



SHREE VENKATESHWARA HI-TECH ENGINEERING COLLEGE
(Autonomous)

Gobichettipalayam, Erode -638455

Regulation 2025 (PG)

Curriculum and Syllabus

ME - INDUSTRIAL SAFETY ENGINEERING

I. Program Educational Objective (PEO)

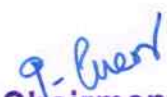
- PEO1:** Possess a mastery of Health safety and environment awareness and safety management skills, to reach higher levels in their profession.
- PEO2:** Proficient safety Engineer rendering professional expertise to the industrial and societal needs at national and global level subject to legal requirements.
- PEO3:** Well communicate the information on Health safety and environment facilitating collaboration with experts across various disciplines so as to create and execute safe methodology in complex engineering activities.
- PEO4:** Demonstrate professional and ethical attitude with awareness of current legal issues by rendering expertise to wide range of industries.

II. Program Outcomes (POs)

1. An ability to independently carry out research /investigation and development work to solve practical problems
2. An ability to write and present a substantial technical report/document.
3. Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program

III. Program Specific Outcomes (PSOs)

1. Apply principles of safety, risk analysis, and environmental management to design and implement effective industrial safety and health systems.
2. Develop expertise in hazard identification, emergency response, and regulatory compliance to promote safe and sustainable industrial operations.

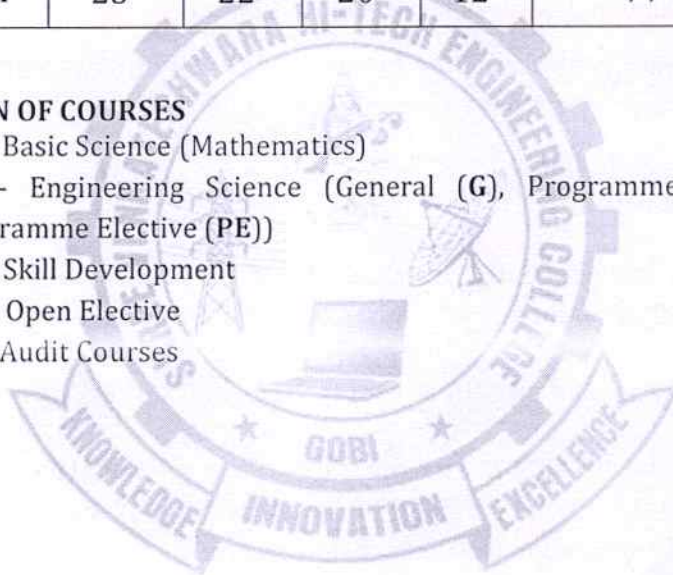

Chairman
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SUMMARY OF CREDITS

S. No	Course Category	Credits per Semester				Total Credits	Credits in %
		I	II	III	IV		
1	BS	4	-	-	-	4	5.19
2	ES(G)	3	-	-	-	3	3.90
3	ES(PC)	12	14	3	-	29	37.66
4	ES(PE)	3	6	6	-	15	19.48
5	SD	1	2	8	12	23	29.87
6	OE	-	-	3	-	3	3.90
7	AC	✓	✓	-	-		
Total Credits / Semester		23	22	20	12	77	100

CATEGORIZATION OF COURSES

- BS – Basic Science (Mathematics)
- ES – Engineering Science (General (G), Programme Core (PC) & Programme Elective (PE))
- SD – Skill Development
- OE – Open Elective
- AC – Audit Courses



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SEMESTER I

S. No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	SDG Mapping	Max.Marks		
				L	T	P				CA	ES	TM
THEORY												
1.	25IST11	Probability And Statistical Methods	BS	4	0	0	4	4	3,4,8,	40	60	100
2.	25IST12	Principles of Safety Management	ES(PC)	3	0	0	3	3	3, 4, 8	40	60	100
3.	25IST13	Environmental Safety	ES(PC)	3	0	0	3	3	6, 12, 13	40	60	100
4.	25IST14	Occupational Health and Industrial Hygiene	ES(PC)	3	0	0	3	3	3, 4, 8	40	60	100
5.	25IST15	Industrial Safety, Health and Environment Acts	ES(PC)	3	0	0	3	3	3, 8, 16	40	60	100
6.	25RMT11	Research Methodology and IPR	ES(G)	3	0	0	3	3	4, 9, 16	40	60	100
7.		Professional Elective – I*	ES(PE)	3	0	0	3	3		40	60	100
8.		Audit Course – I#	AC	2	0	0	2	0		100	-	100
PRACTICALS												
1.	25ISL11	Safety Audit	SD	0	0	2	2	1	3, 8, 16	100	-	100
Total				24	0	2	26	23				

* Programme Elective – I shall be chosen from the list of Programme Electives I offered by same Programme

Audit Course - I shall be chosen from the list of Audit courses

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ME - INDUSTRIAL SAFETY ENGINEERING

SEMESTER II

S. No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	SDG Mapping	Max.Marks		
				L	T	P				CA	ES	TM
THEORY												
1.	25IST21	Fire Engineering and Explosion Control	ES(PC)	3	0	0	3	3	3, 8, 11	40	60	100
2.	25IST22	System Simulation and Hazard Analysis	ES(PC)	4	0	0	4	4	3, 8, 9	40	60	100
3.	25IST23	Electrical Safety	ES(PC)	3	0	0	3	3	3, 7, 8	40	60	100
4.	25IST24	Safety in Process Industries	ES(PC)	3	0	0	3	3	3, 8, 9	40	60	100
5.		Professional Elective – II*	ES(PE)	3	0	0	3	3		40	60	100
6.		Professional Elective- III*	ES(PE)	3	0	0	3	3		40	60	100
7.		Audit Course – II#	AC	2	0	0	2	0		100	-	100
PRACTICALS												
8.	25ISL21	Industrial Safety and Simulation Laboratory	ES(PC)	0	0	2	2	1	3, 8, 9	60	40	100
9.	25ISL22	Technical Seminar	SD	0	0	2	2	1	4, 9, 17	100	-	100
10.	25MDC21	Industry Oriented Course	SD	0	0	2	2	1		100	-	100
Total				21	0	6	27	22				

* Programme Elective – II & III shall be chosen from the list of Programme Electives II & III offered by same Programme

Audit Course - II shall be chosen from the list of Audit courses

\$ 25MDC21 – Industry Oriented Course Using modern tools, techniques, methods etc used in industry taken by industry experts for the period of 15 contact

@ The students individually undergo training in reputed firms / research institute / laboratories for the specified duration (4 weeks) at summer vacation. After the completion of training, a detailed report should be submitted within ten days from the commencement of next semester.

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SEMESTER III

S. No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	SDG Mapping	Max.Marks		
				L	T	P				CA	ES	TM
THEORY												
1.	25IST31	Reliability Engineering	ES(PC)	3	0	0	3	3	8, 9, 12	40	60	100
2.		Professional Elective - IV*	ES(PE)	3	0	0	3	3		40	60	100
3.		Professional Elective - V*	ES(PE)	3	0	0	3	3		40	60	100
4.		Open Elective **	OE	3	0	0	3	3		40	60	100
PRACTICALS												
5.	25ISL31	Project Work - I	SD	0	0	12	12	6	4, 9, 17	60	40	100
6.	25ISL32	Industrial Safety Assessment – Internship @	SD	0	0	4	4	2	3, 8, 9	100	-	100
Total				12	0	16	28	20				

* Programme Elective - IV & V shall be chosen from the list of Programme electives IV & V offered by same Programme

** Open Elective shall be chosen from the list of Open Electives offered by other Programme

@ The students undergone summer internship for the specified duration (4 weeks) during II semester summer vacation and same will be evaluated in semester III

G. Choudhary
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ME - INDUSTRIAL SAFETY ENGINEERING

SEMESTER IV

S. No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	SDG Mapping	Max.Marks		
				L	T	P				CA	ES	TM
PRACTICALS												
1.	25ISL41	Project Work - II	SD	0	0	24	24	12	4, 9, 17	60	40	100

TOTAL CREDITS: 77



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LIST OF PROFESSIONAL ELECTIVES

S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max.Marks		
				L	T	P			CA	ES	TM
SEMESTER I, ELECTIVE I											
1.	25ISE11	Plant Layout and Material Handling	PE	3	0	0	3	3	40	60	100
2.	25ISE12	Work Study and Ergonomics	PE	3	0	0	3	3	40	60	100
3.	25ISE13	Human Factors in Engineering	PE	3	0	0	3	3	40	60	100
4.	25ISE14	Maintainability Engineering	PE	3	0	0	3	3	40	60	100
5.	25ISE15	Optimization Techniques	PE	3	0	0	3	3	40	60	100
SEMESTER II, ELECTIVE II & III											
1.	25ISE21	Transport Safety	PE	3	0	0	3	3	40	60	100
2.	25ISE22	Fireworks Safety	PE	3	0	0	3	3	40	60	100
3.	25ISE23	Safety in Construction	PE	3	0	0	3	3	40	60	100
4.	25ISE24	Nuclear Engineering and Safety	PE	3	0	0	3	3	40	60	100
5.	25ISE25	Safety in Textile Industry	PE	3	0	0	3	3	40	60	100
6.	25ISE26	Safety in Mines	PE	3	0	0	3	3	40	60	100
7.	25ISE27	Dock Safety	PE	3	0	0	3	3	40	60	100
SEMESTER III, ELECTIVE IV & V											
1.	25ISE31	Safety in Engineering Industry	PE	3	0	0	3	3	40	60	100
2.	25ISE32	Quality Engineering in Production Systems	PE	3	0	0	3	3	40	60	100
3.	25ISE33	ISO 45001 and ISO 14000	PE	3	0	0	3	3	40	60	100
4.	25ISE34	Artificial Intelligence and Expert Systems	PE	3	0	0	3	3	40	60	100
5.	25ISE35	Design of Experiments	PE	3	0	0	3	3	40	60	100
6.	25ISE36	Data Analytics	PE	3	0	0	3	3	40	60	100



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LIST OF AUDIT COURSES

S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max.Marks		
				L	T	P			CA	ES	TM
SEMESTER I & II											
1.	25ENA11	English for Research Paper Writing	AC	2	0	0	2	0	100	-	100
2.	25CMA12	Disaster Administration And Management	AC	2	0	0	2	0	100	-	100
3.	25MSA13	Constitution of India	AC	2	0	0	2	0	100	-	100
4.	25TAA14	நற்றமிழ் இலக்கியம்	AC	2	0	0	2	0	100	-	100

LIST OF OPEN ELECTIVES

S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max.Marks		
				L	T	P			CA	ES	TM
OFFERED BY DEPARTMENT OF MANAGEMENT STUDIES											
1.	25MSO31	Sustainable Management	3	0	0	3	3	3	40	60	100
2.	25MSO32	Micro and Small Business Management	3	0	0	3	3	3	40	60	100
3.	25MSO33	Intellectual Property Rights	3	0	0	3	3	3	40	60	100
4.	25MSO34	Ethical Management	3	0	0	3	3	3	40	60	100

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25IST12

PRINCIPLES OF SAFETY MANAGEMENT

L T P C

SDG No.

3 0 0 3

3, 4, 8

Course Objectives:

The main learning objective of this course is to prepare the students:

- To achieve an understanding of principles of safety management.
- To enable the students to learn about various functions and activities of safety department.
- To enable students to conduct safety audit and write audit reports effectively in auditing situations.
- To have knowledge about sources of information for safety promotion and training.
- To familiarize students with evaluation of safety performance.

UNIT-I CONCEPTS AND TECHNIQUES

9

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

UNIT-II SAFETY AUDIT

9

Components of safety audit, types of audit, audit methodology, non-conformity reporting (NCR), audit checklist and report – review of inspection, remarks by government agencies, consultants, experts – perusal of accident and safety records, formats – implementation of audit indication - liaison with departments to ensure co-ordination – check list – identification of unsafe acts of workers and unsafe conditions in the shop floor.

UNIT-III ACCIDENT INVESTIGATION AND REPORTING

9

Concept of an accident, reportable and non reportable accidents, reporting to statutory authorities – principles of accident prevention – accident investigation and analysis – records for accidents, departmental accident reports, documentation of accidents – unsafe act and condition – domino sequence – supervisory role – role of safety committee –cost of accident.

UNIT-IV SAFETY PERFORMANCE MONITORING

9

ANSI (Z16.1) Recommended practices for compiling and measuring work injury experience – permanent total disabilities, permanent partial disabilities, temporary total disabilities - Calculation of accident indices, frequency rate, severity rate, frequency severity incidence, incident rate, accident rate, safety "t" score, safety activity rate – problems.

UNIT-V SAFETY EDUCATION AND TRAINING

9

Importance of training-identification of training needs-training methods – programmes, seminars, conferences, competitions – method of promoting safe practice - motivation – communication - role of government agencies and private consulting agencies in safety training – creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign – Domestic Safety and Training.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- CO1:** Understand the functions and activities of safety engineering department.
- CO2:** Carry out a safety audit and prepare a report for the audit.
- CO3:** Prepare an accident investigation report and To estimate the accident cost using supervisors report and data.
- CO4:** Evaluate the safety performance of an organization from accident records.
- CO5:** Identify various agencies, support institutions and government organizations involved in safety training and promotion

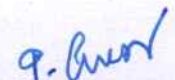
REFERENCE BOOKS:

1. "Accident Prevention Manual for Industrial Operations", N.S.C.Chicago, 13th Edition 2009.
2. Blake R.B., "Industrial Safety" Prentice Hall, Inc., New Jersey,. 3rd Edition 2000.
3. Lees, F.P., "Loss Prevention in Process Industries" Butterworth publications, London, 2nd edition, 1990.

