M.E. Industrial Safety Engineering

Curriculum & syllabus

R 2020

Excel
ENGINEERING COLLEGE

(Autonomous)

Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai Accredited by NBA and NAAC with "A+"and Recognized by UGC (2f&12B)
KOMARAPALAYAM – 637303

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DEPARTMENT OF AERONAUTICAL ENGINEERING
M.E. INDUSTRIAL SAFETY ENGINEERING
REGULATION 2020
CHOICE BASED CREDIT SYSTEM
I TO IV SEMESTER CURRICULUM

I SEMESTER									
Code No.	Course	Category	Periods / Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
Theory Course(s)									
20PMA105	Advanced Numerical Methods	FC	3	2	0	4	40	60	100
20PIS101	Principles of Safety Management	PC	3	0	0	3	40	60	100
20PIS102	Environmental Safety	PC	3	2	0	4	40	60	100
20PIS103	Occupational Health and Industrial hygiene	PC	3	0	0	3	40	60	100
20PIS104	Industrial Safety, Health and Environment Acts	PC	3	2	0	4	40	60	100
20PISEXX	Professional Elective I	PE	3	0	0	3	40	60	100
Practical Course									
20PIS1C5	Technical Seminar - I	EEC	0	0	2	1	100	0	100
TOTAL			**18**	**6**	**2**	**22**	**340**	**360**	**700**

II SEMESTER									
Code No.	Course	Category	Periods / Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
Theory Course(s)									
20PIS201	Fire Engineering and Explosion Control	PC	3	0	0	3	40	60	100
20PIS202	Computer Aided Hazard Analysis	PC	3	0	0	3	40	60	100
20PIS203	Electrical Safety	PC	3	0	0	3	40	60	100
20PIS204	Safety in Chemical Industries	PC	3	0	0	3	40	60	100
20PISEXX	Professional Elective II	PE	3	0	0	3	40	60	100
20PISEXX	Professional Elective III	PE	3	0	0	3	40	60	100
Practical Course									
20PIS205	Industrial Safety Laboratory	PC	0	0	4	2	50	50	100
Employability Enhancement Course									
20PIS206	Technical Seminar -II	EEC	0	0	2	1	100	0	100
	TOTAL		**18**	**0**	**6**	**21**	**390**	**410**	**800**

CHAIRMAN - BOARD OF STUDIES

III SEMESTER									
Code No.	Course	Category	Periods / Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
Theory Courses									
20PEE301	Research Methodology and Intellectual Property Rights	PC	3	0	0	3	40	60	100
20PISEXX	Professional Elective IV	PE	3	0	0	3	40	60	100
20PISEXX	Professional Elective V	PE	3	0	0	3	40	60	100
Employability Enhancement Course									
20PIS302	Project Work Phase – I	EEC	0	0	12	6	50	50	100
TOTAL			**9**	**0**	**12**	**15**	170	230	**400**

IV SEMESTER									
Code No.	Course	Category	Periods / Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
Employability Enhancement Course									
20PIS401	Project Work Phase – II	EEC	0	0	24	12	50	50	100
TOTAL			0	0	24	12	50	50	100

TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE = 70

CREDITS SUMMARY

S. No	CATEGORY	CREDITS PER SEMESTER				TOTAL CREDIT (AICTE)	CREDITS in %
		I	II	III	IV		
1	FC	4				4	5.714
2	PC	14	14	3		31	44.28
3	PE	3	6	6		15	21.42
4	EEC	1	1	6	12	20	28.50
Total		22	21	15	12	70	100%

FC - Foundation Course
PC - Professional Core
PE - Professional Electives
EEC - Employability Enhancement Courses
MC - Mandatory Courses (Non-Credit Courses)
CA - Continuous Assessment
FE - Final Examination

CHAIRMAN BOARD OF STUDIES

LIST OF ELECTIVES FOR M.E. INDUSTRIAL SAFETY ENGINEERING
SEMESTER I

Professional Elective I									
Code No.	Course	Category	Periods / Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
20PISE01	Plant Layout and Materials Handling	PE	3	0	0	3	40	60	100
20PISE02	Work Study and Ergonomics	PE	3	0	0	3	40	60	100
20PISE03	Dock Safety	PE	3	0	0	3	40	60	100
20PISE04	Human Factors in Engineering	PE	3	0	0	3	40	60	100

LIST OF ELECTIVES FOR M.E. INDUSTRIAL SAFETY ENGINEERING
SEMESTER II

Professional Elective II & III									
Code No.	Course	Category	Periods / Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
20PISE10	Transport Safety	PE	3	0	0	3	40	60	100
20PISE11	Fireworks Safety	PE	3	0	0	3	40	60	100
20PISE12	Safety in Construction	PE	3	0	0	3	40	60	100
20PISE13	Nuclear Engineering and Safety	PE	3	0	0	3	40	60	100
20PISE14	Safety in Textile Industry	PE	3	0	0	3	40	60	100

LIST OF ELECTIVES FOR M.E. INDUSTRIAL SAFETY ENGINEERING
SEMESTER III

Professional Elective IV & V									
Code No.	Course	Category	Periods/ Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
20PISE21	Safety in Engineering Industry	PE	3	0	0	3	40	60	100
20PISE22	Quality Engineering in Production Systems	PE	3	0	0	3	40	60	100
20PISE23	Disaster Management	PE	3	0	0	3	40	60	100
20PISE24	OHSAS 18000 and ISO 14000	PE	3	0	0	3	40	60	100
20PISE25	Artificial Intelligence and Expert Systems	PE	3	0	0	3	40	60	100
20PISE26	Research Methodology	PE	3	0	0	3	40	60	100
20PISE27	Industrial Psychology	PE	3	0	0	3	40	60	100

CHAIRMAN-BOARD OF STUDIES

20PMA105	Advanced Numerical Methods	L	T	P	C
		3	2	0	4
Nature of Course	Foundation Core				
Pre requisites	Basics in numerical methods				

Course Objectives

The course is intended to

1. Numerical methods aided by technology to solve algebrair, transcendental and differential equations
2. Apply finite element methods for solving the boundary value problems in differential equations.
3. Develop problem solving skills innumerical integration and differential equations.
4. Understanding of the application of various methods in solving engineering problems.
5. Serve as a precursor for future research

Course Outcomes

CO. No.	Course Outcome	Bloom's Level
CO1	List the common numerical methods and how they are used to obtain approximate solutions	Remember
CO2	Demonstrate the Eigen Value Problems And Curve Fitting.	Understand
CO3	Analyze and evaluate the accuracy of common numerical methods.	Analyze
CO4	Solve the numerical methods to obtain approximate solutions to mathematical problems.	Apply
CO5	Evaluate the numerical methods for various mathematical operations and tasks.	Evaluate

Course Contents:

UNIT I **Numerical Solutions for Linear and Non-Linear Equations** **12**

System of linear equation. Gauss Elimination Method, Gauss Jordan Method, Choleski Method, Gauss-Seidel Method – System of Non-Linear equations . Method of Iteration, Newton-Raphson Method.

UNIT II **Eigen Value Problems and Curve Fitting** **12**

Eigen value problem: Power Method Curve fitting: Least Square approximations – Fitting a straight line – Regression Lines – Non-Linear curve fitting – Method of least square for continuous functions.

