Safety Engineering

Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P			C	CA	ES
IV	0	0	32	60	16	50	50	100
Objective(s)	<ul style="list-style-type: none"> ● To offer a platform to the learner to check on the compliance pertaining to industrial safety. ● To implement their innovative ideas to forefront the risk issues. ● To retrieve the hazards by adopting suitable assessment methodologies. ● To relate problems in global context and suggest recommendations. ● To enhance their decision making and critical thinking ability. 							
Course Outcomes	<p>At the end of the course, the student will be able to</p> <ol style="list-style-type: none"> 1. Select problems prevailing in industries or societal by EHS audit and confirm the title. 2. Understands the Literature review process and technical writing. 3. Able to explain and prepare a project report for the stated problem. 4. Able to present and justify the consolidated work done for the identified problem in the forum. 5. Acquire competence in suggesting methodology to minimize and eliminate the Problem or redesign workstation / equipment to overcome hazardous situations. 							
Methodology	<ul style="list-style-type: none"> ● Three reviews have to be conducted by the committee of minimum of three members one of which should be the guide ● Each review has to be evaluated for 100 marks. ● Attendance is compulsory for all reviews. If a student fails to attend review for some valid reason, one or two chance may be given. ● The project carried out must address industrial safety issues/societal issues which mainly pose threat to life, property and environment ● They should publish the paper preferably in the journals/conferences. ● Final review will be done by the committee that consists of minimum of three members one of which should be the guide (if possible include one external expert examiner). ● Report has to be prepared by the students as per the then format by the institution ● The report should be submitted by the students at the end of the fourth semester. 							

K.S.Rangasamy College of Technology – Autonomous						R 2018		
50 PIS E11- Industrial Health and Hygiene								
PIS: M.E. Industrial Safety Engineering								
Elective – I								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P			C	CA	ES
I	3	0	0	45	3	50	50	100
Objective(s)	<ul style="list-style-type: none"> To impart basic anatomy and functions of human body. To understand the significance of various hazards and its ill effects. To give an overview of ergonomics and ergonomics tools. To emphasize the practical means of achieving industrial health compliance with the current regulations. To provide knowledge on the assessment of industrial health and hygiene. 							
Course Outcomes	<p>At the end of the course, the student will be able to</p> <ol style="list-style-type: none"> Determine the physical hazard at workplace and suggest control measures. Compute the chemical hazards at workplace with adequate mitigating actions. Evaluate the biological and ergonomical hazards at workplace and associated risk factors. Practice the occupational health strategies at workplace. Regulate the man machine interface in the organization. 							
<p>Physical Hazards Noise, compensation aspects, noise exposure regulation, properties of sound, occupational damage- Noise Induced Hearing Loss (NIHL), risk factors, sound measuring instruments, octave band analyzer, noise networks, noise surveys, Noise and Vibration Mapping, noise control programmes, industrial audiometry, hearing conservation programmes- vibration - Standards, whole body vibration, Hand - Arm vibration types, effects, instruments, surveying procedure, permissible exposure limit.</p> <p>Ionizing radiation, types, effects, monitoring instruments, control programmes, OSHA standard- non-ionizing radiations, effects, types, radar hazards, microwaves and radio-waves, lasers, Permissible level- cold environments, hypothermia, wind chill index, control measures- hot environments, thermal comfort, heat stress indices, acclimatization, estimation and control. [10]</p> <p>Chemical Hazards Recognition of chemical hazards-dust, fumes, mist, vapour, fog, gases, types, concentration, Exposure Vs. dose - Indian standards (IS), TLV, IDLH, LD₅₀, LC₅₀, STEL, PEL, REL 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 - Industrial Hygiene Audit - training and education. [9]</p> <p>Biological and Ergonomical Hazards Classification of Bio hazardous agents – examples, bacterial agents, rickettsial and chlamydial agents, viral agents, fungal, parasitic agents, infectious diseases - Epidemic -Pandemic -Covid-19 and WHO guidelines for Covid-19-Biohazard control Programmes, employee health Programmes-laboratory safety programmes-animal care and handling-biological safety cabinets - building design. Work Related Musculoskeletal Disorders –carpal tunnel syndrome (CTS) - Repetitive Strain Injury (RSI) - Tendon pain-disorders of the neck- back injuries – Posture Assessment - Rapid Upper Limb Assessment (RULA), Rapid Entire Body Assessment (REBA).Illumination and Ventilation –hazards – control and measurements. [9]</p> <p>Occupational Health and Toxicology Concept and spectrum of health - functional units and activities of occupational health services, pre-employment and Periodical medical examinations – occupational related diseases, levels of prevention of diseases, notifiable occupational diseases as per Schedule III of Factories Act 1948 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 – Routes of entry - Probit Analysis – Chemical Exposure Assessment – Legal requirements -Medical Surveillance and records – Occupational Health Centre – Factory Medical Officer - cardio pulmonary resuscitation, audiometric tests, eye tests, vital function tests - Fitness test .Industrial toxicology, local, systemic, acute and chronic effects, temporary and cumulative effects, carcinogens entry into human systems. [10]</p> <p>Occupational Physiology 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. [7]</p>								
								Total Hours 45
Text book(s):								
1.	Danuta Koradecka, "Hand book of Occupational Safety and Health", CRC Press, 2010.							
2.	"Hand book of Occupational Safety and Health", National Safety Council, Chicago, 1982.							
Reference(s) :								
1.	"Encyclopaedia of Occupational Health and Safety", Vol.I and II, International Labour Office, Geneva, 2011.							
2.	Barbara A Plog, Patricia J Quinlan, MPH, CIH and Jennifer Villareal "Fundamentals of Industrial Hygiene", National Safety Council , 6 th Edition, 2012.							
3.	Charles D Reese, "Occupational Health and Safety Management: A Practical Approach", CRC Press, 3 rd Edition, 2018.							
4.	Fulekar M H , "Industrial Hygiene and Chemical Safety", I.K. International Publishing House, 2016.							

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Passed in the BoS Meeting Held on 03.03.2021

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Academic Council Convener Signature



Chairman,BoS/MCT

50 PIS E12 - Industrial Noise and Vibration control

PIS: M.E. Industrial Safety Engineering

Elective – I

Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P			C	CA	ES
I	3	0	0	45	3	50	50	100
Objective(s)	<ul style="list-style-type: none"> To understand the health impacts of industrial noise To know about noise level measurement and noise surveys. To understand the significance of noise control measures. To emphasize their knowledge over the ill-effects of vibration. To understand the significance of vibration control in industrial environment. 							
Course Outcomes	<p>At the end of the course, the student will be able to</p> <ol style="list-style-type: none"> Understand specifics about industrial noise and their effects. Identify the existence of noise problem in industrial area through noise mapping. Execute noise control measures for the industrial noise problem. Understand specifics about industrial vibration and their effects. Assess specifics about Hand- Arm vibration and recommends suitable remedial measures. 							
<p>Noise Pollution Sound and its propagation - Noise – Industrial Noise – Workers exposure level – Noise Level measurement - Decibel – Sound level meter – Permissible exposure levels under the Factories Act 1948 and Tamil Nadu Factories Rules 1950 – Occupational Deafness as Notifiable Disease – Use of sound level meter and other means to determine noise exposure. [9]</p> <p>Noise mapping Identification of the existence of noise problems – Severity of noise problems and their impacts over health – Noise source diagnosis – summary of Diagnostic approaches – Noise Mapping- Case study of noise problem in Engineering Industry – Noise survey procedure. [9]</p> <p>Noise control Measures Techniques involving minimal noise modification – Techniques requiring equipment to be added to the existing machinery – Techniques requiring equipment redesign – Use of personal protective equipments – Attenuation levels of different types of PPE – Motivation and communication measures. Noise Control Materials -Noise absorption materials – Transmission Loss materials – Damping materials – Material selection – Comparison of noise reduction methods as applied to a particular noise producing machine. [12]</p> <p>Vibration Vibration - Industrial Vibration - Whole body Vibration – Standards -Vibration isolating materials – Vibration monitoring. [5]</p> <p>Vibration Risks And Their Control Potential Hazards of Industrial Tools and operations that produce vibration – Daily Vibration Dose – measurement Technique – Hand – Arm Vibration (HAV) – Injuries from HAV – Back pain Risks from mobile machine operations – Ergonomics of Vibrating Tools – Right Tool for the Job in the right way (Ergonomics) – Tool design and maintenance – Keeping hands warm – Multiple shift breaks – Job rotation and maintenance. [10]</p>								
						Total Hours 45		
Text book(s):								
1.	Paul N Cheremisinoff, Peter P Cheremisinoff, Ernest E Allen, “ Industrial Noise Control Handbook”, Ann Arbor Science Publishers, 1977							
2.	Lasithan L G, “Mechanical Vibrations and Industrial Noise Control”, Prentice Hall India Learning Private Limited, 2015.							
Reference(s) :								
1.	“Handbook of Industrial Noise Control” NASA, Washington D.C.							
2.	Arnold P G Peterson, “Handbook of Noise Measurement”, 9 th Edition, 1980.							
3.	Cyril M Harris Allan G Piersol, “Harris’ Shock and Vibration Handbook”, McGraw Hill Publications, New York, 5 th Edition, 2002.							
4.	Munjal M L, “ Noise and Vibration Control”, World Scientific, 2013.							

Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P			C	CA	ES
I	3	0	0	45	3	50	50	100

Objective(s)	<ul style="list-style-type: none"> To understand the significance of manual material handling methods. To understand the methods and procedures of mechanical manual handling. To know the hazards involved in material handling. To familiarize with usage of personal protective equipment. To emphasize the suitability and selection the personal protective equipment for industrial work.
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Course Outcomes	<p>At the end of the course, the student will be able to</p> <ol style="list-style-type: none"> Understand the techniques of material handling Identifies issues in manual material handling and guides in material handling practices. Understand the significance of PPE. Choose and recommending suitable respiratory and non-respiratory PPE for workers. Inspect and train workers on respiratory and non-respiratory PPE for workers.
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Material handling

Overview of material handling – Manual material handling and mechanical material handling .Material handling- methods- standards- ergonomic issues- musculoskeletal disorder [6]

Mechanical material handling

Selection, operation, inspection and testing of ropes,slings,chains ,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, scaffolding, hoisting cranes. [9]

Overview of PPE

Concepts of personal protective equipment -Need for Personal Protective Equipment-general Principles-sources of help-requirements-procurement procedures - user involvement. [6]

Non Respiratory Personal Protective Equipment

Head protection-helmet, hoods, bump caps, soft caps, Hair net and caps-Eye and Face protection-spectacles, goggles ,types of goggles and face shields-Hearing Protection – ear muff, ear plugs and combination- Body Protection: coats, aprons, full suits, proximity suits, high visibility clothing, personal flotation devices, puncture resistant and cut resistant clothing- Fall Protection: safety belt, safety harness, lanyard, grabbing device, lifeline, fall arrestor, climbing safety system and safety net- emergency showers- eye wash fountains- eye and face wash fountain- Hand, finger and arm protection: gloves and its types, pads, finger guard, sleeves, creams and lotions-Foot and Leg protection: safety shoes-instep guard, steel insole, rubber boots, non- sparking shoes, non conductive shoes and slip resistant shoes – maintenance procedures - limitations - relevant Indian standards - Personal Training. [15]

Respiratory Personal Protective Equipments

Respiratory Protection, selection of the respiratory protective equipment, quality of breathing air, respiratory fit testing, SCBA, Hose mask, Air-line respirator, air-supplied suits and hoods, air-purifying respirators, canister mask, filter respirator and others- maintenance procedures- limitations

Pre Employment – Fitness test - health surveillance relevant Indian standards – Personal Training [9]

Total Hours 45

Text Book(s):

- Michael G Kay, "Material Handling Equipment", McGraw-Hill, 2nd Edition, 2013.
- "Industrial Safety", National Institute of Industrial Research, New Delhi, 2003.