CO's – PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PSO1	PSO2
CO1	3	-	2	2	1
CO2	-	-	3	3	2
CO3	-	-	-	3	3
CO4	-	-	-	3	2
CO5	-	-	-	2	3
Avg	3	-	2.5	2.6	2.2

1 - low, 2 - medium, 3 - high, '-' - no correlation


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25IST13

ENVIRONMENTAL SAFETY

L T P C

SDG No.

3 0 0 3

6, 12, 13

Course Objectives:

The main learning objective of this course is to prepare the students:

- To provide in depth knowledge in Principles of Environmental safety and its applications in various fields.
- To Understanding the standards of professional conduct that are published by professional safety organizations and/or certification bodies.
- To give understanding of air and water pollution and their control.
- To expose the students to the basis in hazardous waste management.
- To design emission measurement devices.

UNIT-I AIR POLLUTION

9

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-chemical factory stack emissions-CFC.

UNIT-II WATER POLLUTION

9

Classification of water pollutants-health hazards-sampling and analysis of water-water treatment - different industrial effluents and their treatment and disposal -advanced wastewater treatment - effluent quality standards and laws- chemical industries, tannery, textile effluents-common treatment.

UNIT-III HAZARDOUS WASTE MANAGEMENT

9

Hazardous waste management in India-waste identification, characterization and classification- technological options for collection, treatment and disposal of hazardous waste-selection charts for the treatment of different hazardous wastes-methods of collection and disposal of solid wastes-health hazards-toxic and radioactive wastes-incineration and verification - hazards due to bio-process- dilution-standards and restrictions – recycling and reuse.

UNIT-IV ENVIRONMENTAL MEASUREMENT AND CONTROL

9

Sampling and analysis – dust monitor – gas analyzer, particle size analyzer – lux meter-pH meter – gas chromatograph – atomic absorption spectrometer.

Gravitational settling chambers-cyclone separators-scrubbers-electrostatic precipitator - bag filter – maintenance - control of gaseous emission by adsorption, absorption and combustion methods- Pollution Control Board-laws.

UNIT-V POLLUTION CONTROL IN PROCESS INDUSTRIES

9

Pollution control in process industries - cement, paper, petroleum-petroleum products-textile- tanneries-thermal power plants – dyeing and pigment industries - eco-friendly energy.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

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

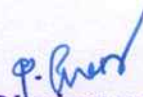
REFERENCE BOOKS:

1. Rao, CS, "Environmental pollution engineering; Wiley Eastern Limited, New Delhi, 1st January 2018.
2. E. C Wolfe, Race to Save to Save Planet, Wadsworth Publishing Co., Belmont, CA 2006.
3. G. T Miller, Environmental Science: Working with the Earth, 11th Edition, Wadsworth Publishing Co., Belmont, CA, 2006

CO's – PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PSO1	PSO2
CO1	3	-	2	2	1
CO2	-	-	3	2	2
CO3	-	-	-	3	2
CO4	-	-	-	3	3
CO5	-	-	-	2	3
Avg	3	-	2.5	2.4	2.2

1 - low, 2 - medium, 3 - high, '-' - no correlation


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25IST14	OCCUPATIONAL HEALTH AND INDUSTRIAL HYGIENE	L	T	P	C
SDG No.		3	0	0	3
3, 4, 8					

Course Objectives:

The main learning objective of this course is to prepare the students:

- To have knowledge about types of physical and chemical hazards.
- To have knowledge about types of biological agents.
- To understand the basic knowledge on anatomy of human organs and its basic functions.
- To enable the students to learn about various functions and activities of occupational health services.
- To enable students to compare the hazards with the permissible levels.

UNIT-I PHYSICAL HAZARDS

9

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

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

UNIT-II CHEMICAL HAZARDS

9

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

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

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

UNIT-III BIOLOGICAL AND ERGONOMICAL HAZARDS

9

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

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

UNIT-IV OCCUPATIONAL HEALTH AND TOXICOLOGY

9

Concept and spectrum of health - functional units and activities of occupational health services, pre- employment and post-employment medical examinations - occupational

related diseases, levels of prevention of diseases, notifiable occupational diseases such as silicosis, asbestosis, pneumoconiosis, siderosis, anthracosis, aluminosis and anthrax, lead-nickel, chromium and manganese toxicity, gas poisoning (such as CO, ammonia, coal and dust etc) their effects and prevention – cardio pulmonary resuscitation, audiometric tests, eye tests, vital function tests.

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

UNIT-V OCCUPATIONAL PHYSIOLOGY

9

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.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

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

REFERENCE BOOKS:

1. Danuta Koradecka, Handbook of Occupational Health and Safety, CRC, 2010.
2. Benjamin O.Alli, Fundamental Principles of Occupational Health and Safety ILO 2008.
3. Interim guidance "COVID-19: Occupational health and safety for health workers", WHO & ILO, 2021.

CO's – PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PSO1	PSO2
CO1	3	-	2	3	2
CO2	-	-	3	2	3
CO3	-	-	-	-	2
CO4	-	-	-	2	2
CO5	-	-	-	3	3
Avg	3	-	2.5	2.5	2.4

1 - low, 2 - medium, 3 - high, '-' - no correlation

25IST15	INDUSTRIAL SAFETY, HEALTH AND	L	T	P	C
SDG No.	ENVIRONMENT ACTS	3	0	0	3
3, 8, 16					

Course Objectives:

The main learning objective of this course is to prepare the students:

- To provide exposure to the students about safety and health provisions related to hazardous processes as laid out in Factories act 1948.
- To familiarize students with powers of inspectorate of factories.
- To help students to learn about Environment act 1986 and rules framed under the act.
- To provide wide exposure to the students about various legislations applicable to an industrial unit.

UNIT-I FACTORIES ACT - 1948 9

Statutory authorities – inspecting staff, health, safety, provisions relating to hazardous processes, welfare, working hours, employment of young persons – special provisions – penalties and procedures-Tamilnadu Factories Rules 1950 under Safety and health chapters of Factories Act 1948. Forms, Registers and notices – Tamilnadu Safety Officer Rules 2005- with updated Amendments.

UNIT-II ENVIRONMENT ACT - 1986 9

General powers of the central government, prevention, control and abatement of environmental pollution-Biomedical waste (Management and handling Rules, 1989-The noise pollution (Regulation and control) Rules, 2000-The Batteries (Management and Handling Rules) 2001- No Objection certificate from statutory authorities like pollution control board.

Air Act 1981 and Water Act 1974: Central and state boards for the prevention and control of air pollution-powers and functions of boards – prevention and control of air pollution and water pollution – fund – accounts and audit, penalties and procedures.

UNIT-III MANUFACTURE, STORAGE AND IMPORT OF HAZARDOUS CHEMICAL RULES 1989 AND MAJOR ACCIDENT HAZARD CONTROL RULES AND AMENDMENT 9

Definitions – duties of authorities – responsibilities of occupier – notification of major accidents – information to be furnished – preparation of offsite and onsite plans – list of hazardous and toxic chemicals – safety reports – safety data sheets. Major Accident Hazard Control Rules. Hazardous Wastes (management, handling and Transboundary Movement) Rules 2016.

UNIT-IV OTHER ACTS AND RULES 9

Indian Boiler (Amendments) Act 2007, static and mobile pressure vessel rules (SMPV), motor vehicle rules, The Mines and Minerals (Development & Regulation) Amendment Act, 2015, workman compensation act, rules – electricity act and rules – hazardous wastes (management, handling and transboundary) rules, 2008 - the building and other construction workers act 1996., Petroleum rules, Gas cylinder rules 2016, Explosives Act 1884 - Pesticides Act – E waste (management) rules 2016.

UNIT-V INTERNATIONAL ACTS AND STANDARDS**9**

Occupational Safety and Health act of USA (The William - Steiger Act of 1970) – Health and safety work act (HASAWA 1974, UK) – ISO 14001 – ISO 45001, European Safety and Health Legislations, American Petroleum Institute (API) Standards, Oil Industry Safety Directorate (OISD) Standards, National Fire Protection Association (NFPA) Standards, Atomic Energy Regulatory Board (AERB), American National Standards Institute(ANSI).

TOTAL : 45 PERIODS**COURSE OUTCOMES:****At the end of the course the students will be able to**

- CO1:** List out important legislations related to health, Safety and Environment.
- CO2:** List out requirements mentioned in factories act for the prevention of accidents.
- CO3:** Understand the health and welfare provisions given in factories act.
- CO4:** Understand the statutory requirements for an Industry on registration, license and its renewal.
- CO5:** Prepare onsite and offsite emergency plan.

REFERENCE BOOKS:

1. The Factories Act 1948, Madras Book Agency, Chennai, 2000
2. Srinivasan S, "The Tamil Nadu Safety Officers Rules 2005" Madras Book Agency, Chennai, 28th Edition, 2017
3. The Environment Act (Protection) 1986, Commercial Law Publishers (India) Pvt. Ltd., New Delhi.

CO's – PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PSO1	PSO2
CO1	3	-	2	2	3
CO2	-	-	3	3	2
CO3	-	-	-	2	2
CO4	-	-	-	-	3
CO5	-	-	-	3	3
Avg	3	-	2.5	2.5	2.6

1 - low, 2 - medium, 3 - high, '-' - no correlation

J. Prasad
Chairman
BoS / Mech

25RMT11	RESEARCH METHODOLOGY AND IPR	L	T	P	C
SDG No.		3	0	0	3
4, 9, 16					

Course Objectives:

The main learning objective of this course is to prepare the students:

- To provide knowledge on the fundamentals of research design, research process, and various research methodologies.
- To develop the ability to collect, analyze, interpret, and present research data using appropriate scientific methods.
- To impart knowledge on Intellectual Property Rights (IPR), including copyrights, trademarks, patents, and international organizations governing IPR.
- To familiarize students with patent filing procedures, patent protection, licensing, and commercialization of innovations.

UNIT-I RESEARCH DESIGN 9

Overview of research process and design, Use of Secondary and exploratory data to answer the research question, Qualitative research, Observation studies, Experiments and Surveys.

UNIT-II DATA COLLECTION AND SOURCES 9

Measurements, Measurement Scales, Questionnaires and Instruments, Sampling and methods. Data - Preparing, Exploring, examining and displaying.

UNIT-III DATA ANALYSIS AND REPORTING 9

Overview of Multivariate analysis, Hypotheses testing and Measures of Association. Presenting Insights and findings using written reports and oral presentation.

UNIT-IV INTELLECTUAL PROPERTY RIGHTS 9

Intellectual Property – The concept of IPR, Evolution and development of concept of IPR, IPR development process, Trade secrets, Copyrights, utility Models, IPR & Bio diversity, Role of WIPO and WTO in IPR establishments, Right of Property, Common rules of IPR practices, Types and Features of IPR Agreement, Trademark, Functions of UNESCO in IPR maintenance.

UNIT-V PATENTS 9

Patents – objectives and benefits of patent, Concept, features of patent, Inventive step, Specification, Types of patent application, process E-filing, Examination of patent, Grant of patent, Revocation, Equitable Assignments, Licences, Licensing of related patents, patent agents, Registration of patent agents.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- CO1:** Explain the concepts of research design, research process, and various methods of conducting scientific research.
- CO2:** Apply appropriate data collection, sampling, measurement, and analysis techniques for solving research problems.
- CO3:** Prepare and present technical reports based on research findings using suitable scientific methods.

- CO4:** Understand the concepts, types, and legal aspects of Intellectual Property Rights, including copyrights, trademarks, and trade secrets.
- CO5:** Explain the patent filing process, examination, grant, licensing, and protection of intellectual property for technological innovations.

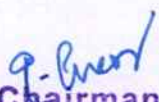
REFERENCE BOOKS:

1. Cooper Donald R, Schindler Pamela S and Sharma JK, "Business Research Methods", Tata McGraw Hill Education, 11e (2012).
2. Catherine J. Holland, "Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets", Entrepreneur Press, 2007.
3. The Institute of Company Secretaries of India, Statutory body under an Act of parliament, "Professional Programme Intellectual Property Rights, Law and practice", September 2013.

CO's - PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PSO1	PSO2
CO1	3	-	2	-	-
CO2	3	2	3	2	2
CO3	2	3	2	-	-
CO4	-	2	3	2	2
CO5	2	2	3	2	3
Avg	2.5	2.3	2.6	2.0	2.3

1 - low, 2 - medium, 3 - high, '-' - no correlation


Chairman
BoS / Mech

25ISL11
SDG No.
3, 8, 16

SAFETY AUDIT

L	T	P	C
0	0	2	1

Course Objectives:

The main learning objective of this course is to prepare the students:

- To Inculcate the Industrial Safety Environment to the students
- To Explore the Human Capital Management and Hazardous System

DESCRIPTION OF THE COURSE

- The students are expected to make a presentation on the state of Safety Audit from the observation from the Industry Safety Department.
- A faculty guide is to be allotted and the Student will visit the industry to aware about the Importance of the Safety.
- Students are encouraged to prepare the Safety System Guidelines from your observation period of Inspection from the Industry Safety Department and contribute the same to the Environment Contribution.
- The Students are advised to go through the below mentioned following heads of safety Measures to be audit and inspect at the time of visit. Depending on the requirements of the organizations, the audit can focus attention on the following aspects of a safety system and make sure that your level of expertise in the safety system.