UNIT III **Numerical Integration** **12**

Trapezoidal Rule - Simpsons Rules-Adaptive Quadrature Method – Gaussian Quadrature-Double integrals using Trapezoidal and Simpson's rule Electrical Installations Devices

UNIT IV **Numerical Solutions of Ordinary Differential Equations** **12**

Single step methods: Euler's Methods – Modified Euler's Method - Runge-Kutta Method of fourth order – Mult Step methods Milne's and Adam's Predictor and Corrector Methods Numerical solution of Ordinary Differential Equation by Finite Difference Method

UNIT V **Numerical Solutions of Partial Differential Equations** **12**

Laplace Equation Gauss Jacobi Method, Gauss Seidel Method – Poisson Equation; Finite difference method. Parabolic Equation: Crank Nicholson Method – Hyperbolic Equation. Explicit method

TOTAL: 60 PERIODS

Text books

1. P.Kandasamy, K.Thilagavathy, K.Gunavathy. "Numerical Methods", S.Chand and Company Ltd.,Ramnagar, New Delhi. 2010.
2. Veerarajan.T and Ramachandran.T., "Numerical Methods with Programming C", Tata McGraw Hill Publishers, New Delhi, 2007

Reference

1. S.R.K.Iyengar, R.K.Jain, "Numerical Methods" New Age International Publishers, New Delhi. 2020.
2. Crewal, B. S.,andGrewal J.S., "Numerical Methods in Engineering and Science", Seventh Edition. Khanna Publishers, New Delhi, 2007.
3. C.F. Gerald and Wheatley P.O., "Applied Numerical Analysis", (Seventh Edition) Pearson Education,Asia, New Delhi.2007.
4. M.K.Jain, S.R.K. Iyengar and R.K.Jain, "Numerical Methods for Scientific and Engineering Computation", Wiley Eastern Limited, New Delhi. 2007.
5. Bala Gurusamy .E , "Numerical Methods", Tata McGraw Hill Publishers, New Delhi,1999, reprint 2007.
6. S.S.Sastry, "Introductory Methods of Numerical Analysis", Prentice Hall of India, Seventh Edition,New Delhi,2005.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3						2	2	2			3	1	
CO2	3	3						2	2	2			3	1	
CO3	3	3						2	2	2			3	1	
CO4	3	3						2	2	2			3	1	
CO5	3	3						2	2	2			3	1	

3 – High; 2 – Medium; 1 – Low

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Quiz	5	15
Understand	Tutorial Class / Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE-I (7.5)	IAE - II (7.5)	IAE - III (10)	
Remember	1 0	1 0	1 0	20
Understand	3 0	3 0	3 0	60
Apply	1 0	1 0	1 0	20
Analyze				
Evaluate				
Create				

CHAIRMAN-BOARD OF STUDIES

20PIS101	Principles of Safety Management	L	T	P	C
		3	0	0	3
Nature of Course	Professional core				
Pre requisites	Principle of Management				

Course Objectives

The course is intended

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

Course Outcomes

On successfu completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	List out and describe the various functions and activities of safety engineeringdepartment.	Understand
CO2	Examine the safety audit and prepare a report for theaudit.	Apply
CO3	Analyze the accident investigation report and estimate the cost due toaccident.	Analyze
CO4	Evaluate the safety performance of an organization from accidentrecords.	Evaluate
CO5	Identify various agencies, support institutions and government organizations involved in safety training and promotion.	Apply

Course Contents:

UNIT I **Concepts and Techniques** 9

History of Safety movement: –Evolution of modern safety concept- general concepts of management 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-IS 14489 : 1998 Code of practice on occupational Safety and health audit

UNIT III **Accident Investigation and Reporting** 9

Concept of an accident, near miss incident, 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 .Total injury illness incidence rate, Lost workday cases incidence rate (LWDI) Number of lost workdays 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 DGFASLI, NSC, ASSE, HSE, OSHA-NEBOSH – creating awareness, awards celebrations, safety posters, safety displays, safety pledge safety incentive scheme, safety campaign.

TOTAL: 45 PERIODS

References

1. Ray Asfahl, C "Industrial Safety and Health Management" Pearson Prentice Hall, 7th Edition 2019
2. Lees, F.P & M Sam Mannan, "Loss Prevention in Process Industries: Hazard Identification, Assessment and Control", Butterworth-Heinemann publications, London, 4th edition, 2012.
3. Philip Hagan, "Accident Prevention Manual for Business and Industry", N.S C.Chicago, 13th edition, 2009.
4. Blake R.B., "Industrial Safety" Prentice Hall, Inc., New Jersey, 2000
5. John V.Grimaldi and Rollin H. Simonds, "Safety Management", Richard D Irwin, 1994.
6. Can Petersen, "Techniques of Safety Management" McGraw-Hill Company, Tokyo, 1981.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2				1	1		1				2	3	
CO2	2	2				1	1		1				2	3	
CO3	3	2				1	1		1				2	3	
CO4	2	2	3			1	1		1				2	3	
CO5	2	3	1			1	1		1				2	3	
3	High					2	Medium					1	Low		

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Quiz	5	15
Understand	Tutorial Class / Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination
	IAE-I (7.5)	IAE - II (7.5)	IAE - III (10)	(60)
Remember	10	10	10	20
Understand	30	30	30	60
Apply	10	10	10	20
Analyze				
Evaluate				
Create				

CHAIRMAN - BOARD OF STUDIES

20PIS102	Environmental Safety	L	T	P	C
		3	2	0	4
Nature of Course	Professional core				
Pre requisites	Nil				

Course Objectives

The course is intended

1. To provide in depth knowledge in Principles of Environmental safety and its applications in various fields.
2. To give understanding of air and water pollution and their control.
3. To expose the students to the fundamentals of waste management.
4. To design emission measurement devices.

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Illustrate the basic concepts of air pollution and its effects.	Understand
CO2	Design the health hazards of water pollution and its various treatment methods.	Evaluate
CO3	Explain various types of hazardous waste and respective treatment methods.	Understand
CO4	Identify and suggest various instruments and devices for environmental parameter measurement and control.	Apply
CO5	Explain and suggest various pollution control measures for various process industries.	Understand

Course Contents:

Unit I Air Pollution 12

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- automobile exhausts-chemical factory stack emissions-Ozone Depletion substances. Guidelines on Air prevention and control of pollution; act, 1981 and rules1982

Unit II Water Pollution 12

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 awa- chemical industries, fermentation, textile effluents-common treatment.

Unit III Hazardous Waste Management 12

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 vitrification - hazards due to bio-process-pollution standards and restrictions – recycling and reuse. Environmental impact assessment (EIA)-scope, guidelines, activities and methodologies.