Reference(s) :

- Raymond A Kulwiec, "Materials Handling Handbook", Wiley, 2nd Edition, 1985
- John V Grimaldi and Rollin H Simonds, "Safety Management", All India Traveller Book Seller, 5th Edition, New Delhi, 2001.
- Roger L Brauer, "Safety and Health for Engineers", Wiley, Third Edition, 2016.
- David E Mulcahy, "Materials Handling Handbook" McGraw-Hill, 1999.

50 PIS E21 -Safety in Chemical Industries

PIS: M.E. Industrial Safety Engineering

Elective – II

Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P			C	CA	ES
I	3	0	0	45	3	50	50	100
Objective(s)	<ul style="list-style-type: none"> To know the process and machineries involved in chemical plant. To impart the systematic and safe operating procedures at chemical industries. To detect and eliminate the process of dangerous mishaps at process industries. To tell learner, in practical terms to enhance safety in all means till the end process. To familiarize with the statutory requirements pertaining to chemical safety. 							
Course Outcomes	<p>At the end of the course, the student will be able to</p> <ol style="list-style-type: none"> Understand the Chemical plant design, process, facilities, statues and inherent safe design Conduct pre and post plant commissioning with HMIS labelling, and document inspection report. Devise operating procedures and emergency procedures start up and shut down operation Approve Work permit for maintenance with recommended safety measures. Devise emergency preparedness and plan to mitigate emergency situations. 							

Safety in Process Design and Pressure System Design

Chemical Plant Location and Layout – Inter Distance between facilities - 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, ASME section 8 division I,II,III- pipe works and valves- IS 2379:1990 Colour coding of pipelines- 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 - Static Electricity, Earthing and bonding. [10]

Plant Commissioning and Inspection

Commissioning phases and organization, process safety information, P&I, preliminary hazard analysis-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 - Hazardous Materials Identification Systems (HMIS) Labelling. [9]

Plant Operations

Operating discipline, operating procedure and inspection, format, emergency procedures- hand over and permit system-start up and shut down operation- Distributed Control Systems (DCS)and Programmable Logic control (PLC)Systems-refinery units- operation of fired heaters, driers, storage- operating activities and hazards- Safety Instrumented System (SIS) – Safety Critical Equipments, trip systems- Safety Integrity Level (SIL), SOP - exposure of personnel – Safety in batch processes – Reactive Hazards. [9]

Plant Maintenance, Modification and Emergency Planning

Management of maintenance, hazards- Corrosion Effects- 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 preparedness, onsite emergency- offsite emergency, disaster planning -APELL. [8]

Storage of hazardous chemicals

General consideration, petroleum product storages, storage tanks and vessel- storages layout- segregation, separating distance, secondary containment- venting and relief, excess flow valve ,RoV valve, emergency shutdown valve, atmospheric vent, pressure, vacuum valves, flame arrestors, fire relief- fire prevention and protection- LPG storages, pressure storages - Mounded Bullet - layout, instrumentation, vapourizer, refrigerated storages- LNG storages, hydrogen storages, toxic storages, chlorine storages, ammonia storages, other chemical storages- underground storages- Plant and Cross Country Pipelines – Trucks - loading and unloading facilities- drum and cylinder storage- ware house, storage hazard assessment of LPG and LNG. [9]

Total Hours 45**Text Book(s):**

- Sam Mannan., “Lees ‘Loss Prevention in Process Industries”, Vol1, Vol2, Vol3, Butterworth-Heinemann,, London, 4th Edition, 2012.
- Fulekar M H, “Industrial Hygiene and Chemical Safety”, I.K. International Publishing House, 2016.

Reference(s) :

- “Quantitative Risk Assessment in Chemical Process Industries” American Institute of Chemical Industries, Centre for Chemical Process safety, 2nd Edition, 1999.
- Fawcett H H and Wood W S, “Safety and Accident prevention in Chemical Operations”, 2nd Edition, John Wiley & Sons, New York, 1982.
- Charles D Reese, “Occupational Health and Safety Management: A Practical Approach”, CRC Press, 3rd Edition, 2018.
- Vyas M N, “Safety and Hazards Management in Chemical Industries”, Atlantic Publishers and Distributors PVT Ltd, 1st edition, 2017.

K.S.Rangasamy College of Technology – Autonomous							R 2018	
50 PIS E22 - Safety in Engineering Industry								
PIS: M.E. Industrial Safety Engineering								
Elective – II								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
I	3	0	0	45	3	50	50	100
Objective(s)	<ul style="list-style-type: none"> To impart knowledge on industrial machineries, its operation and guarding system. To know the industrial operations, hazards and safety precautions. To impart relevant standards and codes pertaining to engineering industry. To give overview on health and welfare measures in engineering industry. To understand the significance of safe operating practices at industry level. 							
Course Outcomes	<p>At the end of the course, the student will be able to</p> <ol style="list-style-type: none"> Understand the General safety rules, principles, maintenance, Inspections of metal and wood working machinery Point out common hazards, safety precautions and PPE in industrial welding operations. Formulate safety measures in cold working, inspection and maintenance of metal sheers, press brakes. Interpret safety in Heat treatment operations, electro plating, hydro testing and shot blasting. Draft Health and welfare measures in engineering industry and waste disposal. 							
<p>Safety in Metal Working Machinery and Wood Working Machines General safety rules, principles, maintenance, Inspections of turning machines, boring machines, milling machine, planning machine and grinding machines, CNC machines. Wood working machinery, types, safety principles, electrical guards, work area, material handling, inspection, standards and codes- saws, types, hazards [8]</p>								
<p>Machine Guarding and ZMS. Basic Principle of Machine guarding- Machinery Hazards- protective devices, machine guarding, types, fixed guard, interlock guard, automatic guard, trip guard, electron eye, positional control guard, - fixed guard fencing- guard construction-guard opening.Design of machine guarding –IS standards – Special machines. Selection and suitability: lathe-drilling-boring-milling-grinding-shaping-sawing-shearing-presses-forge hammer-flywheels-shafts-couplings-gears-sprockets wheels and chains-pulleys and belts- authorized entry to hazardous installations-benefits of good guarding systems. Maintenance-Types- Zero Mechanical State (ZMS), Definition, Policy for ZMS. [10]</p>								
<p>Safety in Welding and Gas Cutting Gas welding and oxygen cutting, resistances welding, arc welding and cutting, common hazards, personal protective equipment, training, safety precautions in brazing, soldering and metalizing – explosive welding, selection, care and maintenance of the associated equipment and instruments – safety in generation, distribution and handling of industrial gases-colour coding – Non Return Valve (NRV) - flashback arrestor – leak detection-pipe line safety-storage and handling of gas cylinders. [9]</p>								
<p>Safety in Cold Forming and Hot Working of Metals Cold working, power presses, point of operation safe guarding, auxiliary mechanisms, feeding and cutting mechanism, hand or foot-operated presses, power press electric controls, power press set up and die removal, inspection and maintenance-metal sheers-press brakes. Hot working safety in forging, hot rolling mill operation, safe guards in hot rolling mills – hot bending of pipes , hazards and control measures. Safety in gas furnace operation, Ferrous and Non Ferrous Furnace, cupola, crucibles, ovens, foundry health hazards, work environment, material handling in foundries, foundry production cleaning and finishing foundry processes. [9]</p>								
<p>Safety in Finishing, Inspection and Testing Heat treatment operations, electro plating, paint shops, sand and shot blasting, safety in inspection and testing, dynamic balancing, hydro testing, valves, boiler drums and headers, pressure vessels, air leak test, steam testing, safety in radiography, personal monitoring devices, radiation hazards, engineering and administrative controls, Health and welfare measures in engineering industry-, PPE - pollution control in engineering industry-industrial waste disposal. [9]</p>								
							Total Hours 45	
Text Book(s):								
1.	Philip Hagan, “Accident Prevention Manual for Business and Industry”, N.S.C.Chicago, 13 th Edition, 2009							
2.	“Occupational Safety Manual” BHEL, Trichy, 1988.							
Reference(s) :								
1.	“Accident Prevention Manual”,National Safety Council, Chicago, 1982.							
2.	Krishnan N V, “Safety in Industry”, Jaico Publishing House, 1996.							
3.	Safety in the use of wood working machines, HSE, UK 2005.							
4.	“Health and Safety in Welding and Allied Processes”, welding Institute, UK, High Tech. Publishing Ltd., London, 1989.							

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Passed in the BoS Meeting Held on 03.03.2021

Approved in Academic Council Meeting held on 26/06/2021

Academic Council Convener Signature



Chairman,BoS/MCT

50 PIS E23- Mechanical Integrity Assessment

PIS: M.E. Industrial Safety Engineering

Elective – II

Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P			C	CA	ES
I	3	0	0	45	3	50	50	100
Objective(s)	<ul style="list-style-type: none"> To give exposure to the guidelines for mechanical integrity assessment . To know about the test carried out pertaining to industrial practice. To understand concept and practices of mechanical integrity. To know the significance of safety protocols and procedures practiced in industries. To give overview on inspection, testing, examination and assessment for mechanical integrity. 							
Course Outcomes	<p>At the end of the course, the student will be able to</p> <ol style="list-style-type: none"> Recognize the concepts and practices of mechanical integrity Understands the risk based mechanical integrity programme. Formulate SIS, SOP,LOTO and other safety systems for industries. Recommend corrosion prevention methods by assessing corrosion. Execute mechanical integrity audit and documentation. 							