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

- Safety Management systems.
- Fire and Explosion prevention, protection and emergency management.
- Work injury prevention.
- Health hazards control.
- Evaluating emergency plan.
- First aid practices
- Management of health and safety
- Accidents and accident reporting
- Asbestos
- Contractors
- Display screen equipment
- Electrical safety
- Emergency lighting
- Environmental protection
- Fire prevention and emergencies
- Hazardous substances
- Housekeeping and cleanliness
- Information and communication
- Kitchens, catering and food safety
- Lifts and lifting equipment
- Manual handling operations
- Noise
- Occupational health

- Personal protective equipment
- Plant rooms, machinery and equipment
- Risk assessment requirements
- Safety Policy
- Safety signs and notices
- Training
- Use of vehicles / vehicle safety
- Water services
- Welfare provision
- Working time
- Work at heights
- Workplace environment
- Accident prevention
- Identifying and correcting Regulatory Deficiencies
- Improvement of Employee Morale
- Identification and Elimination of Safety Hazards

TOTAL : 30 PERIODS

COURSE OUTCOMES:

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

- CO1:** Identify the basic requirements of industrial safety audit systems.
- CO2:** Inspect workplace hazards and safety practices in industries.
- CO3:** Analyze safety audit findings for regulatory compliance.
- CO4:** Prepare a basic safety audit report with recommendations.
- CO5:** Demonstrate safety audit findings through presentation and discussion.

CO's - PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PSO1	PSO2
CO1	-	3	-	3	2
CO2	-	2	2	2	2
CO3	-	-	-	2	-
CO4	-	-	-	3	2
CO5	-	-	-	-	-
Avg	-	2.5	2	2.5	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

25IST21	FIRE ENGINEERING AND EXPLOSION CONTROL	L	T	P	C
SDG No.		3	0	0	3
3, 8, 11					

Course Objectives:

The main learning objective of this course is to prepare the students:

- To provide an in depth knowledge about the science of fire.
- To understand the causes and effects of fire.
- To know the various fire prevention systems and protective equipments.
- To understand the science of explosion and its prevention techniques.
- To understand the various fire prevention techniques to be followed in a building.

UNIT-I PHYSICS AND CHEMISTRY OF FIRE 9

Fire properties of solid, liquid and gases - fire spread - toxicity of products of combustion - theory of combustion and explosion - vapour clouds - flash fire - jet fires - pool fires - unconfined vapour cloud explosion, shock waves - auto-ignition - boiling liquid expanding vapour explosion - case studies - Flixborough, Mexico disaster, Pasedena Texas, Piper Alpha, Peterborough and Bombay Victoria dock ship explosions.

UNIT-II FIRE PREVENTION AND PROTECTION 9

Sources of ignition - fire triangle - principles of fire extinguishing - active and passive fire protection systems - various classes of fires - A, B, C, D, E - types of fire extinguishers - fire stoppers - hydrant pipes - hoses - monitors - fire watchers - lay out of stand pipes - fire station-fire alarms and sirens - maintenance of fire trucks - foam generators - escape from fire rescue operations - fire drills - notice-first aid for burns.

UNIT-III INDUSTRIAL FIRE PROTECTION SYSTEMS 9

Sprinkler-hydrants-stand pipes - special fire suppression systems like deluge and emulsifier, selection criteria of the above installations, reliability, maintenance, evaluation and standards - alarm and detection systems. Other suppression systems - CO₂ system, foam system, dry chemical powder (DCP) system, halon system - need for halon replacement - smoke venting. Portable extinguishers - flammable liquids - tank farms - indices of inflammability-fire fighting systems.

UNIT-IV BUILDING FIRE SAFETY 9

Objectives of fire safe building design, Fire load, fire resistant material and fire testing - structural fire protection - structural integrity - concept of egress design - exists - width calculations - fire certificates - fire safety requirements for high rise buildings - snookers.

UNIT-V EXPLOSION PROTECTING SYSTEMS 9

Principles of explosion-detonation and blast waves-explosion parameters - Explosion Protection, Containment, Flame Arrestors, isolation, suppression, venting, explosion relief of large enclosure- explosion venting-inert gases, plant for generation of inert gas-rupture disc in process vessels and lines explosion, suppression system based on carbon dioxide (CO₂) and halons-hazards in LPG, ammonia (NH₃), sulphur dioxide (SO₃), chlorine (CL₂) etc.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- CO1:** Make familiar about basic concepts of fire and explosion science.
- CO2:** Know the different source of ignition and their prevention techniques.
- CO3:** Understand the operation of various types of firefighting equipments.
- CO4:** Understand the causes and prevention of explosion.
- CO5:** Equip the students to effectively employ explosion protection techniques and their significances to suit the industrial requirement.

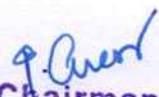
REFERENCE BOOKS:

1. "Accident Prevention manual for industrial operations" N.S.C., Chicago, 1982.
2. Derek, James, "Fire Prevention Hand Book", Butter Worths and Company, London, 1986.
3. Gupta, R.S., "Hand Book of Fire Technology" Orient Longman, Bombay 1977.

CO's - PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PSO1	PSO2
CO1	-	3	-	2	-
CO2	-	-	3	3	2
CO3	-	-	-	3	-
CO4	-	-	-	3	3
CO5	-	-	-	3	2
Avg	-	3	3	2.8	2.3

1 - low, 2 - medium, 3 - high, '-' - no correlation


Chairman
BoS / Mech

25IST22	SYSTEM SIMULATION AND HAZARD ANALYSIS	L	T	P	C
SDG No.		4	0	0	4
3, 8, 9					

Course Objectives:

The main learning objective of this course is to prepare the students:

- To provide knowledge on risk, hazard and their assessment techniques in Industry
- To understand the principles of operation of various equipment for safety application
- To know the consequences of fire, explosion and toxic release
- To know the various software available for risk quantification
- To conduct a risk assessment technique in Industries.

UNIT-I HAZARD, RISK ISSUES AND HAZARD ASSESSMENT 12

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

UNIT-II COMPUTER AIDED INSTRUMENTS 12

Applications of Advanced Equipments and Instruments, Thermo Calorimetry, Differential Scanning Calorimeter(DSC), Thermo Gravimetric Analyser(TGA), Accelerated Rate Calorimeter(ARC), Reactive Calorimeter(RC), Reaction System Screening Tool(RSST) - Principles of operations, Controlling parameters, Applications, advantages.

Explosive Testing, Deflagration Test, Detonation Test, Ignition Test, Minimum ignition energy Test, Sensitiveness Test, Impact Sensitiveness Test(BAM) and Friction Sensitiveness Test (BAM), Shock Sensitiveness Test, Card Gap Test.

UNIT-III RISK ANALYSIS QUANTIFICATION AND SOFTWARES 12

Introduction to Discrete and Continuous Systems Simulation- Fault Tree Analysis and Event Tree Analysis, Logic symbols, methodology, minimal cut set ranking - fire explosion and toxicity index(FETI), various indices - Hazard analysis(HAZAN)- Failure Mode and Effect Analysis(FMEA)- Basic concepts of Reliability- Software on Risk analysis, CISCON, FETI, HAMGARS modules on Heat radiation, Pool fire, Jet, Explosion. Reliability softwares on FMEA for mechanical and electrical systems.

UNIT-IV CONSEQUENCES ANALYSIS 12

Logics of consequences analysis- Estimation- Hazard identification based on the properties of chemicals- Chemical inventory analysis- identification of hazardous processes- Estimation of source term, Gas or vapour release, liquid release, two phase release- Heat radiation effects, BLEVE, Pool fires and Jet fire- Gas/vapour dispersion- Explosion, UVCE and Flash fire, Explosion effects and confined explosion- Toxic effects- Plotting the damage distances on plot plant/layout.

UNIT-V CREDIBILITY OF RISK ASSESSMENT TECHNIQUES**12**

Past accident analysis as information sources for Hazard analysis and consequences analysis of chemical accident, Mexico disaster, Flixborough, Bhopal, Seveso, Pasadena, Feyzin disaster(1966), Port Hudson disaster- convey report, hazard assessment of non-nuclear installation- Rijnmond report, risk analysis of size potentially Hazardous Industrial objects- Rasmussen masses report, Reactor safety study of Nuclear power plant T

TOTAL : 60 PERIODS**COURSE OUTCOMES:****At the end of the course the students will be able to**

- CO1:** Make familiarizing of basic concepts in risk and hazard
- CO2:** Understand the various instruments to bring safety in Industries
- CO3:** Find solution for risk assessment studies through the use of software
- CO4:** Make use of a risk assessment technique to quantify the risk
- CO5:** Equip the students effectively to employ hazard analysis techniques in Industry and helpful to prevent the accidents in Industry

REFERENCE BOOKS:

1. Brown, D.B. System analysis and Design for safety, Prentice Hall, 1976.
2. Guidelines for Hazard Evaluation Procedures, Centre for Chemical Process safety, AIChE 1992
3. ILO- Major Hazard control- A practical Manual, ILO, Geneva, 1988

CO's - PO's& PSO's MAPPING

CO	PO1	PO2	PO3	PSO1	PSO2
CO1	-	3	-	3	2
CO2	-	-	-	2	-
CO3	-	-	-	2	2
CO4	-	-	-	3	3
CO5	-	-	2	3	3
Avg	-	3	2	2.6	2.5

1 - low, 2 - medium, 3 - high, '-' - no correlation

25IST23

ELECTRICAL SAFETY

L T P C

SDG No.

3 0 0 3

3, 7, 8

Course Objectives:

The main learning objective of this course is to prepare the students:

- To provide knowledge on basics of electrical fire and statutory requirements for electrical safety
- To understand the causes of accidents due to electrical hazards
- To know the various protection systems in Industries from electrical hazards
- To know the importance of earthing
- To distinguish the various hazardous zones and applicable fire proof electrical devices

UNIT-I CONCEPTS AND STATUTORY REQUIREMENTS

9

Introduction – electrostatics, electro magnetism, stored energy, energy radiation and electromagnetic interference – Working principles of electrical equipment-Indian electricity act and rules-statutory requirements from electrical inspectorate-international standards on electrical safety – first aid-cardio pulmonary resuscitation(CPR).

UNIT-II ELECTRICAL HAZARDS

9

Primary and secondary hazards-shocks, burns, scalds, falls-human safety in the use of electricity. Energy leakage-clearances and insulation-classes of insulation-voltage classifications-excess energy- current surges-Safety in handling of war equipments-over current and short circuit current-heating effects of current-electromagnetic forces-corona effect-static electricity –definition, sources, hazardous conditions, control, electrical causes of fire and explosion-ionization, spark and arc- ignition energy-national electrical safety code ANSI.

Lightning, hazards, lightning arrestor, installation – earthing, specifications, earth resistance, earth pit maintenance.

UNIT-III PROTECTION SYSTEMS

9

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-earth leakage circuit breaker (ELCB)-cable wires-maintenance of ground-ground fault circuit interrupter-use of low voltage-electrical guards-Personal protective equipment – safety in handling hand held electrical appliances tools and medical equipments.

UNIT-IV SELECTION, INSTALLATION, OPERATION AND MAINTENANCE

9

Role of environment in selection-safety aspects in application - protection and interlock-self diagnostic features and fail safe concepts-lock out and work permit system-discharge rod and earthing devices- safety in the use of portable tools-cabling and cable joints-preventive maintenance.

UNIT-V HAZARDOUS ZONES**9**

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.

TOTAL : 45 PERIODS**COURSE OUTCOMES:****At the end of the course the students will be able to**

- CO1:** Explain the basic concepts, statutory requirements, and standards of electrical safety.
- CO2:** Identify electrical hazards and their causes in industrial environments.
- CO3:** Apply appropriate electrical protection systems to prevent electrical accidents.
- CO4:** Demonstrate safe practices in the selection, installation, operation, and maintenance of electrical systems.
- CO5:** Classify hazardous zones and select suitable explosion-proof and intrinsically safe electrical equipment.

REFERENCE BOOKS:

1. "Accident prevention manual for industrial operations", N.S.C., Chicago, 1982.
2. Power Engineers – Handbook of TNEB, Chennai, 1989.
3. Indian Electricity Act and Rules, Government of India.

CO's – PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PSO1	PSO2
CO1	-	3	-	2	-
CO2	-	-	2	3	2
CO3	-	-	-	3	2
CO4	-	-	-	2	3
CO5	-	-	-	-	-
Avg	-	3	2	2.5	2.3

1 - low, 2 - medium, 3 - high, '-' - no correlation

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Chairman
BoS / Mech

25IST24

SAFETY IN PROCESS INDUSTRIES

L T P C

SDG No.