Unit IV Environmental Measurement And Control 12

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 12

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

TOTAL: 60 PERIODS

Reference

1. "Guidelines for EIA of Industrial and other Projects" Ministry of Environment and Forests, Government of India, 2020.
2. Rao C S, "Environmental Pollution Control Engineering", New Age International,2007
3. Pollution Control Law Series: Pollution Control Acts, Rules and Notification Issued There under, Central Pollution Control Board, Ministry of Environment andForest, Government of India, 2006.
4. MahajanS.P."PollutionControlinProcess industries",TataMcGrawHillPublishingCompany,NewDelhi,2006.
5. Varma and Brener, "Air pollution equipment", Springer Publishers. SecondEdition 2004

TOTAL: 60 PERIODS

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2				1	1		1				2	3	
CO2	2	2				1	1		1				2	3	
CO3	3	2				1	1		1				2	3	
CO4	2	2	3			1	1		1				2	3	
CO5	2	3	1			1	1		1				2	3	
3	High					2	Medium					1	Low		

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Quiz	5	15
Understand	Tutorial Class / Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE- I (7.5)	IAE - II (7.5)	IAE - III (10)	
Remember	10	10	10	20
Understand	30	30	30	60
Apply	10	10	10	20
Analyze				
Evaluate				
Create				

CHAIRMAN-BOARD OF STUDIES

20PIS103	Occupational Health and Industrial Hygiene	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites	Food Processing				

Course Objectives

The course is intended

1. To understand the basic knowledge on anatomy of few important human organs and its basic functions.
2. To enable the students to learn about various functional and activities of occupational health services.
3. To enable the students to compare the hazards of chemicals with the permissible levels.
4. To acquire knowledge about types of hazards arising out of physical, chemical and biological agents.

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Understand the various physiological functions of our body , exposure roots of toxic materials into the body and the test methods for periodical monitoring of health	Understand
CO2	Understand the various effects of physical hazards on human health and the various control measures taken to rectify the same	Understand
CO3	Analyze various types of hazards present in the chemicals processing and testing methodology followed monitoring and controlling the same.	Analyze
CO4	Tounalyze various types of hazards caused by the biological agents and Work related activities.	Analyze
CO5	Understand the notifiable occupational diseases and the impact of toxicity arising out of occupation and to suggest methods for the prevention of such diseases.	Understand

Course Contents:

Unit I **Anatomy, Physiology, Hazard and Pathology** 9

Definition- Anatomy and Physiology of human organs – The lungs Skin Ear Eyes and skin – Functions of organs – Impairment of organs – Effects of various hazards on organs - Cardio pulmonary resuscitation - audiometric tests, eye tests, vital functional tests. Exposure routes of toxic materials and protective mechanisms. Recognition of health hazards, Methods for measuring and evaluating health hazards.

Unit II **Physical Hazards** 9

Noise, compensation aspects, noise exposure regulation, properties of sound occupational damage risk factors, 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 of hot environments, thermal comfort, heat stress indices Methods for controlling thermal exposures, accimatization, estimation and control. Industrial illumination and design of lighting system

Unit III **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 - Genera Control Methods training and education. Toxicology classes of toxicants, metals, agriculture chemicals, solvents, food additives, cosmetics.– human health risk assessment and Environmental risk assessment.

Unit IV Biological and Ergonomical Hazards 9

Classification of Bio-hazardous agents – examples. bacterial agents,rickettsial and chlamydial agents, viral agents. fungal. parasitic agents, infectious diseases – 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 V Occupational Health, Physiology 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. 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. Industrial toxicology, local, systemic and chronic effects, temporary and cumulative effects, carcinogens entry into human systems. Lead-nickel, chromium and manganese toxicity. gas poisoning (such as CO. ammonia. coal and dust etc..) their effects andprevention.

TOTAL: 45 PERIODS

Reference

1. Barbara A.Plog, Patricia J.Quinlan, MPH. CIH and Jennifer Villareal 'Fundamentals of Industrial Hygiene", 6th edition 2012, National Safety Council, 2012.
2. JeannneMagerStellman, "Encyclopedia of Occupational Health and Safety", Vol.I and II, published by International LabourOrganisation. Geneva.2012.
3. Hand book of 'Occupational Safety and Health", National Safety Council Chicago, 2010

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2					1		1				1	3	
CO2	3	2					1		1				1	3	
CO3	3	2					1		1				1	3	
CO4	3	2					1		1				1	3	
CO5	3	2					1		1				1	3	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Quiz	5	15
Understand	Tutorial Class / Assignment	5	
	Attendance	5	

Summative Assesement				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE- I (7.5)	IAE - II (7.5)	IAE - III (10)	
Remember	10	10	10	20
Understand	30	30	30	60
Apply	10	10	10	20
Analyze				
Evaluate				
Create				

CHAIRMAN BOARD OF STUDIES

20PIS104	Industrial Safety, Health and Environment (SHE) Acts	L	T	P	C
		3	2	0	4
Nature of Course	Professional Core				
Pre requisites	Nil				

Course Objectives

The course is intended

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

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	List out important legislations related to health, Safety and Environment.	Understand
CO2.	Examine the requirements mentioned in factories act for the prevention of accidents.	Analyze
CO3.	Understand the health and welfare provisions given in factories act.	Understand
CO4.	Identify the statutory requirements for an industry on registration, license and its renewal.	Apply
CO5.	Choose the onsite and offsite emergency plan.	Analyze

Course contents

Unit I **Factories Act – 1948** **12**

Statutory authorities – inspecting staff, health safety provisions relating to hazardous processes welfare – special provisions – penalties and procedures-Tamilnadu Factories Rules 1950 under Safety and health chapters of Factories Act 1948 - Tamilnadu safety officer rules 2005

Unit II **Environment Act – 1986** **12**

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.

Unit III **Manufacture, Storage & Import of Hazardous Chemical Rules 1989** **12**

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.

Unit IV **Other Acts and Rules** **12**

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** **12**

Occupational Safety and Health act of USA (The William- Steiger's Act of 1970) Health and safety work act (HASAWA

1974, UK) – OHSAS 18000 – ISO 14000 – ISO 45001 - Benefits and Elements.

TOTAL: 60 PERIODS

Reference

1. Subramanian.V., 'The Factories Act 1948 with Tamilnadu factories rules 1950", Macras Book Agency, Chennai, 21st edition ,2000
2. "The Environment Act: (Protection) 1986 with allied rules", Law Publishers (India) Pvt. Ltd. Allahabad.
3. 'Air (Prevention and control of pollution) act 1981". Law Publishers (India) Pvt. Ltd., Allahabad.
4. 'Water (Prevention and control of pollution) act 1974". Law publishers (India) Pvt. Ltd..Allahabad.
5. "The Indian boilers act 1923 with amendments", Law Pubishers (India) Pvt. Ltd. Allahabad.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1		1	1							1	3	
CO2	2	3	1		1	1							1	3	
CO3	3	1	2		2	2							2	3	
CO4	3	1	2		2	2							2	3	
CO5	2	3	1		1	1							1	3	
3	High			2	Medium						1	Low			

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Quiz	5	15
Understand	Tutorial Class / Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE- I (7.5)	IAE - II (7.5)	IAE - III (10)	
Remember	10	10	10	20
Understand	30	30	30	60
Apply	10	10	10	20
Analyze				
Evaluate				
Create				

CHAIRMAN-BOARD OF STUDIES

20PIS105	TECHNICAL SEMINAR	L	T	P	C
		0	0	2	1
Nature of Course	Employability Enhancement Course				
Pre requisites	Undergraduate Project Presentation				

Course objectives:

1. To Enhance the ability of self-study
2. To encourage the students to study advanced engineering developments
3. To improve presentation and communication skills
4. To prepare and present technical reports.
5. To encourage the students to use various teaching aids such as overhead projectors, PowerPoint presentation and demonstration models

Course outcomes:

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	To review, prepare and present technological developments	Analyze
CO2	To face the placement interviews	Analyze
CO3	To improve the speaking skills	Analyze
CO4	To express confidence in handling information, making useful notes and presenting an argument	Understand
CO5	To infer the research and development knowledge	Analyze

Guidelines

- The student is expected to present a seminar on one of the current topics in the field of Thermal Engineering related issues / technology.
- The seminar shall be of 30 minutes duration and give presentation to the Seminar Assessment Committee (SAC).
- A faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also.
- In a session of two periods per week, 4 students are expected to present the seminar.
- Students are encouraged to use various teaching aids such as power point presentation and demonstrative models
- Students are required to prepare a seminar report in the prescribed format given by the department.