Concepts and Practices of Mechanical Integrity Definition – chemical manufacturers association approach – ongoing fitness for service – components of mechanical integrity – engineering design, documented standard operating procedures, Training, Inspection – Preventive / predictive maintenance – Equipment, covered by MI – pressure vessels, storage Tanks, piping system-valves & fittings-pressure Relief systems-controls such as sensors, Alarms and Interlocks-Emergency shutdown system-classification of equipments-critical consequence equipments(Class I) –serious consequence equipments (Class II) – Normal consequence equipments (Class III) – Requirements for inspection, testing, examination and assessment. [9]

Inspection, Testing, Examination and Assessment Form Competency required for inspection-knowledge of inspection techniques-deterioration mechanisms, process & operations, design & Technology, Metallurgy and maintenance-periodical testing-legal requirements-relevant provisions of the factories Act 1948, Boilers Act 2007, the Electricity Act 2003, static and mobile pressure vessels Rules 1981-control of major accident hazards rules 1999-pressure system safety regulations 2000-dangerous substances and explosive atmosphere regulations 2002-visual examination-external examination and internal examination-non-invasive techniques such as non-destructive examination-destructive testing such as pneumatic test and hydraulic test-written scheme of examination-examination report and conclusions-integrity assessment-condition monitoring-temperature, noise, vibration, deterioration mechanism-thermography application- quality assurance. [9]

Maintenance and Repair of Equipments

Objectives and Responsibilities for maintenance organization-types of maintenance-Repair complexities of machinery-preventive/predictive maintenance-Risk-based mechanical integrity programme-programme scope, Risk Ranking, acceptance criteria-individual inspection and test programme specifying inspection technique and frequency-safe system of work-safety integrity level-safety instrumented system-standard/safe operating procedures(SOP)-Lockout/Tagout system(LOTO)-safe isolation procedures-blinding and blanking-double block and bleed valve(DBB)-work permit system-hot work, confined space work, excavation work, working at heights-chimney cleaning work-silo cleaning work. [9]

Corrosion Prevention and Control

Corrosion mechanism-different forms of corrosion-general/uniform corrosion, inter granular corrosion, pitting corrosion, crevice corrosion, stress corrosion cracking, Erosion corrosion, Hydrogen embrittlement, Galvanic corrosion-Electrochemical potential for different metals and noble metals-potential corrosion damages-materials of construction-metal alloying for corrosion prevention-inspection programme for each piece of equipment-special equipment or “bad actors” requiring individualized attention-inspection strategy and interval-corrosion control-organic coatings, Electrochemical methods-Anodic protection and cathodic protection-corrosion inhibitors-corrosion monitoring-ultrasonic thickness measurement-Radiography testing-pipeline inspection-Assessment of corrosion under insulation-corrosion rate estimation-Remaining Assessment. [9]

On-Going Fitness for Service of Buildings, Machines and Electrical Systems

Stability of structural and civil system-foundations-anchor bolts-supports-pipe hangers, pipe bridges-assessment-repair work-key utility service systems-electric power, electronic gadgets, electrical junctions, joints cable tray, electrical distribution system and connections-thermography examination-electrical/electronic equipments, requiring the hazardous Area classification-critical utility systems such as fire water, cooling water, absorption tank, exploding suppression, quenching-failure analysis of alarms, sensors and interlocks-voltage drop calculation-integrity of fire fighting equipments-their maintenance and up keeping-mechanical integrity audits-documentation. [9]

Total Hours 45

Text Book(s):

- “Guidelines for Mechanical Integrity Systems”, Centre for Chemical Process Safety, AIChE: Wiley, 2006.
- American Petroleum institute: Recommended practice for fitness-for-service: API RP 579, Washington-D.C., 2000.

Reference(s) :

- Roy E Sanders, “ Chemical Process Safety”, Elsevier, 3rd Edition, 2006
- Wlater L Frank, David K Whittle, “ Revalidating Process Hazard Analyses”, Wiley-AIChE, 2001.
- “Dangerous Substances and Explosive Atmosphere Regulations-2009 (DSEAR) ACOP”, HSE, UK., 2nd Edition, 2015.
- “Pressure Safety System Regulation- 2000 (PSSR) ACOP”, HSE, UK, 2nd Edition, 2014.

K.S.Rangasamy College of Technology – Autonomous							R 2018		
50 PIS E31- Computer Aided Hazard Analysis									
PIS: M.E. Industrial Safety Engineering									
Elective – III									
Semester	Hours / Week			Total hrs	Credit	Maximum Marks			
	L	T	P			C	CA	ES	Total
II	3	0	0	45	3	50	50	50	100
Objective(s)	<ul style="list-style-type: none"> To impart the learner an amount of qualitative and quantitative methods for risk analysis. To familiarize the learner with hazard identification and risk analysis methods. To give an overview on safety softwares currently used in industries. To give insight on micro calorimetric methods. To elaborate on consequence analysis and dispersion modelling. 								
Course Outcomes	<p>At the end of the course, the student will be able to</p> <ol style="list-style-type: none"> Selection and suitability of hazard evaluation techniques for industrial issues. Understand and apply hazard analysis techniques for scenario and non-scenario based. Utilize software aids for hazard evaluation and estimate heat radiation effect and damage distance using gas/Vapour dispersion Analyze the causes of runaway reaction using micro calorimetric techniques and Perform consequence analysis for hazardous chemicals. Evaluate the sensitivity of pyrotechnic mixtures using mechanical sensitiveness test and explosive testing. 								
<p>Introduction Introduction, hazard, hazard monitoring, different stages of process life time – Hazard reduction approaches and inherent safety review Selection of hazard evaluation techniques - Factors influencing the selection of hazard evaluation techniques- decision making process- hazard review for management changes -combined hazard review- hazard evaluation - Risk issues. [9]</p> <p>Hazard Evaluation Techniques Non Scenario Based:- Checklist analysis, safety review, relative ranking, preliminary hazard analysis (PHA), fire explosion and toxicity index (FETI) Scenario Based:- Fault Tree Analysis & Event Tree Analysis, Logic symbols, methodology, minimal cut set ranking - various indices – what-if analysis/checklist analysis - hazard operability studies (HAZOP) -Hazard analysis (HAZAN) - Failure Mode and Effect Analysis (FMEA). [9]</p> <p>Risk-Based Determination of The Adequacy of Safeguard Scenarios from scenario-based Hazard Evaluations- Severity of consequence- Frequency of Initiating Causes- Effectiveness of Safeguards- Risk Estimation using Risk Matrix or Direct Calculation, Layer of Protection Analysis (LOPA), Safety Integrity Level (SIL). Hazard evaluation software aids – Risk Phast V 6.6 (DNV), HazardReview LEADER, HAZOP manager, HAZOP+ (Reliability workbench), PHA manager, LOPA manager, PHAPro,FEME-Pro,ALOHA. [9]</p> <p>Instrumentation Applications of Advanced Equipments and Instruments, Thermo Calorimetry, Differential Scanning Calorimeter (DSC), Thermo Gravimetric Analyzer (TGA), Accelerated Rate Calorimeter (ARC), Principles of operations, Controlling parameters, Applications, advantages. 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. [9]</p> <p>Consequences Analysis 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.[9]</p>									
									Total Hours 45
Text Book(s):									
1.	Sam Mannan., “Lees’ Loss Prevention in Process Industries”, Vol1,Vol2,Vol3,Butterworth-Heinemann., London, 4 th Edition 2012.								
2.	“Methodologies for Risk and Safety Assessment in Chemical Process Industries”, Commonwealth Science Council, UK.2004.								
Reference(s) :									
1.	Course Material – “Intensive Training Programme on Consequence Analysis”, Process Safety Centre, Indian Institute of Chemical Technology, Tarnaka& CLRI, Chennai.								
2.	“Guidelines for Hazard Evaluation Procedures”, Centre for Chemical Process safety, AIChE 3 rd Edition, 2008.								
3.	“Guidelines for Chemical Process Quantitative Risk Analysis”, 2 nd Edition, Centre for Chemical Process safety, AIChE, 2000								
4.	Frank Crawley, Brian Tyler, “HAZOP: Guide to Best Practice”, Elsevier –IChemE, 3 rd Edition ,2015.								

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Academic Council Convener Signature



Chairman,BoS/MCT

50 PIS E32 - Electrical Safety

PIS: M.E. Industrial Safety Engineering

Elective – III

Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P			C	CA	ES
II	3	0	0	45	3	50	50	100
Objective(s)	<ul style="list-style-type: none"> To explain the facts of electrical installation and maintenance activities. To identify the hazards and faulty electrical appliances. To understand the classes of insulation and PPE. To explain the safer means of accessing electrical appliances. To know the statutory requirements concerned with electrical safety. 							
Course Outcomes	<p>At the end of the course, the student will be able to</p> <ol style="list-style-type: none"> Indicate Statues, standards pertaining to electrical safety and first aid measures. Diagnose Classes of insulation and hazardous conditions. Inspect FRLS insulation, grounding, circuit breaker and PPE. Plan and schedule lock out tag out and work permit. Setup Safe and explosion proof electrical apparatus. 							
<p>Concepts and Statutory Requirements Introduction – electrostatics, electro magnetism, stored energy, energy radiation and electromagnetic interference – Working principles of electrical equipment-Indian electricity act 2003 and rules-statutory requirements from electrical inspectorate-international and Indian standards on electrical safety – first aid-cardio pulmonary resuscitation(CPR)- case studies. [9]</p> <p>Electrical Hazards Primary and secondary hazards-shocks, burns, scalds, falls- burns classification, burn chart-human safety in the use of electricity.Energy leakage-clearances and insulation-classes of insulation-voltage classifications-excess energy-current surges-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 arrester, installation – earthing, specifications, earth resistance, earth pit maintenance. [10]</p> <p>Protection Systems 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.FRLS insulation-insulation and continuity test-system grounding-equipment grounding-rubber mats and relevant standards-Earth Leakage Circuit Breaker (ELCB)- Residual Current Circuit Breaker(RCCB)cable wires-maintenance of ground-ground fault circuit interrupter-use of low voltage-electrical guards-Personal protective equipment – safety in handling hand held electrical appliances tools and medical equipments. [10]</p> <p>Selection, Installation, Operation and Maintenance Role of environment in selection-safety aspects in application - protection and interlock-self diagnostic features and fail safe concepts-lock out and tag out (LOTO)-work permit system- contact prevention techniques-Human protection – rubber mat- discharge rod and earthing devices- cabling and cable joints-preventive maintenance.[9]</p> <p>Hazardous Zones 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. [7]</p>								
								Total Hours 45
Text Book(s):								
1.	Fordham Cooper W, “Electrical Safety Engineering”, Butterworth and Company, London, 3 rd Edition, 2002.							
2.	Rao S, Saluja H L, “ Electrical Safety, Fire Safety Engineering and Safety Management”, Khanna Publishers, New Delhi, 2009.							
Reference(s) :								
1.	John Cadick Mary Capelli-Schellofeffer, Dennis K Neitzel and Al Winfield, “Electrical Safety Handbook”, Mc Graw Hill Education, 4 th Edition, 2012.							
2.	“Accident Prevention Manual for Industrial operations”, N.S.C., Chicago, 1982.							
3.	Massim A G ,Mitolo, “Electrical Safety of Low Voltage Systems”, Mc Graw Hill, 2009							
4.	Indian Electricity Act and Rules, Government of India, 2003.							

Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P			C	CA	ES
II	3	0	0	45	3	50	50	100

Objective(s)	<ul style="list-style-type: none"> To impart basics of nuclear energy To understand the process of nuclear engineering To know the functioning of nuclear reactors, its radiations and control methods. To give overview on nuclear power station, nuclear chemical plants, decommissioning defence nuclear facilities, nuclear safety research and start-ups. To understand the legal norms pertaining to nuclear safety.
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Course Outcomes	<p>At the end of the course, the student will be able to</p> <ol style="list-style-type: none"> Understand radioactivity and its basic concepts. Recognize the significance of control requirements in reactor design. Identify operational problems with control and shut down rods. Design fire and explosion protection system for nuclear power plants. Recommend and implement control measures for radiation exposure to plant personnel.
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Introduction

Binding energy – fission process – radio activity – alpha, beta and gamma rays radioactive decay – decay schemes – effects of radiation – neutron interaction – cross section – reaction rate – neutron moderation – multiplication – scattering – collision – fast fission – resonance escape – thermal utilization – criticality. [9]

Reactor Control

Control requirements in design considerations – means of control – control and shut down rods – their operation and operational problems – control rod worth – control instrumentation and monitoring – online central data processing system. [9]

Reactor Types

Boiling water reactors – radioactivity of steam system – direct cycle and dual cycle power plants-pressurized water reactors and pressurized heavy water reactors – fast breeder reactors and their role in power generation in the Indian context – conversion and breeding – doubling time – liquid metal coolants – nuclear power plants in India. [9]

Safety of Nuclear Reactors

Safety design principles – engineered safety features – site related factors – safety related systems – heat transport systems – reactor control and protection system – fire protection system – quality assurance in plant components – operational safety – safety regulation process – public awareness and emergency preparedness. Accident Case studies- Three Mile island & Chernobyl accident. [9]

Radiation Control

Radiation shielding – radiation dose – dose measurements – units of exposure – exposure limits – barriers for control of radioactivity release – control of radiation exposure to plant personnel – health physics surveillance – waste management and disposal practices – environmental releases. [9]

Total Hours 45**Text Book(s):**

1.	EI-Wakil M M, "Nuclear Power Engineering", McGraw Hill, 1962.
2.	Robert E Masterson, "Nuclear Engineering Fundamentals-A Practical Perspective", CRC Press, 1 st Edition, 2017.

Reference(s) :

1.	Sam Mannan, "Lees' Loss Prevention in Process Industries", Vol1, Vol2, Vol3, Butterworth-Heinemann,, London, 4 th Edition 2012.
2.	EI- Wakil M M, "Nuclear Energy Conversion", American Nuclear Society, 1982.
3.	John R Lamarsh, Anthony J Baratta, "Introduction to Nuclear Engineering", PHI, 3 rd Edition, 2001.
4.	Micheal R Greenberg, "Nuclear Waste, Management, Nuclear Power and Energy Choices", Springer, 2013.

50 PIS E41- Human Factors Engineering

PIS: M.E. Industrial Safety Engineering

Elective - IV

Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P			C	CA	ES
II	3	0	0	45	3	50	50	100

Objective(s)	<ul style="list-style-type: none"> To give an overview on ergonomic and anatomy. To impart facts about human behaviour. To understand the influence of ergo design in accident prevention. To know about work related musculoskeletal disorders. To make the learner to be ergo- aware at all places.
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Course Outcomes	<p>At the end of the course the student will be able to</p> <ol style="list-style-type: none"> Explain human anatomy, anatomy of spine and pelvis, posture and biomechanics. Identify human behaviour using BBS and motivate through management theories. Design work station for static and dynamic worker considering anthropometric factors and work station parameters. Assess ergonomic risk factors of workers using posture evaluation tool. Employ Principles for design of visual and auditory displays in real time situation.
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Ergonomics and Anatomy

Introduction to ergonomics: The focus of ergonomics, ergonomics and its areas of application in the work system, a brief history of ergonomics, attempts to humanize work, modern ergonomics, and future directions for ergonomics. Anatomy, Posture and Bio Mechanics: Some basic bio mechanics and anatomy of the spine and pelvis, Bio Mechanical aspect of body movement .Posture: Good posture and bad posture, Posture stability and posture adaptation, low back pain, risk factors for musculoskeletal disorders in the workplace, behavioral aspects of posture, effectiveness and cost effectiveness, research directions. [9]

Human Behavior

Individual differences, Factors contributing to personality, Fitting the man to the job, Influence of difference on safety, Method of measuring characteristics, Accident Proneness. Motivation, Complexity of Motivation, Job satisfaction. Management theories of motivation, Job enrichment theory. Frustration and Conflicts, Reaction to frustration, Emotion and Frustration. Attitudes-Determination of attitudes, Changing attitudes Learning, Principles of Learning, Forgetting, Motivational requirements- Behavior Based Safety (BBS) – ABC theory – Implementation. [9]

Anthropometry for Work Design

Designing for a population of users, percentile, sources of human variability, anthropometry and its uses in ergonomics, principals of applied anthropometry in ergonomics, application of anthropometry in design, design for everyone, anthropometry and personal space, effectiveness and cost effectiveness. Fundamental aspects of standing and sitting, an ergonomics approach to work station design, design for standing workers, design for seated workers, work surface design, visual display units, guidelines for design of static work, effectiveness and cost effectiveness, research directions. [9]

Man - Machine System and Repetitive Works and Manual Handling Task

Applications of human factors engineering, man as a sensor, man as information processor, man as controller – Man vs Machine. Ergonomics interventions in Repetitive works, handle design, key board design ,measures for preventing in work related musculoskeletal disorders (WMSDs), reduction and controlling, training Anatomy and biomechanics of manual handling, prevention of manual handling injuries in the work place, design of manual handling tasks, lifting, pushing, pulling, carrying and postural stability. **Postural Evaluation Tools: Rapid Upper Limb Assessment (RULA), Rapid Entire Body Assessment (REBA), The Strain Index, NIOSH Lifting equation, Measurement of work effort and fatigue: Borg rating of perceived exertion scale, Muscle Fatigue Assessment method, Hand Activity Level (HAL).** [10]

Display, Controls and Virtual Environments

A general information-processing model of the users, cognitive system, problem solving, effectiveness. Principles for the design of visual and auditory displays- design of controls- combining displays and controls- virtual (synthetic) environments, research issues on human skill and performance. [8]

Total hours 45**Text Book(s):**

1.	McCormick Ernest J, "Human Factors In Engineering and Design", Mcgraw-Hill Book, 2016.
2.	Bridger R S , "Introduction to Ergonomics", CRC Press,3 rd Edition, 2015.

References :

1.	Dan Mc Leod, "The Ergonomics Manual", Philip Jacobs & Nancy Larson, 2000.
2.	Khan M I, " Industrial Ergonomics",Prentice Hall of India,2018.
3.	Wickens C D, Hee J, Liu Y, "Introduction to Human Factors Engineering",Prentice Hall of India, 2 nd Edition,2013.

50 PIS E42 - Cognitive Ergonomics

PIS: M.E. Industrial Safety Engineering

Elective – IV

Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P			C	CA	ES
II	3	0	0	45	3	50	50	100

Objective(s)	<ul style="list-style-type: none"> To impart the basics of anthropometry. To understand the human performance pertaining to job To know the facts about cognitive ergonomics. To address concepts pertaining to cognitive abilities, human machine interaction, human perception and decision making. To outline the significance of safety climate.
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Course Outcomes	<p>At the end of the course, the student will be able to</p> <ol style="list-style-type: none"> Design an ergo work station using ergonomics tools. Pinpoint the components of cognitive ergonomics. Guide on decision making pertaining to ergonomics. Assess mental workload and give suggestions Create a safety climate in the workplace.
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Anthropometry

Designing for a population of users, percentile, sources of human variability, anthropometry and its uses in ergonomics, principals of applied anthropometry in ergonomics, application of anthropometry in design, design for everyone, anthropometry and personal space, effectiveness and cost effectiveness.

Fundamental aspects of standing and sitting, an ergonomics approach to work station design. [10]

Human as an information processing system

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. [9]

Components of cognitive ergonomics

Cognitive ergonomics concerned with mental processes - perception, decision making, memory, reasoning and response execution - Challenges in allocation of attention, multiple task performance and operator workload measurement. [8]

Human Error and assessment

Skilled performance, attention, distraction, human error, work stress, risk perception, and Kansei engineering as these may relate to human- system design, safety and productivity. Assessment methodologies - hierarchical task analysis, cognitive task analysis, mental workload, human error identification/accident investigation, and situation awareness assessment. [10]

Safety culture

Pinpointing of Unsafe behavior-Positive reinforcement- observation and feedback. Evolution of Safety culture, Transformation requirement from reactive to proactive culture – Ethical responsibility for safety professional. [8]

Total Hours 45

Text Book(s):

1.	David B Kaber, Guy Boy, "Advances in Cognitive Ergonomics", CRC Press, 2010
2.	Peter A Hancock, "Human Performance and Ergonomics", Academic Press, 2 nd Edition, 1999

Reference(s) :

1.	Proceedings of Engineering Psychology and Cognitive Ergonomics, 13 th international conference, Canada, 2016
2.	McCormick Ernest J, "Human Factors In Engineering and Design", Mcgraw-Hill Book, 2016.
3.	Bridger R S, "Introduction to Ergonomics", CRC Press, 3 rd Edition, 2015.
4.	Theresa Stack, Lee T Ostrom, Cheryl A Wilhelmsen, "Occupational Ergonomics: A Practical Approach", Wiley, 2016