3 0 0 3

3, 8, 9

Course Objectives:

The main learning objective of this course is to prepare the students:

- To provide knowledge on design features for a process industry and safety in the operation of various equipment in industry.
- To understand the various hazards and prevention in commissioning stage of industry.
- To recognise and identify the safe operation of equipment in process industry.
- To plan and trained for emergency planning in a process industry.
- To get fundamental knowledge on safe storage of chemicals.

UNIT-I SAFETY IN PROCESS DESIGN AND PRESSURE SYSTEM DESIGN 9

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

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

UNIT-II PLANT COMMISSIONING AND INSPECTION 9

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

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

UNIT-III PLANT OPERATIONS 9

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

UNIT-IV PLANT MAINTENANCE, MODIFICATION AND EMERGENCY PLANNING 9

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

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

UNIT-V STORAGES 9

General consideration, petroleum product storages, storage tanks and vessel- storages layout- segregation, separating distance, secondary containment- venting and relief, atmospheric vent, pressure, vacuum valves, flame arrestors, fire relief- fire prevention and

protection- LPG storages, pressure storages, layout, instrumentation, vapourizer, refrigerated storages- LNG storages, hydrogen storages, toxic storages, chlorine storages, ammonia storages, other chemical storages- underground storages- loading and unloading facilities- drum and cylinder storage- ware house, storage hazard assessment of LPG and LNG

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- CO1:** Explain the principles of safe process design and pressure system design in process industries.
- CO2:** Describe plant commissioning, inspection, and monitoring techniques for safe industrial operations.
- CO3:** Apply safe operating and maintenance practices in process industries.
- CO4:** Develop emergency response plans and maintenance procedures for process industries.
- CO5:** Design safe storage systems for petroleum products, LPG, LNG, and hazardous chemicals.

REFERENCE BOOKS:

1. "Accident Prevention Manual for Industrial Operations" NSC, Chicago, 1982.
2. "Quantitative Risk Assessment in Chemical Process Industries" American Institute of Chemical Industries, Centre for Chemical Process safety.
3. Carbide of Calcium Rules, Government of India.

CO's - PO's& PSO's MAPPING

CO	PO1	PO2	PO3	PSO1	PSO2
CO1	-	-	-	3	-
CO2	-	-	2	3	2
CO3	-	-	-	2	2
CO4	-	3	-	3	3
CO5	-	-	-	3	2
Avg	-	3	2	2.8	2.3

1 - low, 2 - medium, 3 - high, '-' - no correlation

G. Anand
Chairman
BoS / Mech

25ISL21	INDUSTRIAL SAFETY AND SIMULATION LABORATORY	L	T	P	C
SDG No.		0	0	2	1
3, 8, 9					

Course Objectives:

The main learning objective of this course is to prepare the students:

- To provide opportunity to operate the equipment to acquire practical knowledge.
- To know the various PPEs and software.
- To carry out experiments to find out the environmental parameters.
- To assess the impact of sensitivity of chemicals on explosivity.
- To run the software to assess the consequence effects of major accidents.

FIRST AID CONCEPTS

Study of Emergency Kits ,First – aid, road safety signs and signals -Safety Software Demo

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.

FRICTION TEST

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

IMPACT TEST

Explosive materials like gun powder, white powder, amerce composition etc.

Burst strength test of packaging materials like paper bags, corrugated cartoons, wood etc.
Auto ignition temperature test.

EXHAUST GAS MEASUREMENT AND ANALYSIS

Measurement of Sox, Nox, Cox, hydrocarbons.

ENVIRONMENTAL PARAMETER MEASUREMENT

Dry Bulb Temperature, Wet Bulb Temperature, and Determination of relative humidity, wind flow and effective corrective effective.

Particle size Measurement Air sampling analysis

TRAINING IN USAGE AND SKILL DEVELOPMENT

Personal protective equipment:

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

Fire extinguishers and its operations

Water Co2 Foam

Carbon dioxide (Co2)

Dry chemical powder and

Currently amendment fire safety systems

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

Illumination testing - by lux meter and photo meter.

Electrical safety

Insulation resistance for motors and cables Estimation of earth resistance

Earth continuity test

Sensitivity test for MCB, ELCB, RCCB, MCCB

Software Usage

Dispersion modeling of various highly dangerous chemicals using ALOHA software

SOFTWARE USAGE - Accident Analysis ,Safety Audit Packages, Consequence Analysis (CISCON), Fire, Explosion and Toxicity Index (FETI), Reliability Analysis for Mechanical system and Electrical System, Failure Mode Analysis

Experiments on simulation to be added

Discrete and continuous

Equipments Required

- | | | | |
|-----|-------------------------|---|-------|
| 1. | Noise level meter | : | 1 No |
| 2. | Friction tester | : | 1 No |
| 3. | Impact tester | : | 1 No |
| 4. | Exhaust gas analyzer: | | 1 No |
| 5. | High volume sampler : | | 1 No |
| 6. | PPE Set | : | 1 No |
| 7. | Fire extinguisher set : | | 1 No |
| 8. | Static charge tester : | | 1 No |
| 9. | First aid kit | : | 1 No |
| 10. | Lock out/Tag out | : | 1 No |
| 11. | Software: ALOHA/CAMEO | | |
| 12. | Extend SIM | | |
| 13. | System | : | 12 No |

TOTAL : 30 PERIODS

COURSE OUTCOMES:

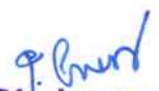
At the end of the course the students will be able to

- C01:** Know and run the various equipments to bring out the safety environment in the industry.
- C02:** Measure the particulate matter and assess the impact of air pollution.
- C03:** Conduct experiments to find out various environmental parameters.
- C04:** Use personal protective equipment in-dependently.
- C05:** Recognise the various problems with the use of software and hence to predict the real situations on major accidents.

CO's – PO's& PSO's MAPPING

CO	PO1	PO2	PO3	PSO1	PSO2
C01	-	2	-	2	-
C02	-	-	3	3	2
C03	-	-	-	2	2
C04	-	-	-	3	-
C05	-	-	-	3	3
Avg	-	2	3	2.6	2.3

1 - low, 2 - medium, 3 - high, '-' - no correlation


Chairman
BoS / Mech

25ISL22
SDG No.
4, 9, 17

TECHNICAL SEMINAR

L T P C
0 0 2 1

Course Objectives:

- To enrich the communication skills of the student through presentation of topics in recent advances in Industrial safety engineering/technology

COURSE OUTCOMES:

Students will develop skills to read, write, comprehend and present research papers.

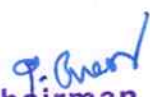
Students shall give presentations on recent areas of research in industrial safety engineering in two cycles. Depth of understanding, coverage, and quality of presentation material (PPT/OHP) and communication skill of the student will be taken as measures for evaluation.

TOTAL : 30 PERIODS

CO's - PO's& PSO's MAPPING

CO	PO1	PO2	PO3	PSO1	PSO2
C01	2	-	2	2	2
C02	3	2	3	2	2
C03	-	3	2	-	-
C04	-	3	2	-	-
C05	2	2	3	2	2
Avg	2.3	2.5	2.4	2	2

1 - low, 2 - medium, 3 - high, '-' - no correlation


**Chairman
BoS / Mech**

25IST31
SDG No.
8, 9, 12

RELIABILITY ENGINEERING

L	T	P	C
3	0	0	3

Course Objectives:

The main learning objective of this course is to prepare the students:

- Impart knowledge in reliability concepts.
- Facilitate students in filling the life data into theoretical distribution.
- Educate the students in reliability evaluation of various configuration.
- Impart knowledge in reliability monitoring methods.
- Analyze effectively various techniques to improve reliability of the system.

UNIT-I RELIABILITY CONCEPTS

9

Reliability definition – Quality and Reliability– Reliability mathematics – Reliability functions – Hazard rate – Measures of Reliability – Design life –A priori and posteriori probabilities – Mortality of a component –Mortality curve – Useful life.

UNIT-II LIFE DATA ANALYSIS

9

Data collection –Non Parametric methods: Ungrouped/Grouped, Complete/Censored data – Time to failure distributions: Exponential, Weibull – Probability plotting – Goodness of fit tests.

UNIT-III RELIABILITY ASSESSMENT

9

Different configurations – Redundancy – k out of n system – Complex systems: RBD – Baye's approach – Cut and tie sets – Fault Trees – Standby systems.

UNIT-IV RELIABILITY MONITORING

9

Life testing methods: Failure terminated – Time terminated – Sequential Testing –Reliability growth monitoring – Reliability allocation – Software reliability-Human reliability.

UNIT-V RELIABILITY IMPROVEMENT

9

Analysis of downtime – Repair time distribution – System repair time – Maintainability prediction – Measures of maintainability – Inspection decisions –System Availability.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- CO1:** Understand the basic concepts of reliability engineering
- CO2:** Effectively analyze various non-parametric methods and failure distributions
- CO3:** Conduct reliability assessment and failure analysis on any complex systems
- CO4:** Effectively design and analyze reliability monitoring techniques
- CO5:** Analyze various techniques to improve reliability of the system

REFERENCE BOOKS:

1. Charles E. Ebeling, "An introduction to Reliability and Maintainability engineering", TMH, 2000.
2. Roy Billington and Ronald N. Allan, "Reliability Evaluation of Engineering Systems", Springer, 2007

CO's – PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PSO1	PSO2
C01	-	3	2	2	-
C02	-	-	2	2	-
C03	3	3	-	3	2
C04	-	-	-	2	3
C05	-	-	-	3	2
Avg	3	3	2	2.4	2.33

1 - low, 2 - medium, 3 - high, '-' - no correlation


Chairman
BoS / Mech

25ISL32	INDUSTRIAL SAFETY ASSESSMENT - INTERNSHIP	L	T	P	C
SDG No.		0	0	4	2
3, 8, 9					

Course Objectives:

- To get an industrial exposure through various industrial environmental experiences and learning safety measures.
- To enhance the collective skills between theoretical knowledge and real-time safety implementations.

GUIDELINES:

- The students are expected to undergo meaningful, practical and hands-on-work experiences related to safety measures through industrial training.
- A faculty guide is to be allotted and he / she will guide and monitor the progress of the Student's training activities and maintain attendance also.
- Minimum duration of internships period is 3-4 weeks.
- Post internship program, Students should submit a report (within 50 pages) which contains brief observations of training (process, product, layout, safety measures and methods, etc.,) and give a presentation.
- Internship should be evaluated through final presentation with viva-voce exam.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

- CO1:** Identify workplace hazards and describe the industrial safety practices followed in the assigned industry.
- CO2:** Apply fundamental industrial safety concepts while observing real-time industrial operations and work environments.
- CO3:** Analyze the effectiveness of safety measures, procedures, and regulatory compliance adopted in the industry.
- CO4:** Prepare a comprehensive internship report documenting industrial processes, layouts, products, safety measures, and observations.
- CO5:** Present and justify the internship findings effectively through technical presentation and viva-voce.

CO's - PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PSO1	PSO2
CO1	-	2	3	3	3
CO2	-	-	-	-	-
CO3	-	-	-	-	-
CO4	-	-	-	-	-
CO5	-	-	-	-	-
Avg	-	2	3	3	3

1 - low, 2 - medium, 3 - high, '-' - no correlation

25ISE11	PLANT LAYOUT AND MATERIAL HANDLING	L	T	P	C
SDG No.		3	0	0	3
8, 9, 11					

Course Objectives:

The main learning objective of this course is to prepare the students:

- To provide provided with the knowledge of the process of analyzing and developing information to produce a plant layout based on the locations and working conditions.
- To educate the students about the basic things of work conditions which includes ventilation, comfort, lighting and its effect based on various nature of work.
- To provide knowledge on effective and safe layout design of an industry.

UNIT-I PLANT LOCATION 9

Selection of plant locations, territorial parameters, considerations of land, water, electricity, location for waste treatment and disposal, further expansions Safe location of chemical storages, LPG, LNG, CNG, acetylene, ammonia, chlorine, explosives and propellants

UNIT-II PLANT LAYOUT 9

Safe layout, equipment layout, safety system, fire hydrant locations, fire service rooms, facilities for safe effluent disposal and treatment tanks, site considerations, approach roads, plant railway lines, security towers.

Safe layout for process industries, engineering industry, construction sites, pharmaceuticals, pesticides, fertilizers, refineries, food processing, nuclear power stations, thermal power stations, metal powders manufacturing, fireworks and match works

UNIT-III WORKING CONDITIONS 9

Principles of good ventilation, purpose, physiological and comfort level types, local and exhaust ventilation, hood and duct design, air conditioning, ventilation standards, application.

Purpose of lighting, types, advantages of good illumination, glare and its effect, lighting requirements for various work, standards- Housekeeping, principles of 5S.

UNIT-IV MANUAL MATERIAL HANDLING AND LIFTING TACKLES 9

Preventing common injuries, lifting by hand, team lifting and carrying, handling specific shape machines and other heavy objects – accessories for manual handling, hand tools, jacks, hand trucks, dollies and wheel barrows – storage of specific materials - problems with hazardous materials, liquids, solids – storage and handling of cryogenic liquids - shipping and receiving, stock picking, dock boards, machine and tools, steel strapping and sacking, glass and nails, pitch and glue, boxes and cartons and car loading – personal protection – ergonomic considerations.