TOTAL: 30 PERIODS

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	-	-			3	2	3	2	3	2	2	-	-	-
CO2	-	-	-	-	-	1	1	3	3	3	2	2	-	-	-
CO3	-	-	-	-	-	3	1	2	2	2	3	3	-	-	-
CO4	-	-	-	-	-	2	2	3	3	2	3	2	-	-	-
CO5	-	-	-	-	-	3	1	3	2	2	3	3	-	-	-
	3	High				2	Medium					1	Low		

Assessment based on Continuous and Final Examination			
Bloom's Level	Continuous Assessment (50 marks) (Attendance – 5 marks)		Final Examination (50 marks)
	Rubric based Continuous Assessment (25 marks)	Model Examination (20 marks)	
Remember			
Understand	40	40	40
Apply			
Analyze			
Evaluate	60	60	60
Create			

CHAIRMAN - BOARD OF STUDIES

20PIS201	Fire Engineering and Explosion Control	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites	Thermodynamics and Thermal Engineering				

Course Objectives

The course is intended to

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

Course Outcomes

On successful completion of the course the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	To make familiar about basic concepts of fire and explosion science.	Understand
CO2.	To know the different source of ignition and their prevention techniques.	Apply
CO3.	To understand the operation of various types of firefighting equipment.	Understand
CO4.	To understand the causes and prevention of explosion.	Understand
CO5.	To equip the students to effectively employ explosion protection techniques and their significances to suit the industrial requirement.	Understand

Course Contents:

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, Pasadena 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 layout 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 – CO_2 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 ines explosion, suppression system based on carbon dioxide (CO_2) and halons-hazards in LPG, ammonia (NH_3), sulphur dioxide (SO_3), chlorine (CL_2) etc.

TOTAL: 45 PERIODS

REFERENCES

1. "Dinko Tuhtar, "Fire and explosion protection"1989
2. Derek, James, "Fire Prevention Hand Book", Butter Worths and Company, London,1986.
3. "Accident Prevention manual for industrial operations" N.S.C., Chicago,1982.
4. "Davis Daniel et al, "Hand Book of Fire Technology"
5. "Fire Prevention and firefighting", Loss prevention Association, India.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	-	-	-	-	-	-	-	-	1	2	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	1	2	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	1	2	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-	1	1	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	1	2	-	-
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Quiz	5	15
Understand	Tutorial Class / Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination
	IAE - I (7.5)	IAE - II (7.5)	IAE - III (10)	(60)
Remember	10	10	10	20
Understand	30	30	30	60
Apply	10	10	10	20
Analyze				
Evaluate				
Create				

CHAIRMAN-BOARD OF STUDIES

20PIS202	Computer Aided Hazard Analysis	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites	Computer Aided Design				

Course Objectives

The course is intended to

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

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	This course would make familiarizing of basic concepts in risk and hazard	Apply
CO2	Course would be helpful to understand the various instruments to bring safety in Industries	Apply
CO3	Students would be trained to find solution for risk assessment studies through the use of softwares	Apply
CO4	Students would be able to make use of a risk assessment technique to quantify the risk	Understand
CO5	Course would equip the students effectively to employ hazard analysis techniques in Industry and helpful to prevent the accidents in Industry	Apply

Course contents:

UNIT I Hazard, Risk Issues and Hazard Assessment 9

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 9

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 Software's 9

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, HAMCARS modules on Heat radiation, Pool fire, Jet, Explosion, Reliability software's on FMEA for mechanical and electrical systems

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	15
Understand	Tutorial Class / Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Internal Assessment Examinations**			**Final Examination (60)**
	IAE – I (7.5)	**IAE – II (7.5)**	**IAE – III (10)**	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

CHAIRMAN - BOARD OF STUDIES

UNIT IV **Consequences Analysis** **9**

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 plan/layout.

UNIT V **Credibility of Risk Assessment Techniques** **9**

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

TOTAL: 45 PERIODS

(Use of Standard and approved Steam Table and Mollier Chart permitted)

REFERENCES:

1. Guidelines for Hazard Evaluation Procedures, Centre for Chemical Process safety, AICHE1992
2. Loss Prevention in Process Industries-Frank P. Less Butterworth-Hein UK 1990 (Vol 1, II and III)
3. ILO- Major Hazard control- A practical Manual, ILO, Geneva,1988.
4. Brown, D.B. System analysis and Design for safety, Prentice Hall,1976
5. Course Material Intensive Training Programme on Consequence Analysis by Process Safety Centre, Indian Institute of Chemical Technology Tarnaka and CLRI, Chennai.
6. Hazop and Hazem, by Trevor A Kletl, Institute of Chemical Engineering
7. Methodologies for Risk and Safety Assessment in Chemical Process Industries, Common wealth Science Council,UK
8. Quantitative Risk assessment in Chemical Industries, Institute of Chemical Industries Centre for Chemical process safety.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	2	-	-	-	-	-	-	-	2	2	-	-
CO2	3	3	3	2	-	-	-	-	-	-	-	2	2	-	-
CO3	3	3	3	3	3	-	-	-	-	-	-	2	2	-	-
CO4	3	3	3	2	-	-	-	-	-	-	-	2	2	-	-
CO5	3	3	3	3	-	-	-	-	-	-	-	2	2	-	-
	3	High				2	Medium					1	Low		

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

References

1. Power Engineers – Handbook of TNEB, Chennai, 1989.
2. Martin Glov Electrostatic Hazards in powder handling, Research Studies Pvt. Ltd., England, 1988.
3. Fordham Cooper, W., "Electrical Safety Engineering" Butterworth and Company, London, 1986.
4. "Accident prevention manual for industrial operations", N.S.C., Chicago, 1982.
5. Indian Electricity Act and Rules, Government of India.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	2	3	2										2	2	
CO 2	2	3	2										2	2	
CO 3	2	3	2										2	2	
CO 4	2	3	2										2	2	
CO 5	2	3	2										2	2	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class / Assignment	5	
	Attendance	5	

20PIS203	Electrical Safety	L	T	P	C
		3	0	0	3
Nature of course	Professional Core				
Pre requisites	Physics for Mechanical science, Electrical Drives and control				

Course Objectives

The course is intended to

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

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO 1	This course would make familiar of basic concepts in electrical circuit and hazards involved in it.	Understand
CO 2	Ability to understand the various effects of electrical hazards	Understand
CO 3	Students would be able to understand the operation of various protection systems from electrical hazards	Understand
CO 4	Recognize different hazardous zones in Industries	Understand
CO 5	Course would be helpful to understand the electrical hazards in Industries.	Apply

Course Contents

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 equipment-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. Safety of fuel cell - batteries - CNG vehicles.