K.S.Rangasamy College of Technology – Autonomous							R 2018	
50 PIS E43 - Behaviour Based Safety and Safety Culture								
PIS: M.E. Industrial Safety Engineering								
Elective – IV								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P			C	CA	ES
II	3	0	0	45	3	50	50	100
Objective(s)	<ul style="list-style-type: none"> To impart facts about human behaviour and attitude. To provide insight into human error and how it can be reduced. To understand the significance the communication process. To explain the concept behind behaviour modification. To guide the learner to create a safety culture at workplace. 							
Course Outcomes	<p>At the end of the course, the student will be able to</p> <ol style="list-style-type: none"> Describe the fundamentals of Behavioural safety. Monitor the performance of the worker. Assess the communication process at worker's level. Determine behaviour Modification among workers. Identifies need based training with real life examples. 							
<p>Fundamentals of Behavioral Safety Historical background-H.W-Heinrich Theory and pyramid-Accident causal Analysis-Unsafe conditions, Unsafe acts, personal factors and proximate factors-ABC Analysis for a behavior of Activator. Behavior and consequences-components of behavior of Safety Programme – Critical behaviors and observation process-Near Miss Management Programme-Suggestion schemes for the effective implementation-Feedback to workers-Improvement, Review and effectiveness of feedback. [9]</p> <p>Performance Monitoring and Consequences Goals and objectives for monitoring activators-policies and procedures-priorities and accountabilities-Training and education-Job Aids such as checklists and flow-charts-pre-job safety Instructions-manuals and pocket guides-Recognition and Rewards for positive performance-Reinforcement of monitoring process-Demerit factors for Negative performance-Consequence classification-positive/Negative(P/N)-Immediate/Future (I/F)-certain/Uncertain (C/V)-positive, Immediate and certain (PIC)-case study on Respiratory Hazards. [10]</p> <p>Observation and Communication Process Observation procedure-Observation checklist-communication of Near Miss Behaviors, Injury causes and critical Behaviors-Observation Result charts, graphs and displays-Tool Box Talks-Frequent observations of safety critical activities such as startup/Shutdown-orientation programme-watch over new employees, younger employees, workers under pressure/stress, workers running/rushing, and new contractors/sub-contractors.[8]</p> <p>Behavior Modification Safety first approach to all Work-management responsibilities-supervisor responsibilities-worker responsibilities-New, young, and contract workers responsibilities-project safety rules-safe operating procedures (SOP)-workplace Hazardous material information system (WHMIS)-PPE and work clothing-compliance monitoring-Harassing behaviors-Disciplinary actions-verbal warning, written warning and removal from the site-safety signage-safety meetings – Digital display of precautionary information-training needs, and need based training with real life examples. [8]</p> <p>Safety Culture Safety culture- Commitment –policy-management-individual- safety culture framework- assumptions-espoused values – artefacts -Attitude towards safety-Traditional safety Vs behavioral safety-Acts of indifference-Acts of improper attitude-Acts due to lack of knowledge-At-Risk Behavior model-intentional, unintentional and Habitual At-Risk Behaviors-Four stages of Being-Rushing, Frustration, fatigue and complacency-four critical errors-eyes not on the task, mind not on the task, Being in or moving into the “Line of Fire” and losing the balance, traction or group-critical Error reduction techniques(CERT)-Advanced safety skills and awareness training-case study on the knowledge of hazards and relevant procedures. [10]</p>								
								Total Hours 45
Text Book(s):								
1.	Kaila H L, “Industrial Safety and Human Behaviour”, AITBS Publishers,2013.							
2.	Roughton J E, J J Mercurio, “ Developing An Effective Safety Culture”, Butterworth Heinemann, 2012.							
Reference(s) :								
1.	Juni Daalmans,“Human Behaviour in Hazardous Situations”, Butterworth Heinemann ,2012.							
2.	Thomas R Krause, “The Behaviour –Based Safety Process”, Wiley, 2 nd Edition,1996.							
3.	Charles D Reese, “Occupational Health and Safety Management: A Practical Approach”, CRC Press, 3 rd Edition,2018.							
4.	Peter A Hancock, “ Human Performance and Ergonomics”, Academic Press,2 nd Edition,1999							

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50 PIS E51 - Safety in Construction

PIS: M.E. Industrial Safety Engineering

Elective – V

Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P			C	CA	ES
III	3	0	0	45	3	50	50	100

Objective(s)	<ul style="list-style-type: none"> To give insights on construction industry and the work nature. To understand the construction accidents and contributing causes. To know the Indian and international regulations pertaining to construction work. To impart knowledge on construction machineries. To describe means and ways for safe demolition activity.
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Course Outcomes	<p>At the end of the course, the student will be able to</p> <ol style="list-style-type: none"> Understand construction industry, hazards, causes, activities and relate with BOCW act. Identify types of excavation, scaffold hazards and suggest adequate control measures. Relate OSHA standards for fall protection and fall prevention in construction practice. Understand Operation and maintenance of Earth moving machinery and investigate accidents. Formulate Demolition, types and safe demolition activity in industrial and domestic site.
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Accidents Causes and Management Systems: 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 – the building and other construction workers act and rules 1996- Pre contract activities, preconstruction meeting - design aids for safe construction – permits to work – tool box meeting- quality assurance in construction - compensation – Recording of accidents and safety measures – Education and training. [9]

Hazards Of Construction and Prevention: 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. [9]

Working at Heights: 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, Mobile elevated Working Platforms(MEWPs) – fall prevention and fall protection, safety harness, safety nets, fall arrestors, controlled access zones, safety monitoring systems – working on fragile roofs, work permit systems, Safety pass – Alternative equipments for scaffolding work - accident case studies. [9]

Construction Machinery: 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, scaffolding, hoisting cranes – use of conveyors and mobile cranes – manual handling. [9]

Safety in Demolition Work: 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 –Case studies. [9]

Total Hours 45

Text Book(s):

1.	Davies V J and Tomasin K “Construction Safety Hand Book”, Thomas Telford Ltd., London, 1990.
2.	Sharma S C and Vineet kumar, “ Safety,Occupational Health and Environmental Management in Construction”, Khanna Publishers, 1 st Edition,2013.

Reference(s) :

1.	Charles D Reese and James V Edison, “Handbook of OSHA Construction Safety and Health”,CRC press,2006
2.	King R W and Hudson R, “Construction hazard and Safety Hand book”, Butter Worth- Heinemann, 1985.
3.	Bhattacharjee S K, “Safety Management in Construction”, Khanna Publishers,2013.
4.	“Health and Safety in Construction” ,HSE publications,3 rd Edition,2006

K.S.Rangasamy College of Technology – Autonomous							R 2018	
50 PIS E52 - Dock Safety								
PIS: M.E. Industrial Safety Engineering								
Elective – V								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P			C	CA	ES
III	3	0	0	45	3	50	50	100
Objective(s)	<ul style="list-style-type: none"> To understand the nature of work and process involved in Docks. To know the types of docks and its safe handling. To familiarize on the regulations pertaining to safety and welfare of dock workers. To carryout testing and examination of lifting equipments and tackles. To explain the significance of emergency action plans. 							
Course Outcomes	<p>At the end of the course, the student will be able to</p> <ol style="list-style-type: none"> Understand the statues pertaining to dock safety. Identify cargo, types of cargo ships and formulate procedures to maintain safety on ships Examine and test the lifting appliances. Understand testing, examination and inspection of containers. Draft and enact emergency action plans. 							
<p>History of Safety Legislation History of dock safety statues in India-background of present dock safety statues-dock workers (safety, health and welfare) act 1986 and the rules and regulations framed there under, other statues like marking of heavy packages act 1951 and the rules framed there under - manufacture, storage and import of hazardous chemicals. Rules 1989 framed under the environment (protection) act, 1989 – few cases laws to interpret the terms used in the dock safety statues.</p> <p>Responsibility of different agencies for safety, health and welfare involved in dock work –responsibilities of port authorities – dock labour board – owner of ship master, agent of ship – owner of lifting appliances and loose gear etc. – employers of dock workers like stevedores – clearing and forwarding agents – competent persons and dock worker. Forums for promoting safety and health in ports – Safe Committees and Advisory Committees. Their functions, training of dock workers. [11]</p> <p>Working On Board the Ship Types of cargo ships – working on board ships – Safety in handling of hatch beams – hatch covers including its marking, Mechanical operated hatch covers of different types and its safety features – safety in chipping and painting operations on board ships – safe means of accesses – safety in storage etc. – illumination of decks and in holds – hazards in working inside the hold of the ship and on decks – safety precautions needed – safety in use of transport equipment - internal combustible engines like fort-lift trucks-pay loaders etc. Working with electricity and electrical management – Storage – types, hazardous cargo. [9]</p> <p>Lifting Appliances Different types of lifting appliances – construction, maintenance and use, various methods of rigging of derricks, safety in the use of container handling/lifting appliances like portainers, transtainer, top lift trucks and other containers – testing and examination of lifting appliances – portainers – transtainers – top lift trucks – derricks in different rigging etc- use and care of synthetic and natural fiber ropes – wire rope chains, different types of slings and loose gears. [8]</p> <p>Transport Equipment The different types of equipment for transporting containers and safety in their use-safety in the use of self loading container vehicles, container side lifter, fork lift truck, dock railways, conveyors and cranes. Safe use of special lift trucks inside containers – Testing, examination and inspection of containers – carriage of dangerous goods in containers and maintenance and certification of containers for safe operation. Handling of different types of cargo – stacking and unstacking both on board the ship and ashore – loading and unloading of cargo identification of berths/walking for transfer operation of specific chemical from ship to shore and vice versa – restriction of loading and unloading operations. [9]</p> <p>Emergency Action Plan and Dock Workers (SHW) Regulations 1990 Emergency action Plans for fire and explosions - collapse of lifting appliances and buildings, sheds etc., - gas leakages and precautions concerning spillage of dangerous goods etc., - Preparation of on-site emergency plan and safety report. Dock workers (SHW) rules and regulations 1990-related to lifting appliances, Container handling, loading & unloading, handling of hatch coverings and beams, Cargo handling, conveyors, dock railways, forklift. [8]</p>								
								Total Hours 45
Text Book(s):								
1.	"Safety and Health in Dock work", International Labour Organization, 2 nd Edition, 1997.							
2.	"The Dock Workers Act 1948 with rules 1962", Universal Law Publishing, New Delhi, 2016.							
Reference(s) :								
1.	Velitchkovitch J, "Guide to Safety and Health in Dock Work" , ILO, 1976.							
2.	Taylor D A, "Introduction to Marine Engineering" , Butterworth-Heinemann, 2 nd Edition 1996.							
3.	Srinivasan R, "Harbour, Dock and Tunnel Engineering". CPH Pvt Limited, 28 th Edition, 2016							
4.	Bindra S R, "Course in Dock & Harbour Engineering". Dhanpat Rai Publications (P) Limited, New Delhi, 2013							

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Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P			C	CA	ES
III	3	0	0	45	3	50	50	100

Objective(s)

- To explain the facts about road safety.
- To describe the transportation of hazardous goods.
- To understand the roles and responsibilities of hazardous transport drivers.
- To impart the safety guidelines to be followed in road transport inside the premises.
- To impart the safety guidelines to be followed in road transport

Course Outcomes

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

1. Understand factors for improving safety on roads.
2. Understand the statues pertaining to transportation of hazardous goods.
3. Identify the safety responsibility of drivers and legal requirements
4. Recognize factors influencing road alignment and plant road lines
5. Identify factors influencing safety practice on plant railway lines.