Fiber rope, types, strength and working load inspection, rope in use, rope in storage - wire rope, construction, design factors, deterioration causes, sheaves and drums, lubrication, overloading, rope fitting, inspection and replacement – slings, types, method of attachment, rated capacities, alloy chain slings, hooks and attachment, inspection

UNIT-V MECHANICAL MATERIAL HANDLING**9**

Hoisting apparatus, types - cranes, types, design and construction, guards and limit devices, signals, operating rules, maintenance safety rules, inspection and inspection checklist - conveyors, precautions, types, applications.

Powered industrial trucks, requirements, operating principles, operators selection and training and performance test, inspection and maintenance, electric trucks, gasoline operated trucks, LPG trucks - power elevators, types of drives, hoist way and machine room emergency procedure, requirements for the handicapped, types- Escalator, safety devices and brakes, moving walks - man lifts, construction, brakes, inspection.

TOTAL : 45 PERIODS**COURSE OUTCOMES:**

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

- CO1:** Identify equipment requirements for a specific process and for various locations and working conditions.
- CO2:** Design an efficient material handling system.
- CO3:** Understand the difficulties during the design and implementation of the plant layout.
- CO4:** Know about material handling requirements and methods
- CO5:** Understand the inspection and maintenance techniques.

REFERENCE BOOKS:

1. "Accident Prevention Manual for Industrial Operations", N.S.C.Chicago, 13th Edition 2009.
2. Alexandrov. M.P. "Material handling equipment" Mir Publishers, Moscow, 1981.
3. APPLE M. JAMES "Plant layout and material handling", 3rd edition, John Wiley and sons.
4. "Encyclopedia of occupational safety and health", ILO Publication, 1985.

CO's - PO's& PSO's MAPPING

CO	PO1	PO2	PO3	PSO1	PSO2
CO1	2	-	-	3	-
CO2	-	-	-	2	-
CO3	2	-	-	3	2
CO4	-	-	-	2	-
CO5	-	-	-	2	2
Avg	2	-	-	2.4	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

25ISE12	WORK STUDY AND ERGONOMICS	L	T	P	C
SDG No.		3	0	0	3
3, 8, 9					

Course Objectives:

The main learning objective of this course is to prepare the students:

- To study the applications of ergonomic principles and physiology of workers
- To know the concepts of personal protective equipment and its usages
- To create the knowledge in process and equipment design in safety aspects

UNIT-I WORK STUDY 9

Study of operations – work content – work procedure – breakdown – human factors – safety and method study – methods and movements at the workplace – substitution with latest devices – robotic concepts – applications in hazardous workplaces – productivity, quality and safety (PQS).

UNIT-II ERGONOMICS 9

Definition – applications of ergonomic principles in the shop floor – work benches – seating arrangements – layout of electrical panels- switch gears – principles of motion economy – location of controls – display locations – machine foundations – work platforms, fatigue, physical and mental strain – incidents of accident – physiology of workers.

UNIT-III PERSONAL PROTECTION 9

Concepts of personal protective equipment – types – selection of PPE – invisible protective barriers – procurement, storage, inspection and testing – quality – standards – ergonomic considerations in personal protective equipment design.

UNIT-IV PROCESS AND EQUIPMENT DESIGN 9

Process design – equipment – instrument – selection – concept modules – various machine tools - in- built safety – machine layout-machine guarding-safety devices and methods – selection, inspection, maintenance and safe usage – statutory provisions, operator training and supervision – hazards and prevention.

UNIT-V MAN MACHINE SYSTEMS 9

Job and personal risk factors – standards-selection and training-body size and posture-body dimension (static/dynamic) – adjustment range – penalties – guide lines for safe design and postures – evaluation and methods of reducing posture strain.

Man-machine interface-controls -types of control-identification and selection-types of displays- compatibility and stereotypes of important operations-fatigue and vigilance-measurement characteristics and strategies for enhanced performance.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand work study techniques to optimize workplace efficiency.

CO2: Apply ergonomic principles to enhance worker comfort and productivity.

- C03:** Identify and utilize appropriate personal protective equipment for safety.
- C04:** Design safe and efficient processes and equipment.
- C05:** Evaluate and improve man-machine interaction for optimal performance.

REFERENCE BOOKS:

1. "Accident Prevention Manual for Industrial Operations", N.S.C.Chicago, 13th Edition 2009.
2. "Work Study", National Productivity Council, New Delhi, 1995.
3. E.J.Mc Cormick and M.S.Sanders "Human Factors in Engineering and Design", TMH, New Delhi, 1982.
4. Hunter, Gomas, "Engineering Design for Safety", Mc Graw Hill Inc., 1992.
5. Introduction to Work Study", ILO, Oxford and IBH Publishing company, Bombay, 1991".
6. Mundel, Motion and Time Study, 6th Edition, Allied Publishers, Madras, 1989.
7. W.Benjamin Neibal Motion and Time Study, 9th Edition 1993.

CO's - PO's& PSO's MAPPING

CO	PO1	PO2	PO3	PSO1	PSO2
C01	-	2	-	2	-
C02	2	-	-	3	-
C03	-	-	-	3	2
C04	-	-	-	3	2
C05	-	-	-	2	2
Avg	2	2	-	2.6	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

g. Chandra
Chairman
BoS / Mech

25ISE13
SDG No.
3, 8, 9

HUMAN FACTORS IN ENGINEERING

L	T	P	C
3	0	0	3

Course Objectives:

The main learning objective of this course is to prepare the students:

- To Study the work procedure and understanding the relationships between the workers and working environments.
- To study the applications of ergonomic principles and physiology of workers.
- To know the concepts of personal protective equipment and its usages.
- To create the knowledge in process and equipment design in safety aspects.

UNIT-I ERGONOMICS AND ANATOMY

9

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, future directions for ergonomics

Anatomy, Posture and Body Mechanics: Some basic body mechanics, anatomy of the spine and pelvis related to 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.

UNIT-II HUMAN BEHAVIOR

9

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.

UNIT-III ANTHROPOMETRY AND WORK DESIGN FOR STANDING AND SEATED WORKS

9

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.

UNIT-IV MAN - MACHINE SYSTEM AND REPETITIVE WORKS AND MANUAL HANDLING TASK

9

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, carrying, postural stability.

UNIT-V HUMAN SKILL AND PERFORMANCE AND DISPLAY, CONTROLS AND VIRTUAL ENVIRONMENTS

9

A general information-processing model of the users, cognitive system, problem solving, effectiveness.

Principles for the design of visual displays- auditory displays- design of controls- combining displays and controls- virtual (synthetic) environments, research issues.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- CO1:** Apply ergonomic principles to optimize worker comfort and safety.
- CO2:** Analyze human behavior to improve workplace efficiency and satisfaction.
- CO3:** Design workspaces considering anthropometric data for standing and seated tasks.
- CO4:** Enhance man-machine systems to minimize repetitive strain and handling injuries.
- CO5:** Integrate human factors into display, control design, and virtual environments for optimal performance.

REFERENCE BOOKS:

1. Ergonomic design for organizational effectiveness, Michael O'Neill 1st Edition 1998.
2. Human factors in engineering and design, MARK S.SANDERS 1992.
3. Introduction to Ergonomics, R.S. Bridger, Taylor and Francis 3rd Edition 2008.
4. The Ergonomics manual, Dan Mc Leod, Philip Jacobs and Nancy Larson.

CO's – PO's& PSO's MAPPING

CO	PO1	PO2	PO3	PSO1	PSO2
CO1	-	-	-	3	-
CO2	-	-	3	2	-
CO3	2	-	-	3	-
CO4	-	-	-	3	2
CO5	-	-	-	2	2
Avg	2	-	3	2.6	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

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Chairman
BoS / Mech

25ISE14	MAINTAINABILITY ENGINEERING	L	T	P	C
SDG No.		3	0	0	3
8, 9, 12					

Course Objectives:

The main learning objective of this course is to prepare the students:

- To enable the students know about the basic concept of maintainability engineering.
- To impart knowledge on various maintenance models, maintenance policies and replacement model of various equipment.
- To provide knowledge on logistics for the effective utilization of existing resources and facilities availability of spares parts.

UNIT-I MAINTENANCE CONCEPT 6

Maintenance definition – Need for maintenance – Maintenance objectives and challenges – Tero technology – Maintenance costs - Scope of maintenance department.

UNIT-II MAINTENANCE MODELS 12

Proactive/Reactive maintenance – Imperfect maintenance – Maintenance policies – PM versus b/d maintenance – PM schedule and product characteristics – Inspection models- Optimizing profit/downtime – Replacement decisions.

UNIT-III MAINTENANCE LOGISTICS 11

Human factors – Maintenance staffing: Learning curves – Simulation – Maintenance resource requirements: Optimal size of service facility – Optimal repair effort – Maintenance planning and scheduling – Spare parts planning.

UNIT-IV MAINTENANCE QUALITY 8

Maintenance excellence – Five Zero concept –FMECA –Root cause analysis – System effectiveness – Design for maintainability – Reliability Centered Maintenance.

UNIT-V TOTAL PRODUCTIVE MAINTENANCE 8

TPM features – Chronic and sporadic losses – Equipment defects – Six major losses – Overall Equipment Effectiveness – TPM pillars – Autonomous maintenance – TPM implementation.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- CO1:** Understand basic concepts of maintainability engineering.
- CO2:** Identify various maintenance models and their applications.
- CO3:** Analyze different maintenance policies for engineering systems.
- CO4:** Evaluate replacement models for equipment management.
- CO5:** Optimize logistics for effective resource utilization and spare parts availability.

REFERENCE BOOKS:

1. Andrew K.S.Jardine & Albert H.C.Tsang, "Maintenance, Replacement and Reliability", Taylor and Francis, 2006.
2. Bikas Badhury & S.K.Basu, "Tero Technology: Reliability Engineering and Maintenance Management", Asian Books, 2003.
3. Seichi Nakajima, "Total Productive Maintenance", Productivity Press, 1993.

CO's – PO's& PSO's MAPPING

CO	PO1	PO2	PO3	PSO1	PSO2
C01	-	-	-	2	-
C02	-	-	3	2	-
C03	-	2	-	3	-
C04	-	-	-	2	2
C05	-	-	-	2	2
Avg	-	2	3	2.2	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

q. Anand
Chairman
BoS / Mech

25ISE15	OPTIMIZATION TECHNIQUES	L	T	P	C
SDG No.		3	0	0	3
4, 9, 12					

Course Objectives:

The main learning objective of this course is to prepare the students:

- To understand the non-linear problem.
- To know about multi-objective problem.
- To create awareness of Meta heuristic algorithms.

UNIT-I INTRODUCTION 5

Classification of optimization problems, concepts of design vector, Design constraints, constraints surface, objective function surface and multi-level optimization, parametric linear programming

UNIT-II DECISION ANALYSIS 10

Decision Trees, Utility theory, Game theory, Multi Objective Optimization, MCDM- Goal Programming, Analytic Hierarchy process, ANP

UNIT-III NON-LINEAR OPTIMIZATION 15

Unconstrained one variable and multi variable optimization, KKT Conditions, Constrained optimization, Quadratic programming, Convex programming, Separable programming, Geometric programming, Non-Convex programming

UNIT-IV NON-TRADITIONAL OPTIMIZATION -1 10

Classes P and NP, Polynomial time reductions, Introduction to NP- Hard problems, Overview of Genetic algorithms, Simulated Annealing, neural network based optimization.

UNIT-V NON-TRADITIONAL OPTIMIZATION -2 5

Particle Swarm optimization, Ant Colony Optimization, Optimization of Fuzzy Systems.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- CO1:** Understand basic concepts and importance of optimization techniques.
- CO2:** Analyze and solve decision-making problems using optimization methods.
- CO3:** Formulate and solve non-linear optimization problems.
- CO4:** Apply non-traditional optimization techniques to complex problems.
- CO5:** Implement advanced meta-heuristic algorithms for multi-objective optimization.

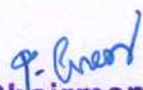
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1. Christos H. Papadimitriou, Kenneth Steiglitz, Combinatorial Optimization, PHI 2006
2. Fredrick S.Hillier and G.J.Liberman, "Introduction to Operations Research", McGraw Hill Inc. 1995.
3. Kalymanoy Deb, "Optimization for Engineering Design", PHI, 2003
4. Ravindran - Phillips -Solberg, "Operations Research - Principles and Practice", John Wiley India, 2006
5. Singiresu S.Rao, "Engineering optimization - Theory and practices", John Wiley and Sons, 1996.

CO's - PO's& PSO's MAPPING

CO	PO1	PO2	PO3	PSO1	PSO2
CO1	2	-	2	-	-
CO2	-	2	3	-	2
CO3	2	-	3	-	2
CO4	-	-	3	-	2
CO5	-	-	3	-	2
Avg	2	2	2.8	-	2

1 - low, 2 - medium, 3 - high, '-' - no correlation


Chairman
BoS / Mech

25ISE21

TRANSPORT SAFETY

L T P C

SDG No.

3 0 0 3

3, 8, 11

Course Objectives:

The main learning objective of this course is to prepare the students:

- To provide the students about the various activities/steps to be followed in safe handling the hazardous goods transportation from one location to another location.
- To educate the reasons for the road accident and the roles and responsibilities of a safe Driver and the training needs of the driver.
- To inculcate the culture of safe driving and fuel conservation along with knowing of basic traffic symbols followed throughout the highways.