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-

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	10	10	10	20
Understand	40	40	20	60
Apply			20	20
Analyze				
Evaluate				
Create				

CHAIRMAN-BOARD OF STUDIES

20PIS204	Safety in Chemical Industries	L	T	P	C
		3	0	0	3
Nature of course	Professional Core				
Pre requisites	Engineering physics, Chemistry				

Course Objectives:

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

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	This course would make familiar of safe design of equipment which are the essential to chemical industry and leads to design of entire process industries	Understand
CO2	Course would be helpful to understand the design of pressure systems.	Understand
CO3	Students would understand the problems and find innovative solutions while industries facing Problems in commissioning and maintenance stages.	Understand
CO4	Students can prepare the emergency planning for chemical industry problems	Understand
CO5	Students would be able to create safe storage systems.	Understand

Course Contents:

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

UNITV **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

References

1. Loss, F.P. "Loss Prevention in Process Industries" Butterworths and Company, 1996 Petroleum Act and Rules, Government of India
2. Carbide of Calcium Rules, Government of India.1985
3. GREEN, A E., "High R sk Safety Technology", John Wiley and Sons,.1984
4. "Accident Prevention Manual for Industrial Operations" NSC, Chicago, 1982.
5. "Quantitative Risk Assessment in Chemical Process Industries" American Institute of Chemical Industries Centre for Chemical Process safety.
6. Fawcett, H.h. and Wood, "Safety and Accident Prevention in Chemical Operations" Wiley inters, Second Edition.

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	-	-	-	-	-	-	-	-	3	-	-	2	-	-
CO2	3	-	-	-	-	-	-	-	-	3	-	-	2	-	-
CO3	3	-	-	-	-	-	-	-	-	3	-	-	2	-	-
CO4	3	-	-	-	-	-	-	-	-	3	-	-	2	-	-
CO5	2	-	-	-	-	-	-	-	-	2	-	-	2	-	-
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class / Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

CHAIRMAN BOARD OF STUDIES

20PIS205	Industrial Safety Laboratory	L	T	P	C
		0	0	4	2
Nature of Course	Professional Core				
Pre requisites					

Course Objectives

The course is intended

1. To provide opportunity to operate the equipment to acquire practical knowledge.
2. To know the various PPEs and software.
3. To carry out experiments to find out the environmental parameters.
4. To assess the impact of sensitivity of chemicals on explosive y.

To run the software to assess the consequence effects of major accidents

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO 1	This course would make students to know and run the various equipment to bring out the safety environment in the industry.	Analyze
CO 2	Students would be trained to conduct experiments to find out various environmental parameters.	Analyze
CO 3	Course would be helpful for the students to measure the particulate matter and assess the impact of air pollution	Analyze
CO 4	Students would be able to use personal protective equipment independently.	Analyze
CO 5	Students can recognize the various problems with the use of software and hence to predict the real situations on major accidents.	Analyze

Laboratory Components

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 for improving the ergonomics

Friction Test
Explosive materials like barium nitrate, gun powder, white powder, ammorces 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 Co_2 Foam
Carbon dioxide (Co_2)
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
First-Aid
Road safety signals and symbols

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	Name of the equipment	Quantity	Experiment No.
1.	Noise level meter	1	1
2.	Friction tester	1	2
3.	Impact tester	1	3
4.	Exhaustgasanalyzer	1	4
5.	High volume sampler	1	5
6.	PPESet	1	6
7.	Fire extinguisher set	1	7
8.	Static charge tester	1	8
9.	Firstaidkid	1	9
10.	Lockout/Tag out	1	10
11.	Software ALOHA,CAMEO		

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	3	-	-	-	-	2	-	-	-	2	-	-
CO2	3	3	3	3	-	-	-	-	2	-	-	-	2	-	-
CO3	3	3	3	3	-	-	-	-	2	-	-	-	2	-	-
CO4	3	3	2	3	-	-	-	-	2	-	-	-	2	-	-
CO5	3	3	2	3	-	-	-	-	2	-	-	-	2	-	-
	3	High				2	Medium				1	Low			

Assessment based on Continuous and Final Examination			
Bloom's Level	Continuous Assessment (50 marks) (Attendance – 5 marks)		Final Examination [50 marks]
	Rubric based Continuous Assessment [25 marks]	Model Examination [20 marks]	
Remember			
Understand	40	40	40
Apply			
Analyze			
Evaluate	60	60	60
Create			

CHAIRMAN - BOARD OF STUDIES

20PIS206	Technical Seminar -II	L	T	P	C
		0	0	4	2
Nature of Course	EEC				
Pre requisites	Technical Seminar -I				

Course objectives:

1. To Enhance the ability of self-study
2. To encourage the students to study advanced engineering developments
3. To Improve presentation and communication skills
4. To prepare and present technical reports
5. To encourage the students to use various teaching aids such as overhead projectors, PowerPoint presentation and demonstration models

Course outcomes:

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	To review, prepare and present technological developments	Analyze
CO2	To face the placement interviews	Analyze
CO3	To improve the speaking skills	Analyze
CO4	To express confidence in handling information, making useful notes, and presenting an argument	Understand
CO5	To infer the research and development knowledge	Analyze

Guidelines

- The student is expected to present a seminar on one of the current topics in the field of Thermal Engineering related issues / technology
- The seminar shall be of 30 minutes duration and give presentation to the Seminar Assessment Committee (SAC).
- A faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also.
- In a session of two periods per week, 4 students are expected to present the seminar.
- Students are encouraged to use various teaching aids such as power point presentation and demonstrative models.
- Students are required to prepare a seminar report in the prescribed format given by the department.

TOTAL: 30 PERIODS

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	-	-			3	2	3	2	3	2	2	-	-	-
CO2	-	-	-	-	-	1	1	3	3	3	2	2	-	-	-
CO3	-	-	-	-	-	3	1	2	2	2	3	3	-	-	-
CO4	-	-	-	-	-	2	2	3	3	2	3	2	-	-	-
CO5	-	-	-	-	-	3	1	3	2	2	3	3	-	-	-
	3	High					2	Medium				1	Low		

Assessment based on Continuous and Final Examination			
Bloom's Level	Continuous Assessment (50 marks) (Attendance – 5 marks)		Final Examination [50 marks]
	Rubric based Continuous Assessment [25 marks]	Model Examination [20 marks]	
Remember			
Understand	40	40	40
Apply			
Analyze			
Evaluate	60	60	60
Create			

CHAIRMAN-BOARD OF STUDIES

20PEE301	**Research Methodology and Intellectual Property Rights (Common to all Branches of M.E., / M.Tech., Programme)**	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites	Basic Research Knowledge				

Course Objectives

1. To learn the basics of research problems, effective technical writing and developing a research proposal.
2. To study about Nature of Intellectual Property and Patent Rights.