Road Transport: 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. [8]

Transportation of Hazardous Goods: Legal requirements - Transport emergency card (TREM) – driver training, defensive driving -parking of tankers on the highways, Industry – technological smart systems in parking -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 – Security Procedures – communication – hazard identification and risk assessment- Emergency measures for fire and spillages during transportation of hazardous materials. [9]

Safety Responsibility of Drivers: 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-CMVR Central Motor Vehicle Rules (1988) - driver relaxation and rest pauses – speed and fuel conservation – emergency planning and HAZMAT codes. [9]

Road Safety: 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-Displays and signages-Plant road safety- overloading-concentration of driver.-Transportation of hazardous goods. [10]

Plant railway: Clearance-track-warning methods-loading and unloading-moving cars-safety practices.

Shop Floor And Repair Shop Safety: Housekeeping – Safe materials storage - Transport precautions-safety on manual, mechanical handling equipment operations-safe driving-fork lift truck-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- slip trip and falls. [9]

Total Hours 45**Text Book(s):**

1. Nicholas P Cheremisinoff, "Transportation of Hazardous Materials: A Guide to Compliance", William Andrew,1994.
2. Geetam Tiwari, Dinesh Mohan, "Transport Planning and Traffic Safety: Making cities,Roads and Vehicles safer",CRC Press,2016.

Reference(s) :

1. Babkov V F, "Road Conditions and Traffic Safety", MIR Publications, Moscow, 1986.
2. Kadiyali, "Traffic Engineering and Transport Planning", Khanna Publishers, New Delhi, 1983.
3. Motor Vehicles Act - 1988, Universal Law Publishing, New Delhi,2016.
4. Popkes C A, "Traffic Control and Road Accident Prevention", Chapman and Hall Limited, 1986.

K.S.Rangasamy College of Technology – Autonomous						R2018		
50 PIS E61- Environmental Safety								
PIS: M.E. Industrial Safety Engineering								
Elective - VI								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3	50	50	100
Objective(s)	<ul style="list-style-type: none"> To give insight on Environment pollution. To impart the causes and consequences of air pollution. To educate the causes and ill effects of water pollution. To describe the causes and effects of hazardous wastes. To impart knowledge on pollution control equipments and methods. 							
Course Outcomes	<p>At the end of the course, the students will be able to</p> <ol style="list-style-type: none"> Associate air pollutants, causes and effects and execute controls measures for air pollution at domestic and industrial level pertaining to air pollution statuses Associate water pollutants, causes and effects and execute controls measures for water pollution at domestic and industrial level pertaining to water pollution statuses Understand the characteristics of hazardous waste and execute controls measures for land pollution at domestic and industrial level pertaining to hazardous waste management statuses. Experiment sampling techniques to measure the level of gaseous pollutants and particulate matters in industrial sector and environment. Investigate hazards and implement Pollution control measures at Major hazardous industries. 							
<p>Air Pollution 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 - ultra violet radiation, infrared radiation, radiation from sun-hazards due to depletion of ozone - deforestation-ozone holes- automobile exhausts- stack emissions - CFC- Statutory Provisions related to Air Pollution - Emission standards : Permissible Limits –National Ambient Air Quality Standards(NAAQS) -MINAS – EURO Norms – Legal Compliance to statutory Norms. [9]</p> <p>Water Pollution 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 - Statutory Provisions related to Water Pollution- Effluent standards: Permissible Limits – Legal Compliance to statutory norms. [9]</p> <p>Hazardous Waste Management Hazardous waste management in India-waste identification, characterization and classification-technological options for collection, transport ,storage, treatment and disposal of hazardous waste- Disposal Facilities - Secured Landfills -selection charts for the treatment of different hazardous wastes-methods of collection and disposal of solid wastes-health hazards-toxic ,E-waste and radioactive wastes-incineration and vitrification - hazards due to bio-process-dilution-standards and restrictions – recycling and reuse- Statutory Provisions related to Hazardous waste management & handling. [9]</p> <p>Environmental Measurement and Control Sampling and analysis – dust monitor – gas analyzer, particle size analyzer –pH meter – gas chromatograph – atomic absorption spectrometer- Inductive Coupled Spectrophotometer. 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 – National Forest Policy – National Water Policy – National Agriculture Policy – National Environment Policy – Ministry of Environment and Forest (MoEF) – CPCB, TNPCB- online monitoring, Corporate Social Responsibility (CSR) - Corporate Responsibility for environmental protection (CREP) – UNFCC – Stockholm convention on Persistent organic pollutants 2001. [10]</p> <p>Pollution Control in Major hazardous (MAH) Industries Environmental Impact Assessment (EIA) – Pollution control in process industries like cement, paper, petroleum-petroleum products-textile-tanneries-thermal power plants -dyeing and pigment industries - eco-friendly energy - National Environment Assessment and Monitoring Authority (NEAMA). [8]</p>								
						Total Hours 45		
Text book(s):								
1.	Rao C S, “Environmental Pollution Engineering”, Wiley Eastern Limited, New Delhi, 2 nd Edition 2007.							
2.	Rao M N , Sultana R, “ Solid and Hazardous Waste Management”, BS Publications, 2013.							
Reference(s) :								
1.	Mahajan S P, “Pollution Control in Process Industries”, Tata McGraw Hill Publishing Company, New Delhi, 2006.							
2.	Varma and Brauer, “Air Pollution Equipment”, Springer Publishers, 2 nd Edition,1981.							
3.	Rajni Kant and Keshav Kant, “ Water Pollution : Management, Control and Treatment”, Narosa Publishing House, 2016.							
4.	Karl B Schnelle Jr, Russell F Dunn, Mary Ellen Ternes “ Air Pollution Control Technology Handbook”,CRC Press,2 nd Edition, 2017.							

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K.S.Rangasamy College of Technology – Autonomous							R2018	
50 PIS E62–Reliability Engineering								
PIS: M.E. Industrial Safety Engineering								
Elective – VI								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P			C	CA	ES
III	3	0	0	45	3	50	50	100
Objective(s)	<ul style="list-style-type: none"> • To learn the concept of reliability. • To describe the reliability prediction models. • To enhance knowledge on hazard plotting and risk assessment. • To ascertain functionality of safety barriers system ensuring safety for the human beings. • To study the probability of failure on demand in regard with factory setting. 							
Course Outcomes	<p>At the end of the course, the student will be able to</p> <ol style="list-style-type: none"> 1. Understand the significance of reliability metrics. 2. Calculate failure data analysis using exponential, normal, gamma and Weibull distribution and draw hazard plotting 3. Solve problems and work on m/n configuration systems, series parallel systems. 4. Understand the concepts of reliability testing and reliability allocation. 5. Conduct risk assessment to identify the industrial problem and provide suitable solution. 							
<p>Reliability Concept Reliability function – failure rate – mean time between failures (MTBF) – mean time to failure (MTTF) – A priori and a posteriori concept - mortality curve – useful life – availability – maintainability – system effectiveness. [9]</p>								
<p>Failure Data Analysis Time to failure distributions – Exponential, normal, Gamma, Weibull, ranking of data – probability plotting techniques – Hazard plotting. [9]</p>								
<p>Reliability Prediction Models Series and parallel systems – RBD approach – Standby systems – m/n configuration – Application of Bayes' theorem – cut and tie set method – Markov analysis – Fault Tree Analysis – limitations. [9]</p>								
<p>Reliability Management Reliability testing – Reliability growth monitoring – Non-parametric methods – Reliability and life cycle costs – Reliability allocation – Replacement model. [9]</p>								
<p>Risk Assessment Definition and measurement of risk – risk analysis techniques – risk reduction resources – industrial safety and risk assessment. [9]</p>								
								Total Hours 45
Text book (s) :								
1	Srinath L S, "Reliability Engineering", Affiliated East-West Press Pvt. Ltd, New Delhi, 4 th Edition 2006.							
2	Charles E Ebeling, "An Introduction to Reliability and Maintainability Engineering", Tata Mcgraw Hill, 2009.							
Reference(s) :								
1	Mohammed Modarres et al, "Reliability and Risk analysis", CRC Press, 2 nd edition, 2009.							
2	Naikan V N A, "Reliability Engineering and Life Testing", PHI, 2013.							
3	Bhaskar S, Narayanamoorthy S, "Statistical Quality Control and Reliability Engineering", Anuradha agencies Publishers,2002.							
4	Smith C O, "Introduction to Reliability in Design", McGraw Hill, London, 1976.							

50 PIS E63 - Integrated Management Systems

PIS: M.E. Industrial Safety Engineering

Elective - VI

Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3	50	50	100
Objective(s)	<ul style="list-style-type: none"> To impart the significance of ISO certification. To give insight to PDCA cycle. To scrutinize the standards from the elementary view. To give exposure of transition from OHSAS 18001 to ISO 45001. To make the learner competent in areas pertaining to integrated management system both at national and international level. 							
Course Outcomes	<p>At the end of the course, the student will be able to</p> <ol style="list-style-type: none"> Understand the structure and features of OHSAS 18001. Understand the significance of ISO 45001 OSHMS. Implement ISO 45001 as per legal requirements. Understand the significance of ISO 14001 Environment Management System Understand the significance of ISO 9001 Quality Management System. 							

OHSAS Standard

Introduction – Development of OHSAS standard – Structure and features of OHSAS 18001 –FOHSR -Planning – Guidelines, methodology steps developing action plan-OHSAP -OH&S policy- certification procedure – OH & S management system element, specification and scope- Benefits of certification of OHSAS 18001- correspondence between OHSAS 18001, ISO22000, ISO18001, ISO 15001, ISO 14001:1996 and ISO 9001:1994 – Guidelines (18002:2000) for implementing OHSAS 18001. [9]

ISO 45001

ISO 45001- need for ISO 45001 – Terms and definitions -structure and features of ISO 45001- contents of ISO 45001- developing OH&S Policy –guidelines- Benefits -Certification Procedure-correspondence between OHSAS 18001 and ISO 45001 Gap Analysis -migration from OHSAS 18001 to ISO 45001. [8]

ISO 45001 Implementation and Operation, Checking and Review

Guidelines for structure and Responsibilities, Clauses 4 – 10 – Context of the Organisation-Leadership- Organisational roles and workers participation – Planning –actions to address risk and opportunities –hazard identification-assessment of OH&S risks and other risks to an OHSMS- Determination of legal and other requirements -Planning actions – OH&S objectives and their planning –competence and awareness- Communication – Documentation. Operational Planning and control – Emergency Preparedness and response –Monitoring, measurement, analysis and performance evaluation – OHSMS audit –Continual improvement – Beyond ISO 45001. [10]

ISO 14001

EMS, ISO 14001, specifications, objectives, Environmental Policy, Guidelines & Principles (ISO 14004), environmental aspects and management programmes, clauses 4.1 to 4.5. Documentation requirements, 3 levels of documentation for a ISO 14000 based EMS, steps in ISO 14001.