UNIT-I TRANSPORTATION OF HAZARDOUS GOODS

9

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

UNIT-II ROAD TRANSPORT

8

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.

UNIT-III DRIVER AND SAFETY

9

Driver safety programme – selection of drivers – driver training-tacho-graph-driving test-driver's responsibility-accident reporting and investigation procedures-fleet accident frequency-safe driving incentives-slogans in driver cabin-motor vehicle transport workers act- driver relaxation and rest pauses – speed and fuel conservation – emergency planning and Haz mat codes

UNIT-IV ROAD SAFETY

10

Road alignment and gradient-reconnaissance-ruling gradient-maximum rise per k.m.-factors influencing alignment like tractive resistance, tractive force, direct alignment, vertical curves-breaking characteristics of vehicle-skidding-restriction of speeds-significance of speeds- Pavement conditions – Sight distance – Safety at intersections – Traffic control lines and guide posts-guard rails and barriers – street lighting and illumination overloading-concentration of driver.

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

UNIT-V SHOP FLOOR AND REPAIR SHOP SAFETY

9

Transport precautions-safety on manual, mechanical handling equipment operations-safe driving- movement of cranes-conveyors etc., servicing and maintenance equipment-grease rack operation- wash rack operation-battery charging-gasoline handling-other safe practices-off the road motorized equipment.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- CO1:** Understand safe procedures for handling and transporting hazardous materials between locations.
- CO2:** Analyze causes of road accidents and implement measures to prevent them.
- CO3:** Identify the roles, responsibilities, and training needs of a safe driver.
- CO4:** Apply safe driving practices and fuel conservation techniques.
- CO5:** Ensure safety protocols are followed in shop floor and repair shop environments.

REFERENCE BOOKS:

1. "Accident Prevention Manual for Industrial Operations", NSC, Chicago, 1982.
2. Babkov, V.F., "Road Conditions and Traffic Safety" MIR Publications, Moscow, 1986.
3. K.W.Ogden, "Safer Roads – A guide to Road Safety Engineering"
4. Pasricha, "Road Safety guide for drivers of heavy vehicle" Nasha Publications, Mumbai, 1999.

CO's – PO's& PSO's MAPPING

CO	PO1	PO2	PO3	PSO1	PSO2
CO1	-	-	-	3	2
CO2	-	2	3	2	3
CO3	2	-	-	2	3
CO4	-	-	-	2	-
CO5	-	-	-	3	2
Avg	2	2	3	2.4	2.5

1 - low, 2 - medium, 3 - high, '-' - no correlation

P. Bhand
Chairman
BoS / Mech

25ISE22
SDG No.
3, 8, 12

FIREWORKS SAFETY

L	T	P	C
3	0	0	3

Course Objectives:

The main learning objective of this course is to prepare the students:

- To study the properties of pyrotechnic chemicals
- To know about the hazards in the manufacture of various fireworks
- To understand the hazards in fireworks industries related processes
- To study the effects of static electricity
- To learn pyrotechnic material handling, transportation and user safety

UNIT-I PROPERTIES OF FIREWORKS CHEMICALS

9

Fire properties – potassium nitrate (KN03), potassium chlorate (KCl03), barium nitrate (BaNO3), calcium nitrate (CaNO3), Sulphur (S), Phosphorous (P), antimony (Sb), Pyro Aluminum (Al) powder- Reactions-metal powders, Borax, ammonia (NH3) – Strontium Nitrate, Sodium Nitrate, Potassium per chloride. Fire and explosion, impact and friction sensitivity.

UNIT-II STATIC CHARGE AND DUST

9

Concept-prevention-earthing-copper plates-dress materials-static charge meter lightning, Causes- effects-hazards in fireworks factories-lightning arrestor :concept-installation-earth pit-maintenance- resistance-legal requirements-case studies.

Dust: size-desirable, non-respirable-biological barriers-hazards-personal protective equipment- pollution prevention.

UNIT-III PROCESS SAFETY

8

Safe-quantity, mixing-filling-fuse cutting – fuse fixing – finishing – drying at various stages- packing- storage-hand tools-materials, layout: building-distances- factories act – explosive act and rules – fire prevention and control – risk related fireworks industries.

UNIT-IV MATERIAL HANDLING AND TRANSPORTATION

10

Manual handling – wheel barrows-trucks-bullock carts-cycles-automobiles-fuse handling – paper caps handling-nitric acid handling in snake eggs manufacture-handling the mix in this factory-material movement-godown-waste pit.

Packing-magazine-design of vehicles for explosive transports loading into automobiles-transport restrictions-case studies-overhead power lines-driver habits-intermediate parking-fire extinguishers- loose chemicals handling and transport.

UNIT-V WASTE CONTROL AND USER SAFETY

9

Concepts of wastes – Wastes in fireworks-Disposal-Spillages-storage of residues. Consumer anxiety- hazards in display-methods in other countries-fires, burns and scalds-sales outlets-restrictions-role of fire service.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- CO1:** Gain knowledge of the chemical reactions of Fireworks chemicals
- CO2:** Know safe manufacture of Fireworks items
- CO3:** Improve process safety in fireworks industries
- CO4:** Analyse safety measures applicable against static electricity
- CO5:** Suggest safe practices for handling of fireworks in factories, transport and at user end

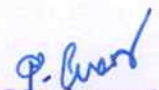
REFERENCE BOOKS:

1. "Seminar on explosives", Dept.of explosives.
2. J.A.Purkiss, "Fireworks-Fire Safety Engineering"
3. Bill of once, "Fireworks Safety manual"
4. "Goeff, "Dust Explosion prevention, Part 1"

CO's – PO's& PSO's MAPPING

CO	PO1	PO2	PO3	PSO1	PSO2
CO1	-	3	-	2	2
CO2	3	-	-	3	3
CO3	-	-	2	3	2
CO4	3	-	-	3	2
CO5	-	-	2	3	3
Avg	3	3	2	2.8	2.4

1 - low, 2 - medium, 3 - high, '-' - no correlation


Chairman
BoS / Mech

25ISE23

SAFETY IN CONSTRUCTION

L	T	P	C
3	0	0	3

SDG No.

3, 8, 11

Course Objectives:

The main learning objective of this course is to prepare the students:

- To know causes of accidents related to construction activities and human factors associated with these accident
- To understand the construction regulations and quality assurance in construction
- To have the knowledge in hazards of construction and their prevention methods
- To know the working principles of various construction machinery
- To gain knowledge in health hazards and safety in demolition work

UNIT-I ACCIDENTS CAUSES AND MANAGEMENT SYSTEMS

9

Problems impeding safety in construction industry- causes of fatal accidents, types and causes of accidents related to various construction activities, human factors associated with these accident – construction regulations, contractual clauses – Pre contract activates, preconstruction meeting - design aids for safe construction – permits to work – quality assurance in construction - compensation – Recording of accidents and safety measures – Education and training

UNIT-II HAZARDS OF CONSTRUCTION AND PREVENTION

9

Excavations, basement and wide excavation, trenches, shafts – scaffolding , types, causes of accidents, scaffold inspection checklist – false work – erection of structural frame work, dismantling – tunneling – blasting, pre blast and post blast inspection – confined spaces – working on contaminated sites – work over water - road works – power plant constructions – construction of high rise buildings.

UNIT-III WORKING AT HEIGHTS

9

Fall protection in construction OSHA 3146 – OSHA requirement for working at heights, Safe access and egress – safe use of ladders- Scaffoldings , requirement for safe work platforms, stairways, gangways and ramps – fall prevention and fall protection , safety belts, safety nets, fall arrestors, controlled access zones, safety monitoring systems – working on fragile roofs, work permit systems, height pass – accident case studies.

UNIT-IV CONSTRUCTION MACHINERY

9

Selection, operation, inspection and testing of hoisting cranes, mobile cranes, tower cranes, crane inspection checklist - builder's hoist, winches, chain pulley blocks – use of conveyors - concrete mixers, concrete vibrators – safety in earth moving equipment, excavators, dozers, loaders, dumpers, motor grader, concrete pumps, welding machines, use of portable electrical tools, drills, grinding tools, manual handling scaffolding, hoisting cranes – use of conveyors and mobile cranes – manual handling.

UNIT-V SAFETY IN DEMOLITION WORK

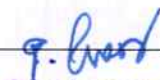
9

Safety in demolition work, manual, mechanical, using explosive - keys to safe demolition, pre survey inspection, method statement, site supervision, safe clearance zone, health hazards from demolition

- Indian standard - trusses, girders and beams – first aid – fire hazards and preventing methods – interesting experiences at the construction site against the fire accidents.

TOTAL : 45 PERIODS

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COURSE OUTCOMES:

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

- CO1:** Identify the problems impeding safety in construction industries, types and causes of accidents and designing aids for safe construction.
- CO2:** Understand the hazards during construction of power plant, road works and high rise buildings.
- CO3:** Understand the safety procedure for working at heights during construction.
- CO4:** Have knowledge in selection, operation, inspection and testing of various construction machinery.
- CO5:** List out construction regulations and Indian standards for construction and demolition work.

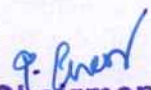
REFERENCE BOOKS:

1. Handbook of OSHA Construction safety and health Charles D. Reese and James V. Edison
2. Hudson, R., "Construction hazard and Safety Hand book, Butter Worth's, 1985.
3. Jnathea D.Sime, "Safety in the Build Environment", London, 1988.
4. V.J.Davies and K.Thomasin "Construction Safety Hand Book" Thomas Telford Ltd., London, 1990.

CO's - PO's& PSO's MAPPING

CO	PO1	PO2	PO3	PSO1	PSO2
CO1	2	-	-	3	2
CO2	3	-	-	3	2
CO3	-	3	-	3	2
CO4	2	-	-	2	-
CO5	-	-	2	2	3
Avg	2.3	3	2	2.6	2.25

1 - low, 2 - medium, 3 - high, '-' - no correlation


Chairman
BoS / Mech

25ISE24	NUCLEAR ENGINEERING AND SAFETY	L	T	P	C
SDG No.		3	0	0	3
7, 9, 13					

Course Objectives:

The main learning objective of this course is to prepare the students:

- To know about nuclear energy and fission fusion process.
- To gain knowledge in reactor types, design considerations and their operational problems.
- To know the current status of India in nuclear energy.

UNIT-I INTRODUCTION 9

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.

UNIT-II REACTOR CONTROL 9

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.

UNIT-III REACTOR TYPES 9

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.

UNIT-IV SAFETY OF NUCLEAR REACTORS 9

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 and Chernobyl accident.

UNIT-V RADIATION CONTROL 9

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.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- CO1:** Understand the fundamental principles of nuclear energy, including fission and fusion processes.
- CO2:** Acquire knowledge of various reactor types and their design considerations.
- CO3:** Identify and analyze operational challenges in nuclear reactors

CO4: Evaluate the safety measures and protocols for nuclear reactor operations.

CO5: Assess the current status and advancements of nuclear energy in India.

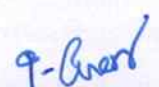
REFERENCE BOOKS:

1. "Loss prevention in the process Industries" Frank P.Lees Butterworth-Hein-UK, 1990.
2. Loffness, R.L., "Nuclear Power Plant" Van Nostrand Publications, 1979.
3. R.L.Murray, "Introduction to Nuclear Engineering", Prentice Hall.
4. Sri Ram K, "Basic Nuclear Engineering" Wiley Eastern Ltd., New Delhi, 1990.
5. Sterman U.S."Thermal and Nuclear Power Stations", MIR Publications, Moscow, 1986.

CO's - PO's& PSO's MAPPING

CO	PO1	PO2	PO3	PSO1	PSO2
CO1	2	-	2	2	-
CO2	2	-	3	2	2
CO3	3	-	3	2	2
CO4	3	-	3	3	3
CO5	2	-	3	2	2
Avg	2.4	-	2.8	2.2	2.3

1 - low, 2 - medium, 3 - high, '-' - no correlation


Chairman
B&S / Mech

25ISE25

SAFETY IN TEXTILE INDUSTRY

L T P C

SDG No.

3 0 0 3

3, 8, 12

Course Objectives:

The main learning objective of this course is to prepare the students:

- To provide the student about the basic knowledge about the textile industries and its products by using various machineries.
- To enforce the knowledge on textile processing and various processes in making the yarn from cotton or synthetic fibres.
- To understand the various hazards of processing textile fibres by using various activities.
- To inculcate the knowledge on health and welfare activities specific to the Textile industries as per the Factories Act.

UNIT-I INTRODUCTION

9

Introduction to process flow charts of i) short staple spinning, ii) long staple spinning, iii) viscose rayon and synthetic fibre, manufacturer, iv) spun and filament yarn to fabric manufacture, v) jute spinning and jute fabric manufacture-accident hazard, guarding of machinery and safety precautions in opening, carding, combing, drawing, flyer frames and ring frames, doubles, rotor spinning, winding, warping, softening/spinning specific to jute.

UNIT-II TEXTILE HAZARDS I

9

Accident hazards i) sizing processes- cooking vessels, transports of size, hazards due to steam ii) Loom shed – shuttle looms and shuttless looms iii) knitting machines iv) non-wovens.