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Examine research problem formulation.	Apply
CO2	Analyze research related information.	Analyze
CO3	Follow research ethics.	Apply
CO4	Utilize the Patent information and databases	Apply
CO5	Emphasis the need of information about Intellectual Property Right to be promoted among students in general and engineering in particular	Analyze

Course Contents:

Unit I Basics of Research Problem **9**

Meaning of research problem – Sources of research problem – Criteria Characteristics of a good research problem – Errors in selecting a research problem - Scope and objectives of research problem, Approaches of investigation of solutions for research problem - Data collection – Analysis Interpretation Necessary instrumentations

Unit II Technical Writing and Proposal **9**

Effective literature studies approaches – Analysis Plagiarism Research ethics – Effective technical writing How to write Report – Paper – Developing Research Proposal – Format of research proposal Presentation and Assessment by a review committee

Unit III Intellectual Property **9**

Nature of Intellectual Property: Patents – Designs – Trade and Copyright. Process of Patenting and Development Technological research – Innovation – Patenting Development. International Scenario: International cooperation on Intellectual Property – Procedure for grants of patents – Patenting under PCT.

Unit IV Patent Rights **9**

Patent Rights: Scope of Patent Rights – Licensing and transfer of technology – Patent information and databases – Geographical Indications

Unit V Developments in IPR **9**

New Developments in IPR: Administration of Patent System New developments in IPR – IPR of Biological Systems – Computer Software – Traditional knowledge Case Studies – IPR and IITs.

Total: 45 Periods

Reference

1. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.
2. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners".

2014.
3. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008
4. Halbert, 'Resisting Intellectual Property', Taylor & Francis Ltd, 2007
5. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction", Juta and Company Ltd, 2nd Edition 2004.
6. Wayne Goddard and Stuart Melville, 'Research Methodology. An Introduction', 2004.
7. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students', 1996.
8. Stuart Melville and Wayne Goddard, "Research methodology: aninIroduction for science & engineering students', Juta and Company Ltd, 1996.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
Cos	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	3	-	-	-	2	1	1	2	3	1	2
CO2	3	3	3	3	3	-	-	-	2	1	1	2	3	1	2
CO3	3	3	3	3	3	-	-	-	2	1	1	2	3	1	2
CO4	3	3	3	3	3	-	-	-	2	1	1	2	3	1	2
CO5	3	3	3	3	3	-	-	-	2	1	1	2	3	1	2
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class / Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

CHAIRMAN BOARD OF STUDIES

20PIS302	PROJECT WORK PHASE - I	L	T	P	C
		0	0	12	6
Nature of course	Employability Enhancement Course				
Pre requisites	Concepts of Research Methodology				

Course Objectives

The course is intended to

1. Identify a specific problem for the current structural needs of the society.
2. Collect information related to the same through detailed review of literature
3. Develop the methodology to solve the identified problem
4. Review the methodology and comparing its merits and demerits.
5. Experimental work related to the methodology which includes basic concepts , basic tests etc.,

Course Outcomes

On successful completion of the course, students will be able to

CO. No	Course Outcome	Bloom's Level
CO 1	Identify and formulate research problem	Apply
CO 2	Concentrate on literatures related to research problem.	Understand
CO 3	Possess the ability to write a standard technical paper and presentation.	Apply
CO 4	Find the correct procedure for applying patents	Apply
CO 5	Become well versed on patent rights, licensing and transfer of technology.	Understand

Course Contents

The student individually works on a specific topic approved by faculty member who is familiar in this area of interest. The student can select any topic which is relevant to his/her specialization of the programme. The topic may be experimental or analytical or case studies. At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work. The students will be evaluated through a viva-voce examination by a panel of examiners including one external examiner

Total : 180 Periods

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	3	3	3	3	3	3	3	3	3	3	3	3			
CO 2	3	3	3	3	3	3	3	3	3	3	3	3			
CO 3	3	3	3	3	3	3	3	3	3	3	3	3			
CO 4	3	3	3	3	3	3	3	3	3	3	3	3			
CO 5	3	3	3	3	3	3	3	3	3	3	3	3			
	3	High				2	Medium					1	Low		

	Continuous Assessment [50 marks]						Final Viva Voce Examination [50 marks]
	Review I [10]	Review II [10]	Review III [10]	Publication [10]	Report [10 Marks]	Total [50]	
Marks	100	100	100	10	10	50	50

CHAIRMAN-BOARD OF STUDIES

20PIS401	PROJECT WORK PHASE - II	L	T	P	C
		0	0	24	12
Nature of course	Employability Enhancement Course				
Pre requisites	Knowledge in Electronics Engineering				

Course Objectives

The course is intended to

1. Solve the identified problem based on the formulated methodology
2. Develop skills to analyze the problem related to area.
3. Continue the trials until the expected positive results are obtained
4. Preparation of preliminary report and discussion on test results
5. Arrive at conclusion and suggestion for future works.

Course Outcomes

On successful completion of the course, students will be able to

CO. No	Course Outcome	Bloom's Level
CO 1	Select different software/ computational/analytical tools.	Apply
CO 2	Design and develop an experimental set up/ equipment/test rig.	Creating
CO 3	Conduct tests on existing setup with equipments and draw logical results.	Analyzing
CO 4	Conclude the results with suitable remarks and suggestion for further extension of work	Evaluating
CO 5	Present the r topic of study to the engineering community.	Apply

Course Contents

The student should continue the phase I work on the selected topic as per the formulated methodology. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department. The students will be evaluated based on the report and the viva-voce examinal on by a panel of examiners including one external examiner.

Total : 360 Periods

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	3	3	3	3	3	3	3	3	3	3	3	3			
CO 2	3	3	3	3	3	3	3	3	3	3	3	3			
CO 3	3	3	3	3	3	3	3	3	3	3	3	3			
CO 4	3	3	3	3	3	3	3	3	3	3	3	3			
CO 5	3	3	3	3	3	3	3	3	3	3	3	3			
	3	High				2	Medium					1	Low		

	Continuous Assessment [50 marks]						Final Viva Voce Examination [50 marks]
	Review I [10]	Review II [10]	Review III [10]	Publication [10]	Report [10 Marks]	Total [50]	
Marks	100	100	100	10	10	50	50

CHAIRMAN, BOARD OF STUDIES

LIST OF ELECTIVES FOR M.E. INDUSTRIAL SAFETY ENGINEERING

SEMESTER I

Professional Elective I

20PISE01	Plant Layout and Materials Handling	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Production planning and control				

Course Objectives

The course is intended to

1. 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
2. To educate the students about the basic things of work conditions which include ventilation, comfort, lighting and its effect based on various nature of work.
3. To provide knowledge on effective and safe layout design of an industry.