Implementation plan, Registration, Importance of ISO 14000 to the Management. Auditing ISO14000-General principles of Environmental Audit, Auditor, steps in audit, Audit plan – comparative study between OHSAS 18001 and ISO 14001 – Case studies. [9]

ISO 9001

Introduction to ISO 9001- Scope, Application – Range of ISO standards – Principles of quality management- Steps for implementing ISO 9001:2008: Check list – Process approach – Documentation- Clause-wise explanation and Audit concepts – Measurement, analysis and improvement: General – Monitoring and measurement – Control of nonconforming product – Analysis of data – Improvement – Certification of quality management system – Steps involved – Audit of quality management system: Purpose – Types of quality audits – Case studies. [9]

Total Hours 45**Text book(s):**

1	Arora K C Dr, "ISO 9000 to OHSAS 18001", S.K. Kataria& Sons, Delhi,2010.
2.	ISO 45001:2018 – Occupational Health and Safety Management System.

References:

1	Wayne Pardy, Terri Andrews, " Integrated Management System", Bernan Press, 2 nd Edition, 2019.
2	Ramesh C Grover, Sachin Grover, " Providing Safe & Health workplace with ISO 45001:2018", Notion Press,
3	Garry Cornell, " The ISO 14001: 2015 Companion", Advisera Expert Solutions Ltd, 2017.
4	Milton P Dentch, "The ISO 45001:2018 Implementation Hand book", ASQ Quality Press, 2018.

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50 AT 001 English for Research Paper Writing

Common to all Branches

Semester	Hours / Week			Total hrs	Credit C	Maximum Marks		
	L	T	P			CA	ES	Total
I/II	2	0	0	30	-	100	-	100
Objectives	<ul style="list-style-type: none"> To know how to improve your writing skills and level of readability To learn about what to write in each section To gain the skills needed when writing a Title To improve research paper writing skills 5. To enhance the knowledge on plagiarism while writing papers 							
Course Outcomes	<p>At the end of the course, the students will be able to</p> <ol style="list-style-type: none"> Gain an introductory knowledge of the some of the issues explored in influential works of the English-language tradition, Explain some of the stylistic strategies writers have used to explore those issues. Read complex texts actively: recognize key passages; raise questions; Describe complexity and ambiguity; comprehend the literal and figurative Enhance their skill in use of language. 							
<p>Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness [5]</p> <p>Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction [5]</p> <p>3Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check. [5]</p> <p>key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, [5]</p> <p>skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions [5]</p> <p>useful phrases, how to ensure paper is as good as it could possibly be the first- time submission [5]</p>								
						Total Hours 30		
Text book(s):								
1	Goldbort R “Writing for Science:, Yale University Press 2006							
2	Day R “How to Write and Publish a Scientific Paper”, Cambridge University Press, 2006.							
References:								
1	Highman N “Handbook of Writing for the Mathematical Sciences”, SIAM. Highman'sbook.1999.							
2	Adrian Wallwork, “English for Writing Research Papers:, Springer New York Dordrecht Heidelberg London, 2011							
3	Singh Bhakar, “Hand Book for Writing Research Paper”, Bharati Publications, New Delhi, 2014.							
4	Steven D Krause, “The Process of Research Writing”, Steven D. Krause Publisher, 2004							

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50 AT 002 Disaster Management								
Common to all Branches								
Semester	Hours / Week			Total hrs	Credit C	Maximum Marks		
	L	T	P			CA	ES	Total
I/II	2	0	0	30	-	100	-	100
Objectives	<ul style="list-style-type: none"> Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response. Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives. To understand approaches of Disaster Management Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations. Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in 							
Course Outcomes	<p>At the end of the course the students will be able to:</p> <ol style="list-style-type: none"> Understand the various hazards Analyze the situation during hazards and take necessary steps for protection Know the risks involved in natural disaster Apply the knowledge of risk assessment and protect the public Create awareness about disaster and its management techniques among public 							
<p>Introduction [5] Disaster: Definition, Factors And Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.</p> <p>Repercussions of Disasters and Hazards: [5] Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks of Disease And Epidemics, War And Conflicts.</p> <p>Disaster Prone Areas in India [5] Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides and Avalanches; Areas Prone to Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases and Epidemics</p> <p>Disaster Preparedness and Management [5] Preparedness: Monitoring of Phenomena Triggering A Disaster Or Hazard; Evaluation of Risk: Application of Remote Sensing, Data From Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness.</p> <p>Risk Assessment [5] Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People’s Participation in Risk Assessment. Strategies for Survival.</p> <p>Disaster Mitigation [5] Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends in Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs Of Disaster Mitigation in India.</p> <p style="text-align: right;">Total Hours 30</p>								
Text book(s):								
1	Nishith R, Singh A K, “Disaster Management in India: Perspectives, issues and strategies”, New Royal book Company.							
2	Sahni, Pardeep Et.Al. (Eds.),” Disaster Mitigation Experiences And Reflections”, Prentice Hall Of India, New Delhi.							
Reference(s):								
1	Damon Coppola, “Introduction to International Disaster Management” 3rd Edition, Butterworth-Heinemann ,2015.							
2	Goel S L, “Disaster Administration and Management Text and Case Studies”,Deep &Deep Publication Pvt. Ltd., New Delhi.							
3	Gupta A K, Niar S S and Chatterjee S Disaster management and Risk Reduction, Role of Environmental Knowledge, Narosa Publishing House, New Delhi, 2013.							
4	Murthy DB N, “Disaster Management”, Deep and Deep Publication PVT. Ltd. ,New Delhi,2012.							

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Chairman,BoS/MCT

K.S.Rangasamy College of Technology – Autonomous R2018**50 AT 003 - Sanskrit for Technical Knowledge****Common to all Branches**

Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P			C	CA	ES
I/II	2	0	0	30	-	100	-	100
Objective(s)	<ul style="list-style-type: none">To get a working knowledge in illustrious Sanskrit, the scientific language in the world.To improve brain functioningTo develop the logic in mathematics, science & other subjects enhancing the memory powerTo explore the huge knowledge from ancient literatureTo inculcate technical knowledge on Sanskrit							
Course Outcomes	At the end of the course, the students will be able to <ol style="list-style-type: none">Know the basic Sanskrit language.Explain an ancient Sanskrit literature about science & technology.Develop logical skill among the group.Speak and write Sanskrit languageDescribe the technical concepts of engineering							

Basics of Sanskrit

Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences.

[10]

Sanskrit Literature

Order, Introduction of roots, Technical information about Sanskrit Literature.

[10]

Technical Concepts in Engineering

Technical concepts of Engineering-Electrical, Mechanical,Architecture, Mathematics.

[10]

Total Hours 30**Text book (s) :**

1	Vishwas Dr, Abhyaspustakam” – Samskrita-Bharti Publication, New Delhi. 2014
2	PrathamaDeeksha-VempatiKutumbshastri, “Teach Yourself Sanskrit” Rashtriya SanskritSansthanam, New Delhi Publication.2016

Reference(s) :

1	Suresh Soni, “India’s Glorious Scientific Tradition” Ocean books (P) Ltd., New Delhi.2007
2	Venkitasubramonia Iyer S, “Technical Literature in Sanskrit, Volume 10”, University of Kerala, 1997
3	Kaviraj Gopinath, “The Sandilya Sanhita Bhaktikhanda”, Publisher: Nabu Press, 2016
4	Khmer Bible, “Sanskrit textbook rewrites the script on modern science”, Cambodia Press, 2019.

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50 AT 004 Value Education

Common to all Branches

Semester	Hours / Week			Total hrs	Credit C	Maximum Marks		
	L	T	P			CA	ES	Total
I/II	2	0	0	30	-	100	-	100

Objectives	<ul style="list-style-type: none"> To know value of education and self- development To Imbibe good values in students To let the should know about the importance of character To gain knowledge on moral values To inculcate the habit of ethics and behaviour
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Course Outcomes	<p>At the end of the course, the students will be able to</p> <ol style="list-style-type: none"> 1. Explain about knowledge of self-development 2. Describe the importance of Human values 3. Develop the overall personality 4. Exercise work with ethics in work place 5. Demonstrate moral values and behaviour in practice
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- Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism.
- Moral and non- moral valuation. Standards and principles.
- Value judgements [5]
- Importance of cultivation of values.
- Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness.
- Honesty, Humanity. Power of faith, National Unity.
- Patriotism. Love for nature, Discipline [5]
- Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking.
- Integrity and discipline.
- Punctuality, Love and Kindness.
- Avoid fault Thinking.
- Free from anger, Dignity of labour.
- Universal brotherhood and religious tolerance.
- True friendship.
- Happiness Vs suffering, love for truth.
- Aware of self-destructive habits.
- Association and Cooperation.
- Doing best for saving nature [10]
- Character and Competence –Holy books vs Blind faith.
- Self-management and Good health.
- Science of reincarnation.
- Equality, Non violence, Humility, Role of Women.
- All religions and same message.
- Mind your Mind, Self-control.
- Honesty, Studying effectively [10]

Total Hours 30

Text book(s):

1	Chakroborty, S K, "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi 2016.
2	Ghose D N, "A Textbook of Value Education". Dominant Publishers, 2005.

References:

1	Venkataiah N, "Value Education", APH Publishing, 1998.
2	Venkataiah N, "Research in Value Education", APH Publishing, 1996.
3	Shukla R P, "Value education and human rights", Sarup & Sons, 2004.
4.	Satya Pal Ruhela, "The Emerging Concept of Education in Human Values", Daya Books, 1996.