UNIT-III TEXTILE HAZARDS II

9

Scouring, bleaching, dyeing, punting, mechanical finishing operations and effluents in textile processes.

UNIT-IV HEALTH AND WELFARE

9

Health hazards in textile industry related to dust, fly and noise generated-control measures-relevant occupational diseases, personal protective equipment-health and welfare measures specific to textile industry, Special precautions for specific hazardous work environments.

UNIT-V SAFETY STATUS

9

Relevant provision of factories act and rules and other statues applicable to textile industry – effluent treatment and waste disposal in textile industry.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- CO1:** Know about the overall picture about the textile industries and its operations.
- CO2:** Understand the various concepts underlying in the processes involved in processing of fibres to yarn.
- CO3:** Find out various hazards in the textile industry and will be able to apply the control measures to mitigate the risk emanating from the hazard.

- CO4:** Handle the various health and welfare activities as per the Factories act and could implement statutory requirements.
- CO5:** Create of his own arrangement in designing various methods meant for mitigating the risk and able to guide his subordinates in executing the work safely.

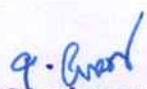
REFERENCE BOOKS:

1. Groover and Henry DS, "Hand book of textile testing and quality control"
2. Shenai, V.A. "A technology of textile processing", Vol.I, Textile Fibres
3. "Safety in Textile Industry" Thane Belapur Industries Association, Mumbai.
4. 100 Textile fires – analysis, findings and recommendations LPA

CO's – PO's& PSO's MAPPING

CO	PO1	PO2	PO3	PSO1	PSO2
CO1	2	-	2	2	-
CO2	2	-	3	2	2
CO3	3	-	3	3	3
CO4	2	-	3	2	3
CO5	3	-	3	3	2
Avg	2.4	-	2.8	2.4	2.5

1 - low, 2 - medium, 3 - high, '-' - no correlation


Chairman
BoS / Mech

25ISE26

SAFETY IN MINES

L	T	P	C
3	0	0	3

SDG No.

3, 8, 12

Course Objectives:

The main learning objective of this course is to prepare the students:

- To provide in depth knowledge on Safety of mines of various types.
- To study, know and understand about the types of mines and various risk involved in the mining operations.
- To get exposed to various types of accidents happened in mines and how to manage during accidents.
- To analyse the nature of mining activities and developing a safety system to reduce the risk and also to implement the Emergency preparedness in the working environment of mines and to plan for the disaster management.

UNIT-I OPENCAST MINES

9

Causes and prevention of accident from: Heavy machinery, belt and bucket conveyors, drilling, hand tools-pneumatic systems, pumping, water, dust, electrical systems, fire prevention. Garage safety - accident reporting system-working condition-safe transportation - handling of explosives.

UNIT-II UNDERGROUND MINES

9

Fall of roof and sides-effect of gases-fire and explosions-water flooding-warning sensors-gas detectors-occupational hazards-working conditions-winding and transportation.

UNIT-III TUNNELLING

9

Hazards from: ground collapse, inundation and collapse of tunnel face, falls from platforms and danger from falling bodies. Atmospheric pollution (gases and dusts) - trapping - transport-noise- electrical hazards-noise and vibration from: pneumatic tools and other machines - ventilation and lighting - personal protective equipment.

UNIT-IV RISK ASSESSMENT

9

Basic concepts of risk-reliability and hazard potential-elements of risk assessment - statistical methods - control charts-appraisal of advanced techniques-fault tree analysis-failure mode and effect analysis - quantitative structure-activity relationship analysis-fuzzy model for risk assessment.

UNIT-V ACCIDENT ANALYSIS AND MANAGEMENT

9

Accidents classification and analysis-fatal, serious, minor and reportable accidents - safety audits- recent development of safety engineering approaches for mines-frequency rates-accident occurrence- investigation-measures for improving safety in mines-cost of accident-emergency preparedness - disaster management.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- CO1:** Familiar with the concept of safety aspects in the mining industries.
- CO2:** Understand the various types of mining activities like open case mines, underground mines and tunnel ling.
- CO3:** Understand about the various risks involved in the mining activities and come to know about the various safety activities to be taken to ensure the safety of the workers
- CO4:** Implement the techniques like risk assessment Disaster management and emergency preparedness with the proper knowledge on accident prevention.
- CO5:** Effectively employ their knowledge on accident prevention in mines.

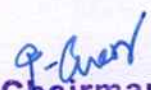
REFERENCE BOOKS:

1. DGMS Circulars-Ministry of Labour, Government of India press, OR Lovely Prakashan - DHANBAD, 2002.
2. Kejiriwal, B.K. Safety in Mines, Gyan Prakashan, Dhanbad, 2001.
3. "Mine Health and Safety Management", Michael Karmis ed., SME, Littleton, Co.2001.

CO's - PO's& PSO's MAPPING

CO	PO1	PO2	PO3	PSO1	PSO2
CO1	-	3	-	2	-
CO2	-	-	-	2	2
CO3	-	2	-	3	3
CO4	-	-	-	3	3
CO5	-	-	-	3	2
Avg	-	2.5	-	2.6	2.5

1 - low, 2 - medium, 3 - high, '-' - no correlation


Chairman
BoS / Mech

25ISE27

DOCK SAFETY

L T P C

SDG No.

3 0 0 3

3, 8, 9

Course Objectives:

The main learning objective of this course is to prepare the students:

- To understand safety legislation related to dock activities in India.
- To understand the causes and effects of accidents during dock activities.
- To know the various material handling equipment and lifting appliances in dock.
- To know the safe working on board the ship and storage in the yards.
- To understand the safe operation of crane, portainers, lift trucks and container handling equipment.

UNIT-I HISTORY OF SAFETY LEGISLATION

9

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.

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.

UNIT-II WORKING ON BOARD THE SHIP

9

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 forklift trucks-pay loaders etc. Working with electricity and electrical management – Storage – types, hazardous cargo.

UNIT-III LIFTING APPLIANCES

9

Different types of lifting appliances – construction, maintenance and use, various methods of rigging of derricks, safety in the use of container handling/lifting appliances like portainers, transtainer, top lift trucks and other containers – testing and examination of lifting appliances – portainers – transtainers – toplift trucks – derricks in different rigging etc.

Use and care of synthetic and natural fiber ropes – wire rope chains, different types of slings and loose gears.

UNIT-IV TRANSPORT EQUIPMENT

9

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.

UNIT-V EMERGENCY ACTION PLAN AND DOCK WORKERS (SHW) REGULATIONS 1990

9

Emergency action Plans for fire and explosions - collapse of lifting appliances and buildings, sheds etc., - gas leakages and precautions concerning spillage of dangerous goods etc., - Preparation of on- site emergency plan and safety report.

Dock workers (SHW) rules and regulations 1990-related to lifting appliances, Container handling, loading and unloading, handling of hatch coverings and beams, Cargo handling, conveyors, dock railways, forklift.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- CO1:** Familiar of various operations carried out in a dock.
- CO2:** Know the different acts and rules for safe dock operations.
- CO3:** Understand the operation of various types of material handling equipments.
- CO4:** Prepared to response at the time of emergency in a dock.
- CO5:** Recognize the various problems associated with the use of lifting equipments and in the storage yards.

REFERENCE BOOKS:

1. "Dock Safety" Thane Belapur Industries Association, Mumbai.
2. Bindra SR "Course in Dock and Harbour Engineering"
3. Safety and Health in Dock work, IInd Edition, ILO, 1992.
4. Srinivasan "Harbour, Dock and Tunnel Engineering"
5. Taylor D.A., "Introduction to Marine Engineering".

CO's – PO's& PSO's MAPPING

CO	PO1	PO2	PO3	PSO1	PSO2
CO1	-	-	-	2	-
CO2	-	3	-	2	3
CO3	-	-	-	3	2
CO4	-	-	-	2	3
CO5	-	-	2	3	2
Avg	-	3	2	2.4	2.5

1 - low, 2 - medium, 3 - high, '-' - no correlation

25ISE31

SAFETY IN ENGINEERING INDUSTRY

L T P C

SDG No.

3 0 0 3

3, 8, 9

Course Objectives:

The main learning objective of this course is to prepare the students:

- To know the safety rules and regulations, standards and codes
- To study various mechanical machines and their safety importance
- To understand the principles of machine guarding and operation of protective devices.
- To know the working principle of mechanical engineering processes such as metal forming and joining process and their safety risks.
- Developing the knowledge related to health and welfare measures in engineering industry

UNIT-I SAFETY IN METAL WORKING MACHINERY AND WOOD WORKING MACHINES

9

General safety rules, principles, maintenance, Inspections of turning machines, boring machines, milling machine, planing 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.

UNIT-II PRINCIPLES OF MACHINE GUARDING

9

Guarding during maintenance, Zero Mechanical State (ZMS), Definition, Policy for ZMS – guarding of hazards - point of operation protective devices, machine guarding, types, fixed guard, interlock guard, automatic guard, trip guard, electron eye, positional control guard, fixed guard fencing- guard construction- guard opening.

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.

UNIT-III SAFETY IN WELDING AND GAS CUTTING

9

Gas welding and oxygen cutting, resistance welding, arc welding and cutting, common hazards, personal protective equipment, training, safety precautions in brazing, soldering and metalizing – explosive welding, selection, care and maintenance of the associated equipment and instruments – safety in generation, distribution and handling of industrial gases-colour coding – flashback arrestor – leak detection-pipe line safety-storage and handling of gas cylinders.

UNIT-IV SAFETY IN COLD FORMING AND HOT WORKING OF METALS

9

Cold working, power presses, point of operation safe guarding, auxiliary mechanisms, feeding and cutting mechanism, hand or foot-operated presses, power press electric controls, power press set up and die removal, inspection and maintenance-metal sheers-press brakes.

Hot working safety in forging, hot rolling mill operation, safe guards in hot rolling mills – hot bending of pipes, hazards and control measures. Safety in gas furnace operation, cupola, crucibles, ovens, foundry health hazards, work environment, material handling in

foundries, foundry production cleaning and finishing foundry processes.

UNIT-V SAFETY IN FINISHING, INSPECTION AND TESTING

9

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, Indian Boilers Regulation.

Health and welfare measures in engineering industry-pollution control in engineering industry- industrial waste disposal.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- CO1:** Have the knowledge in safety rules, standards and codes in various mechanical engineering processes
- CO2:** Design machine guarding systems for various machines such as lathe, drilling, boring, milling etc.,
- CO3:** Implement the safety concepts in welding, gas cutting, storage and handling of gas cylinders, metal forming processes etc.,
- CO4:** Have knowledge in testing and inspection as per rules in boilers, heat treatment operations etc.,
- CO5:** Take preventive measures in health and welfare of workers' aspects in engineering industry.

REFERENCE BOOKS:

1. "Accident Prevention Manual" – NSC, Chicago, 1982.
2. "Occupational safety Manual" BHEL, Trichy, 1988.
3. "Safety Management by John V. Grimaldi and Rollin H. Simonds, All India Travelers Book seller, New Delhi, 1989.
4. "Safety in Industry" N.V. Krishnan Jaico Publishery House, 1996.

CO's – PO's& PSO's MAPPING

CO	PO1	PO2	PO3	PSO1	PSO2
CO1	3	3	-	3	2
CO2	3	-	3	3	2
CO3	2	3	3	3	3
CO4	2	-	-	2	1
CO5	2	-	-	2	2
Avg	2.4	3	3	2.6	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

g. C. Srinivas
Chairman
BoS / Mech

25ISE32	QUALITY ENGINEERING IN PRODUCTION SYSTEMS	L	T	P	C
SDG No.		3	0	0	3
8, 9, 12					

Course Objectives:

The main learning objective of this course is to prepare the students:

- To know the quality engineering concepts in product design and development processes.
- To know the control and process parameters' characteristics with feedback system.
- To know the methods for production and diagnosis process improvements.
- To have knowledge on ISO quality systems and types of quality tools such as failure and effect analysis.
- To understand the six-sigma concepts and its implementation in engineering industries.

UNIT-I INTRODUCTION TO QUALITY ENGINEERING AND LOSS FUNCTION 9

Quality value and engineering- overall quality system-quality engineering in product design - quality engineering in design of production processes - quality engineering in production - quality engineering in service. Loss function Derivation – use-loss function for products/system- justification of improvements-loss function and inspection- quality evaluations and tolerances-N type, S type, L type.

UNIT-II ON-LINE QUALITY CONTROL 9

On-line feedback quality control variable characteristics-control with measurement interval- one unit, multiple units-control systems for lot and batch production. On-line process parameter control variable characteristics- process parameter tolerances-feedback control systems-measurement error and process control parameters.

UNIT-III ON-LINE QUALITY CONTROL ATTRIBUTES AND METHODS FOR PROCESS IMPROVEMENTS 9

Checking intervals- frequency of process diagnosis. Production process improvement method- process diagnosis improvement method- process adjustment and recovery improvement methods.

UNIT-IV QUALITY ENGINEERING AND TPM 9

Preventive maintenance schedules- PM schedules for functional characteristics- PM schedules for large scale systems. Quality tools-fault tree analysis, event tree analysis, failure mode and effect analysis. ISO quality systems.