Course Outcomes

On successful completion of the course the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	Identify equipment requirements for a specific process and for various locations and working conditions.	Understand
CO2.	Understand the improving safety on roads	Apply
CO3.	Design an efficient material handling system.	Understand
CO4.	Understand the difficulties during the design and implementation of the plant layout.	Apply
CO5.	To known mechanical handling equipment and safety operations	Understand

Course Contents:

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

References

1. "Encyclopedia of occupational safety and health", LO Publication,1998
2. "Accident prevention manual for industrial operations" N S C , Chicago, 1982.
3. Alexandrov M P "Material handling equipment" Mir Publishers, Moscow,1981
4. APPLE M , JAMES "Plant layout and material handling", 3rd edition, John Wiley and sons.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
Cos	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	-	-	-	-	-	-	-	-	1	2	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	1	2	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	1	2	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-	1	1	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	1	2	-	-
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Quiz	5	15
Understand	Tutorial Class / Assignment	5	
	Attendance	5	

CHAIRMAN - BOARD OF STUDIES

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE- I (7.5)	IAE - II (7.5)	IAE - III (10)	
Remember	10	10	10	20
Understand	30	30	30	60
Apply	10	10	10	20
Analyze				
Evaluate				
Create				

20PISE02	Work Study and Ergonomics	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Engineering Ergonomics Production planning and control				

Course Objectives

The course is intended to

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

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	To know in work procedure and applications in hazardous	Apply
CO2	Incorporate human factors in design of Personal protective equipment	Apply
CO3	Know the process safety	Apply
CO4	Understand the Material Handling and Transportation	Understand
CO5	Know the risk factors, guide lines for safe design of man machine systems considering human factors	Apply

Course contents:

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

References

1. Introduction to Work Study", ILO. Oxford and IBH Publishing company, Bombay 2015".
2. "Work Study", National Productivity Council. New Delhi, 1995.
3. W.Benjamin Neibal Motion and Time Study, 7thEdition, 1992
4. Hunter, Gomas, "Engineering Design for Safety", McGraw Hill Inc., 1992
5. Mundel, Motion and Time Study. 6th Edition, Allied Publishers, Madras 1989.
6. "Accident Prevention Manual for Industrial Operations". NSC Chicago. 1992
7. E.J.McCormick and M.S.Sanders "Human Factors in Engineering and Design", TMH New Delhi, 1992.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	2	-	-	-	-	-	-	-	2	2	-	-
CO2	3	3	3	2	-	-	-	-	-	-	-	2	2	-	-
CO3	3	3	3	3	3	-	-	-	-	-	-	2	2	-	-
CO4	3	3	3	2	-	-	-	-	-	-	-	2	2	-	-
CO5	3	3	3	3	-	-	-	-	-	-	-	2	2	-	-
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class / Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

CHAIRMAN - BOARD OF STUDIES

20PISE03	Dock Safety	L	T	P	C
		3	0	0	3

Nature of Course	Professional Elective
Pre requisites	Principle of management, Total quality management

Course Objectives

The course is intended to

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

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	This course would make the student to familiar of various operations carried out in a dock.	Apply
CO2	Students would know the different acts and rules for safe dock operations.	Apply
CO3	Students could be able to understand the operation of various types of material handling equipments.	Apply
CO4	Students would be prepared to response at the time of emergency in a dock	Understand
CO5	Students can recognize the various problems associated with the use of lifting equipments and in the storage yards.	Apply

Course contents:

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, 1986, 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 dockworkers

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 fort-lift trucks-pay loaders etc. Working with electricity and electrical management – Storage – types Hazardous cargo

UNITIII **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 trucksandothercontainers-testingandexaminationofliftingappliances-portainers-transtainers, top lift trucks – derricks in different rigging etc. Use and care of synthetic and natural fiber ropes – wire rope chains, different types of slings and loose gears

UNITIV **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 unshackling 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.

UNITV **Emergency action plan and dock workers (SHW)** **9**

Regulations1990 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

REFERENCES

1. Srinivasan "Harbour, Dock and TunnelEngineering", 25th Edition,2016
2. Safety and Health in Dock work, IInd Edition, ILO, 1992.
3. "Dock Safety" Thane Belapur Industries Association,Mumbai.
4. Bindra SP, "Course in Dock and HarbourEngineering"
5. Taylor D.A. "Introduction to MarineEngineering".

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

	POs												PSOs		
COs	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	2	-	-	-	-	-	-	-	2	2	-	-
CO2	3	3	3	2	-	-	-	-	-	-	-	2	2	-	-
CO3	3	3	3	3	3	-	-	-	-	-	-	2	2	-	-
CO4	3	3	3	2	-	-	-	-	-	-	-	2	2	-	-
CO5	3	3	3	3	-	-	-	-	-	-	-	2	2	-	-
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	15
Understand	Tutorial Class / Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Internal Assessment Examinations**			**Final Examination (60)**
	IAE – I (7.5)	**IAE – II (7.5)**	**IAE – III (10)**	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

CHAIRMAN-BOARD OF STUDIES

20PISE04	Human Factors in Engineering	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Professional ethics, Environmental engineering				

Course Objectives

The course is intended to

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

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Students can have the knowledge in work procedure and applications in hazardous workplaces.	Apply
CO2	To known human behavior	Apply
CO3	Students can design their own safety devices and equipment to reduce the accidents possibilities.	Apply
CO4	Students will be able to incorporate human factors in design of Personal protective equipment	Understand
CO5	They know the risk factors, guidelines for safe design of man machine systems considering human factors	Apply

Course contents:

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, and 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, behavioural 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 andSeated 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

UNITIV **Man - machine system and repetitive works andManualhandlingtask** 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

UNITV **Human skill and performance anddisplay, Controls andvirtual 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

References

1. Ergonomic design for organizational effectiveness, MichaelO'Neill, 1998
2. Human factors in engineering and design, MARKS.SANDERS, 1992
3. Introduction to Ergonomics R.S Bridger, Taylor and Francis
4. The Ergonomics manual, Dan McLeod, Philip Jacobs and NancyLarson

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
	POs												PSOs		
COs	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	2	-	-	-	-	-	-	-	2	2	-	-
CO2	3	3	3	2	-	-	-	-	-	-	-	2	2	-	-
CO3	3	3	3	3	3	-	-	-	-	-	-	2	2	-	-
CO4	3	3	3	2	-	-	-	-	-	-	-	2	2	-	-
CO5	3	3	3	3	-	-	-	-	-	-	-	2	2	-	-
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class / Assignment	5	
	Attendance	5	

CHAIRMAN BOARD OF STUDIES

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

LIST OF ELECTIVES FOR M.E. INDUSTRIAL SAFETY ENGINEERING

SEMESTER II

Professional Elective II & III

20PISE10	Transport Safety	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Highway Engineering				

Course Objectives

The course is intended to

1. 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.
2. To educate the reasons for the road accident and the roles and responsibilities of a safe Driver and the training needs of the driver.
3. To inculcate the culture of safe driving and fuel conservation along with knowing of basic traffic symbols followed throughout the highways.

Course Outcomes

On successful completion of the course the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Recognize various safety activities undertaken in transporting of hazardous goods	Understand
CO2	Understand the various symbols which are specific to the road safety	Apply
CO3	Able to reduce the accidents occurred in the roads.	Understand
CO4	Apply for the safe transportation of hazardous goods.	Apply
CO5	Creating TREM card and safe loading and unloading procedure.	Understand

Course Contents:

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.