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K.S.Rangasamy College of Technology – Autonomous R2018								
50 AT 005 Pedagogy Studies								
Common to all Branches								
Semester	Hours / Week			Total hrs	Credit C	Maximum Marks		
	L	T	P			CA	ES	Total
I/II	2	0	0	30	-	100	-	100
Objectives	<ul style="list-style-type: none"> To understand the language background of students. To learnt about the nature of classroom discourse. To describe the nature and need of informational reading. To analyse content areas and to write. To understand the importance and role of language for content areas. 							
Course Outcomes	<p>At the end of the course the students will be able to:</p> <ol style="list-style-type: none"> Develop and document their own personal learning network Create a concept map to identify layers of understanding Develop a project-based lesson plan that emphasizes student exploration, interaction, creation, and feedback cycles Compare strengths and weaknesses of online tools and methods Articulate a personal philosophy for teaching and learning 							
<p>Module 1 Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology, Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions. Overview of methodology and Searching. [6]</p> <p>Module 2 Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education. [4]</p> <p>Module 3 Evidence on the effectiveness of pedagogical practices, Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies. [8]</p> <p>Module4 Professional development: alignment with classroom practices and follow- up support, Peer support. Support from the head teacher and the community. Curriculum and assessment Barriers to learning: limited resources and large class sizes. [6]</p> <p>Module 5 Research gaps and future directions, Research design, Contexts, Pedagogy, Teacher education Curriculum and assessment Dissemination and research impact. [6]</p>								
Total Hours 30								
Text book(s):								
1	Anderson T and Elloumi, F (Eds.). "Theory and practice of online learning" Athabasca, AB, Canada: Athabasca University, 2 nd Edition, 2008.							
2	Fink L D, "Creating significant learning experiences: An integrated approach to designing college courses. San Francisco, CA: Jossey-Bass", 2013.							
References:								
1	Akyeampong K " Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.", 2003.							
2	Akyeampong K, Lussier K, Pryor J, Westbrook J " Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count?", International Journal Educational Development, 33 (3): 272–282,2013.							
3	Alexander R J , "Culture and pedagogy: International comparisons in primary education", Oxford and Boston: Blackwell, 2001.							
4	Chavan M , " Read India: A mass scale, rapid, 'learning to read' campaign",2003.							

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K.S.Rangasamy College of Technology – Autonomous R2018								
50 AT 006 - Stress Management by Yoga								
Common to all Branches								
Semester	Hours / Week			Total hrs	Credit C	Maximum Marks		
	L	T	P			CA	ES	Total
I/II	2	0	0	30	-	100	-	100
Objective(s)	<ul style="list-style-type: none"> To gain knowledge on overall health of body and mind. To know how to overcome stress. To inculcate the habit of yoga practice. To perform yoga exercises. To manage stress at work place. 							
Course Outcomes	<p>At the end of the course, the students will be able to</p> <ol style="list-style-type: none"> Develop healthy mind in a healthy body Improve social health Prove their efficiency Handle stress at work places Practice yoga exercise 							
1. Definitions of Eight parts of yoga. (Ashtanga)								[10]
2. Yam and Niyam. Do's and Don't's in life. <ol style="list-style-type: none"> Ahinsa, satya, asthaya, bramhacharya and aparigraha Shaucha, santosh, tapa, swadhyay, ishwarpranidhan 								[10]
3. Asan and Pranayam <ol style="list-style-type: none"> Various yog poses and their benefits for mind & body Regularization of breathing techniques and its effects-Types of pranayama 								[10]
Total Hours 30								
Text book(s):								
1	Yogic Asanas for Group Training-Part-I", Janardan Swami YogabhyasiMandal, Nagpur.2016							
2	"Rajayoga or conquering the Internal Nature" by Swami Vivekananda, AdvaitaAshrama(Publication Department), Kolkata. 2018							
References:								
1	Acharya Yatendra, "Yoga & Stress Management", The Picnic Basket 2019							
2	Swami Shivapremananda, "Yoga for Stress Relief: A Simple and Unique Three-Month Program for De-Stressing and Stress Prevention", Random House; 1st edition , January 20, 1998.							
3	Udupa K N, "Stress and Its Management by Yoga", Motilal Banarsidass Publ., 1985							
4	Udupa K N, "Disorders of Stress and Their Management by Yoga: A Study of Neurohumoral Response", Banaras Hindu University, 1978.							

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K.S.Rangasamy College of Technology – Autonomous R2018								
50 AT 007 - Personality Development Through Life Enlightenment Skills								
Common to all Branches								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P			C	CA	ES
I/II	2	0	0	30	-	100	-	100
Objective(s)	<ul style="list-style-type: none"> To learn to achieve the highest goal happily. To become a person with stable mind, pleasing personality and determination. To awaken wisdom in students. To inculcate the habit of personality development To gain knowledge on life skills 							
Course Outcomes	<p>At the end of the course, the students will be able to</p> <ol style="list-style-type: none"> Develop versatile personality. Achieve the highest goal in life by developing personality. Lead the nation and mankind to peace and prosperity. Improve their life skills Explain about work culture in work place 							
Neetisatakam -Holistic development of personality								
Verses- 19,20,21,22 (wisdom)								
Verses- 29,31,32 (pride & heroism)								
Verses- 26,28,63,65 (virtue)								
Verses- 52,53,59 (dont's)								
Verses- 71,73,75,78 (do's) [10]								
Approach to day to day work and duties.								
ShrimadBhagwadGeeta : Chapter 2-Verses 41, 47,48, Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35, Chapter 18-Verses 45, 46, 48. [10]								
Statements of basic knowledge.								
ShrimadBhagwadGeeta: Chapter2-Verses 56, 62, 68 Chapter 12 -Verses 13, 14, 15, 16,17, 18 Personality of Role model. ShrimadBhagwadGeeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42, Chapter 4-Verses 18, 38,39 Chapter18 – Verses 37,38,63 [10]								
Total Hours 30								
Text book(s) :								
1	Swami Swarupananda “Srimad Bhagavad Gita” Advaita Ashram PublicationDepartment), Kolkata, 2016							
2	P.Gopinath,Rashtriya, Bhartrihari’s Three Satakam (Niti-sringar-vairagya) SanskritSansthanam, New Delhi. 2015							
References:								
1	Sagir Ahmed, “Enlightenment: Personality Development & Management”, Mind & Body Philosophy eBooks, 2015							
2	S.K Chakroborty,. “Valuesand Ethics for organizations Theory and practice”, OxfordUniversity Press, New Delhi, 2018							
3	Prashant Kumar Nayak, “Personality Development Through Life Enlightenment Skills”, Springer, 2010							
4	Saroj Hiremath, “Life skills and Personality Development”, Sage Publisher 2016							

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K.S.Rangasamy College of Technology – Autonomous R2018

50 AT 008 - Constitution of India

Common to all Branches

Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P			C	CA	ES
I/II	2	0	0	30	-	100	-	100
Objective(s)	<ul style="list-style-type: none"> To know the premises informing the twin themes of liberty and freedom from a civil rights perspective. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution. To gain knowledge on bill passing To acquire knowledge on function of election commission 							
Course Outcomes	<p>At the end of the course the students will be able to:</p> <ol style="list-style-type: none"> Discuss the growth of the demand for civil rights in India for the bulk of fns before the arrival of Gandhi in Indian politics. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution. Discuss the passage of the Hindu Code Bill of 1956. Explain the functions of Election Commission 							
<p>History of Making of the Indian Constitution: History - Drafting Committee, (Composition & Working) [5]</p> <p>Philosophy of the Indian Constitution: Preamble - Salient Features [5]</p> <p>Contours of Constitutional Rights & Duties: Fundamental Rights - Right to Equality - Right to Freedom - Right against Exploitation -Right to Freedom of Religion - Cultural and Educational Rights - Right to Constitutional Remedies - Directive Principles of State Policy - Fundamental Duties. [5]</p> <p>Organs of Governance: Parliament - Composition - Qualifications and Disqualifications - Powers and Functions Executive - President - Governor - Council of Ministers - Judiciary, Appointment and Transfer of Judges, Qualifications - Powers and Functions. [5]</p> <p>Local Administration: District's Administration head: Role and Importance, - Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation - Panchayat raj: Introduction, PRI: Zila Panchayat - Elected officials and their roles, CEO Zila Panchayat: Position and role- Block level: Organizational Hierarchy (Different departments) -Village level: Role of Elected and Appointed officials - Importance of grass root democracy. [5]</p> <p>Election Commission: Election Commission: Role and Functioning- Chief Election Commissioner and Election Commissioners- State Election Commission: Role and Functioning- Institute and Bodies for the welfare of SC/ST/OBC and Women. [5]</p>								
						Total Hours 30		
Text book(s):								
1	The Constitution of India, 1950 (Bare Act), Government Publication							
2	Busi S N, Ambedkar, B R., "Framing of Indian Constitution", 1 st Edition, 2015.							
Reference(s):								
1	Basu, D D , "Introduction to the Constitution of India", Lexis Nexis, 2015.							
2	Jain M P, "Indian Constitution Law", 7 th Edition, Lexis Nexis, 2014.							
3	Bhansali S R, Textbook on The Constitution of India, Universal Publishers, 2015							
4	Jain M P, Outlines of Indian Legal and Constitutional History, Lexisnexis, 2014							

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K.S.Rangasamy College of Technology – Autonomous R2018

50 AT 009 - Research Ethics

Common to all Branches

Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P			C	CA	ES
II/III	1	0	0	15	-	100	-	100
Objective(s)	<ul style="list-style-type: none"> • Analyze the ethical practices in research • Familiarize about research and documentation • Enlighten about collaborative research • Aware about publication ethics 							
Course Outcomes	<p>At the end of the course, the student will be able to</p> <ol style="list-style-type: none"> 1. Comprehend the importance of ethical practices in research. 2. Distinguish ethical practices from unethical practices in Research Design. 3. Understand ethical practices in conducting research and its dissemination. 							

Note: The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

Introduction to Ethical Practice in Research

Values Underlying Research Integrity; Framework for Good Academic Research Practices [2]

Ethics in Research Design & Conducting Research

Planning; Research Questions and Documentation ; Literature Review; Data Precision, Accuracy & errors, Research Execution, Documentation & Manuscript writing; Checks for Plagiarism, Falsification, Fabrication, and Misrepresentation [5]

Collaborative Research & IPR

Collaboration and Authorship; Sharing of Credits; Intellectual Property [5]

Dissemination

Selection of the Right Medium for Publication; Choosing the Right Journal for Publication; Translation of Research [3]

Total Hours 15

Text book(s):

1	Guidance Document: Good Academic Research Practices. New Delhi: University Grants Commission, Sep 2020 (https://www.ugc.ac.in/e-book/grap_29092020/mobile/index.html)
2	UGC Regulation: Promotion of Academic Integrity and Prevention of Plagiarism in HEI's, Regulation 2018 (https://www.ugc.ac.in/pdfnews/7771545_academic-integrity-Regulation2018.pdf)

Reference(s):

1	Muralidhar, K., Ghosh, A., & Singhvi, A. K. (2019). Ethics in Science Education, Research and Governance. ISBN: 978-81-939482-1-7 (https://www.insaindia.res.in/pdf/Ethics_Book.pdf)
2	Griffiths, P. A., McCormick Adams, R., Albertis, B. M., Blout, E. R., Browder, F. E., Challoner, M. D., & Stine, D. D. (1995). On being a scientist: responsible conduct in research. Washington (DC): National Academy
3	Steven D. Krause (2007) Process of Research writing (Open Textbook Library, University of Michigan)
4	Chery Lowry (2016) Choosing & Using sources: A guide to academic research (Open Textbook Library, University of Michigan)