UNIT-V SIX SIGMA AND ITS IMPLEMENTATION 9

Introduction- definition-methodology- impact of implementation of six sigma-DMAIC method-roles and responsibilities -leaders, champion, black belt, green belts. Do's and don't's - readiness of organization - planning-management role- six sigma tools - sustaining six sigma.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

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

REFERENCE BOOKS:

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

CO's - PO's& PSO's MAPPING

CO	PO1	PO2	PO3	PSO1	PSO2
CO1	3	-	2	2	-
CO2	2	-	3	2	-
CO3	-	3	-	2	-
CO4	-	2	-	1	2
CO5	-	-	-	1	1
Avg	2.5	2.5	2.5	1.6	1.5

1 - low, 2 - medium, 3 - high, '-' - no correlation

P. G. V. V.
Chairman
BoS / Mech

25ISE33
SDG No.
3, 8, 12

ISO 45001 AND ISO 14000

L	T	P	C
3	0	0	3

Course Objectives:

The main learning objective of this course is to prepare the students:

- To provide the basic knowledge on Occupational Health and Safety Management System and Environmental Management System standards.
- To inculcate the knowledge on various terms and terminologies which are used in the Occupational Health, Safety and Environmental Management system.
- To educate about the various steps to be taken for certification of ISO 45001(Occupational health and safety management systems) and ISO14001 (Environmental Management Systems) standards.
- To impart knowledge on Environment Impact Assessment (EIA), Life Cycle Assessment of product and principles of Eco labelling.

UNIT-I OH & S MANAGEMENT SYSTEM STANDARD

9

Introduction to ISO 45001 – Development of various OHSMS standards – aim of OH & S management system–success factors– plan do check act cycle- contents and scope of ISO 45001- terms and definitions –leadership and worker participation –leadership and commitment - OH & S policy- organizational roles and responsibilities and authorities – consultation and participation of workers

UNIT-II PLANNING

9

Actions to address risk and opportunities – hazard identification and assessment of risks and opportunities –determination of legal and other requirements-planning action- OH &S objectives and planning to achieve them- support – resources – competence –awareness-communication – documented information –operation planning & control –management of change – procurement – Emergency preparedness and response.

UNIT-III PERFORMANCE EVALUATION

9

Monitoring , measurement , analysis and performance evaluation -evaluation of compliance- Internal audit-management review- Improvement- Incident, nonconformity and corrective action – continual improvement- guidance of the use of the document ISO 45001 - benefits of certification- certification procedure.

UNIT-IV ISO 14001& ISO 19011

9

EMS, ISO 14001, specifications, objectives, Environmental Policy, Guidelines and Principles (ISO 14004), 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. ISO 19011- Guidelines for auditing management Systems-General principles, managing audit programme- audit activities, steps in audit, audit plan-competence of auditors.

UNIT-V ENVIRONMENT IMPACT ASSESSMENT

9

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

Audit-methodology, Auditors Audit results management review-Continual improvement.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- CO1:** Explain the concepts, principles, and requirements of ISO 45001 Occupational Health and Safety Management System and its organizational framework.
- CO2:** Apply the planning and operational requirements of ISO 45001, including risk assessment, legal compliance, emergency preparedness, and documented information.
- CO3:** Analyze the performance evaluation, internal auditing, management review, and continual improvement processes for ISO 45001 certification.
- CO4:** Illustrate the requirements of ISO 14001 Environmental Management System, ISO 19011 auditing guidelines, and the procedures for environmental management system implementation and certification.
- CO5:** Evaluate the principles and applications of Life Cycle Assessment (ISO 14040), Eco-labeling (ISO 14020 series), and Environmental Impact Assessment (EIA) for sustainable industrial practices.

REFERENCE BOOKS:

1. ISO 45001: 2018 –Occupational Health and safety management systems Requirements with guidance for use
2. ISO14001:2004, Environmental Management Systems Requirements with Guidance for Use”, ISO,2004.
3. “Guidelines on Occupational Health and Safety Management Systems (OSH-MS)” International Labour Organization, 2001.
4. “ISO 19011:2011 Guidelines for Auditing Management Systems”, ISO, 2011.

CO's – PO's& PSO's MAPPING

CO	PO1	PO2	PO3	PSO1	PSO2
CO1	3	3	2	3	2
CO2	-	-	3	2	3
CO3	3	3	-	3	3
CO4	-	-	-	2	2
CO5	-	-	-	-	-
Avg	3	3	2.5	2.5	2.5

1 - low, 2 - medium, 3 - high, '-' - no correlation

25ISE34	ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS	L	T	P	C
SDG No.		3	0	0	3
4, 9, 17					

Course Objectives:

The main learning objective of this course is to prepare the students:

- To know the fundamental concepts and applications of Artificial intelligence.
- To familiarize with AI languages like PROLOG and LISP.
- To understand the various features of expert system
- To have knowledge about Neural Network and corresponding selection of parameters.

UNIT-I INTRODUCTION 9

Intelligence – Definition, types cognitive aspect approach, measuring intelligence – early efforts, IQ and AI: aspects of intelligence – learning, problem solving, creativity, behaviour and biology. Artificial intelligence: Historical background, applications of AI, objections and myths, AI languages: Introduction to PROLOG and LISP.

UNIT-II COGNITIVE PSYCHOLOGY 11

The mind – informative and cybernetics, components for thought, modes of perception – visual, auditory and other systems: memory mechanisms, problem solving – planning, search, the GPS systems; types of learning – rote, parameter, method and concept: Game playing, reasoning, Artificial Vision – picture processing – identifying real objects; Vision programs, factory vision systems.

UNIT-III KNOWLEDGE ENGINEERING 9

Introduction – role of knowledge engineer, knowledge representation – psychology, production rules, logic and programming, Common sense and fuzzy logic, semantic networks, learning systems.

UNIT-IV EXPERT SYSTEMS 9

Introduction, knowledge acquisition for Expert system, features of Expert systems –System structure, inference Engines, uncertainties, memory mechanisms, range of applications, actual expert systems – VP expert. Assignment – Development of a simple expert system.

UNIT-V INTRODUCTION TO NEURAL NETWORKS 7

Neural Network Architecture – Learning methods – Architecture of a Back Propagation Network – Selection of parameters – Simple variations of BPN.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- CO1:** Understand basic concepts and real-world applications of Artificial Intelligence.
- CO2:** Develop knowledge in cognitive psychology as it relates to AI.
- CO3:** Gain proficiency in AI programming languages.
- CO4:** Identify and explain key features and functions of expert systems.
- CO5:** Understand neural networks and select appropriate parameters for various applications.

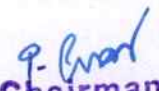
REFERENCE BOOKS:

1. Charnaik, E., and McDermott, D., "Introduction to Artificial Intelligence", Addison Wesley, 1985.
2. Dan W. Patterson, "Introduction to Artificial Intelligence and Expert Systems", Prentice Hall of India, 1992.
3. Elaine R., and Kevin, "Artificial Intelligence", 2nd Edition, Tata McGraw Hill, 1994.
4. Rajasekaran S and Vijayalakshmi Pai, G.A, "Neural Networks, Fuzzy Logic and Genetic Algorithms – Synthesis and Applications", PHI, 2003.

CO's – PO's& PSO's MAPPING

CO	PO1	PO2	PO3	PSO1	PSO2
CO1	3	-	2	-	-
CO2	3	3	3	-	-
CO3	-	2	-	-	-
CO4	-	-	-	1	1
CO5	-	-	-	1	-
Avg	3	2.5	2.5	1	1

1 - low, 2 - medium, 3 - high, '-' - no correlation


Chairman
BoS / Mech

25ISE35
SDG No.
4, 9, 12

DESIGN OF EXPERIMENTS

L	T	P	C
3	0	0	3

Course Objectives:

The main learning objective of this course is to prepare the students:

- To impart knowledge on principles and steps in designing a statistically designed experiment.
- To build foundation in analysing the data in single factor experiments and to perform post hoc tests.
- To provide knowledge on analysing the data in factorial experiments.
- To educate on analysing the data analysis in special experimental designs and Response Surface Methods.
- To impart knowledge in designing and analysing the data in Taguchi's Design of Experiments to improve Process/Product quality.

UNIT-I EXPERIMENTAL DESIGN FUNDAMENTALS

9

Importance of experiments, experimental strategies, basic principles of design, terminology, ANOVA, steps in experimentation, sample size, normal probability plot, linear regression models.

UNIT-II SINGLE FACTOR EXPERIMENTS

9

Completely randomized design, Randomized block design, Latin square design. Statistical analysis, estimation of model parameters, model adequacy checking, pair wise comparison tests.

UNIT-III MULTIFACTOR EXPERIMENTS

9

Two and three factor full factorial experiments, Randomized block factorial design, Experiments with random factors, rules for expected mean squares, approximate F- tests. 2K factorial Experiments.

UNIT-IV SPECIAL EXPERIMENTAL DESIGNS

9

Blocking and confounding in 2K designs. Two level Fractional factorial design, nested designs, Split plot design, Introduction to Response Surface Methods.

UNIT-V TAGUCHI METHODS

9

Steps in experimentation, design using Orthogonal Arrays, data analysis, Robust design-control and noise factors, S/N ratios, parameter design, Multi-level experiments, Multi-response optimization, Introduction to Shainin DOE.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- CO1:** Understand the fundamental principles of Design of Experiments.
- CO2:** Analyze data in the single factor experiments
- CO3:** Analyze data in the multifactor experiments.
- CO4:** Understand the special experimental designs & Response Surface Methods.
- CO5:** Apply Taguchi based approach to evaluate quality.

REFERENCE BOOKS:

1. Krishnaiah, K. and Shahabudeen, P. Applied Design of Experiments and Taguchi Methods, PHI learning private Ltd., 2012.
2. Montgomery, D.C., Design and Analysis of experiments, John Wiley and Sons, Eighth edition, 2012.
3. Phillip J. Rose, Taguchi techniques for quality engineering, McGraw Hill, 1996.
4. Montgomery, D.C., Design and Analysis of Experiment, Minitab Manual, John Wiley and Sons, Seventh edition, 2010.

CO's – PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PSO1	PSO2
CO1	1	1	-	1	-
CO2	-	-	1	1	-
CO3	-	-	1	1	-
CO4	-	-	1	1	-
CO5	2	1	1	2	1
Avg	1.5	1	1	1.2	1

1 - low, 2 - medium, 3 - high, '-' - no correlation


Chairman
BoS / Mech

25ISE36

DATA ANALYTICS

L T P C

SDG No.

3 0 0 3

4, 9, 17

Course Objectives:

The main learning objective of this course is to prepare the students:

- To recognize the importance of data analytics
- To exhibit competence on data analytics packages
- To apply solution methodologies for industrial problems.

UNIT-I INTRODUCTION

9

Introduction to Multivariate Statistics-Degree of Relationship among Variables-Review of Univariate and Bivariate Statistics-Screening Data Prior to Analysis-Missing Data, Outliers, Normality, Linearity, and Homoscedasticity.

UNIT-II MULTIPLE REGRESSION

9

Multiple Regression- Linear and Nonlinear techniques- Backward-Forward-Stepwise Hierarchical regression-Testing interactions (2way interaction) - Analysis of Variance and Covariance (ANOVA & ANCOVA) - Multivariate Analysis of Variance and Covariance (MANOVA & MANCOVA).

UNIT-III LOGISTIC REGRESSION

9

Regression with binary dependent variable -Simple Discriminant Analysis Multiple Discriminant analysis-Assessing classification accuracy- Conjoint analysis (Full profile method).

UNIT-IV PRINCIPAL COMPONENT ANALYSIS

9

Principal Component Analysis -Factor Analysis- Orthogonal and Oblique Rotation-Factor Score Estimation-Multidimensional Scaling-Perceptual Map-Cluster Analysis (Hierarchical Vs. Nonhierarchical Clustering).

UNIT-V LATENT VARIABLE MODELS

9

Latent Variable Models an Introduction to Factor, Path, and Structural Equation Analysis-Time series data analysis (ARIMA model) - Decision tree analysis (CHAID, CART) - Introduction to Big Data Management.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- CO1: Understand the significance and applications of data analytics.
- CO2: Implement multiple regression techniques for predictive modeling.
- CO3: Utilize logistic regression for classification problems.
- CO4: Apply principal component analysis and latent variable models for dimensionality reduction and data interpretation.
- CO5: Demonstrate proficiency in using various data analytics tools and packages.

REFERENCE BOOKS:

1. Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. "Multivariate data analysis", (7th edition). Pearson India. 2015
2. Gujarati, D. N., "Basic econometrics", Tata McGraw-Hill Education, 2012
3. Cohen, J., Cohen, P., West, S. G., & Aiken, L. S. "Applied multiple regression/correlation analysis for the behavioral sciences", Routledge., 2013
4. Han, J., Kamber, M., & Pei, J. "Data mining: concepts and techniques: concepts and techniques", Elsevier, 2011.

CO's - PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PSO1	PSO2
CO1	1	1	1	1	-
CO2	1	1	1	1	-
CO3	1	1	1	1	-
CO4	1	1	1	1	-
CO5	1	1	1	2	1
Avg	1	1	1	1.2	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

J. Anand
Chairman
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