UNITV **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

REFERENCES

1. Pasricha, "Road Safety guide for drivers of heavy vehicle" Nasha Publications. Mumbai, 1999.
2. Motor Vehicles Act, 1988, Government of India
3. Babkov, V.F. "Road Conditions and Traffic Safety" MIR Publications Moscow, 1986.
4. Popkes, C.A. "Traffic Control and Road Accident Prevention" Chapman and Hall Limited, 1985.
5. Kadiyali, "Traffic Engineering and Transport Planning" Khanna Publishers, New Delhi, 1993.
6. "Accident Prevention Manual for Industrial Operations", NSC Chicago, 1982.
7. K.W.Ogden, "Safer Roads – A guide to Road Safety Engineering"

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	-	-	-	-	-	-	-	-	1	2	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	1	2	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	1	2	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-	1	1	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	1	2	-	-
	3	High			2	Medium						1	Low		

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Quiz	5	15
Understand	Tutorial Class / Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination
	IAE- I (7.5)	IAE - II (7.5)	IAE - III (10)	(60)
Remember	10	10	10	20
Understand	30	30	30	60
Apply	10	10	10	20
Analyze				
Evaluate				
Create				

CHAIRMAN BOARD OF STUDIES

20PISE11	Fireworks Safety	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Industrial Engineering				

Course Objectives

The course is intended to

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

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	To gain knowledge of the chemical reactions of Fireworks chemicals	Apply
CO2	To know safe manufacture of Fireworks items	Apply
CO3	To improve process safety in fireworks industries	Apply
CO4	To analyze safety measures applicable against static electricity	Understand
CO5	To suggest safe practices for handling of fireworks in factories, transport and at user end	Apply

Course contents:

UNIT I **Properties of fireworks Chemicals** 9

Fire properties – potassium nitrate (KNO3), potassium chlorate (KClO3), barium nitrate (BaNC3) 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 arrester 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-hard locks 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 the 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

UNITV **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 scales-sales outlets-restrictions-role of fire service

TOTAL: **45 PERIODS**

References

1. "Proceedings of National seminar on Fireworks Safety-1999", MSEC-1999.
2. K.N.Ghosh, "Principles of fireworks", H.Khatsuria, Sivakasi, 1987.
3. A.Chelladurai, "Fireworks related accidents", McGraw-Hill Company, New York, 1950
4. J.A.Purkiss, "Fireworks-Fire Safety Engineering"
5. A.Chelladurai "Fireworks principles and practice"
6. A.Chelladurai, "History of the fireworks in India" Brock, "History of fireworks"

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
	POs												PSOs		
COs	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	2	-	-	-	-	-	-	-	2	2	-	-
CO2	3	3	3	2	-	-	-	-	-	-	-	2	2	-	-
CO3	3	3	3	3	3	-	-	-	-	-	-	2	2	-	-
CO4	3	3	3	2	-	-	-	-	-	-	-	2	2	-	-
CO5	3	3	3	3	-	-	-	-	-	-	-	2	2	-	-
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class / Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

CHAIRMAN - BOARD OF STUDIES

20PISE12	Safety in Construction	L	T	P	C
		3	0	0	3
Nature of course	Professional Elective				
Pre requisites	Construction Engineering				

Course Objectives

The course is intended to

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

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO 1	To identify the problems impeding safety in construction industries.	Understand
CO 2	To identify types and causes of accidents, and designing aids for safe construction.	Understand
CO 3	To understand the hazards during construction of power plant, road works and high rise buildings.	Understand
CO 4	To understand the safety procedure for working at heights during construction.	Understand
CO 5	To have knowledge in selection, operation, inspection and testing of various construction machinery. To list out construction regulations and Indian standards for construction and demolition work.	Apply

Course Contents

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 activities, preconstruction meeting - design aids for safe construction – permits to work – quality assurance in construction –compensation Recording of accidents and safety measures – Education andtraining

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-Application of drone in safety environment.

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.

UNITIV **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, compers, 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

UNITV **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

References

1. V.J.Davies and K.Thomasin "Construction Safety Hand Book" Thomas Telford Ltd., London, 1990.
2. JnathcalD.Sims. "Safety in the Budd Environment", London, 1968.
3. Hudson, R ,"Construction hazard and Safety Hand book Butler Worth's, 1985.
4. "Handbook of OSHA Construction safety and health ",charles C. Reese and James V.Edison

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	2	3	2										2	2	
CO 2	2	3	2										2	2	
CO 3	2	3	2										2	2	
CO 4	2	3	2										2	2	
CO 5	2	3	2										2	2	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class / Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	10	10	10	20
Understand	40	40	20	60
Apply			20	20
Analyze				
Evaluate				
Create				

CHAIRMAN-BOARD OF STUDIES

20PISE13	Nuclear Engineering and Safety	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Power Plant Engineering				

Course Objectives:

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

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Demonstrate nuclear fission and fusion process and their utilization.	Apply
CO2	UnderstandControl requirements of reactor control	Understand
CO3	Understand types of reactors and their Control requirements.	Understand
CO4	To known the current status of India in nuclear energy	Apply
CO5	Explain the safety design principles and safety regulation process.	Apply

Course Contents:

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 – on line 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 – liquic 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 – real 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

REFERENCES:

1. Sri Rami K, "Basic Nuclear Engineering" Wiley Eastern Ltd., New Delhi, 1990.

2. "Loss prevention in the process Industries" Frank P.Lees Butterworth-Hein-UK, 1990.
3. StermanU.S."Thermal and Nuclear Power Stations". MIR Publications, Moscow, 1966.
4. Loffress, R.L. "Nuclear Power Plant" Van Nostrand Publications. 1979
5. M.M.E.L.Wakil, "Nuclear Energy Conversion", International Text Book Co
6. M.M.E.L.Wakil, "Nuclear Power Engineering", International Text Book Co.
7. R.L.Murray, "Introduction to Nuclear Engineering". Prentice Hall. Third Edition.

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	-	-	-	-	-	-	-	-	3	-	-	2	-	-
CO2	3	-	-	-	-	-	-	-	-	3	-	-	2	-	-
CO3	3	-	-	-	-	-	-	-	-	3	-	-	2	-	-
CO4	3	-	-	-	-	-	-	-	-	3	-	-	2	-	-
CO5	2	-	-	-	-	-	-	-	-	2	-	-	2	-	-
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class / Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

CHAIRMAN, BOARD OF STUDIES

20PISE14	Safety in Textile Industry	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Textile technology and chemistry				

Course Objectives

The course is intended

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

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO 1	The student will able to know about the overall picture about the textile industries and its operations.	Analyze
CO 2	The student could understand the various concepts underlying in the processes involved in processing of fibres to yarn.	Analyze
CO 3	The student will be able to 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	Analyze
CO 4	The student could have the capability to handle the various health and welfare activities as per the Factories act and could implement statutory requirements.	Analyze
CO 5	The student could create of his own arrangement in designing various methods mean for mitigating the risk and able to guide his subordinates in executing the work safely	Analyze

Course Contents:

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 shuttles looms iii) knitting machines iv) non-wovens.

UNIT III **Textile Hazards II** 9

Scouring, bleaching, dyeing, printing, 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.

UNITV **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

References

1. 100 Textile fires – analysis, findings and recommendationsLPA
2. Groover and Henry DS, "Hand book of textile testing and quality control"
3. "Quality tolerances for water for textile industry", IS
4. Shenai, V.A. "A technology of textile processing", Vol.I, TextileFibres
5. Little, A.H.,"Water supplies and the treatment and disposal ofeffluent"

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	-	-	-	-	-	-	-	-	3	-	-	2	-	-
CO2	3	-	-	-	-	-	-	-	-	3	-	-	2	-	-
CO3	3	-	-	-	-	-	-	-	-	3	-	-	2	-	-
CO4	3	-	-	-	-	-	-	-	-	3	-	-	2	-	-
CO5	2	-	-	-	-	-	-	-	-	2	-	-	2	-	-
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class / Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

CHAIRMAN-BOARD OF STUDIES

Crucibles,Ovens, Foundry Health Hazards, Work Environment, Material Handling in Foundries, FoundryProduction 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 InInspection And Testing, Dynamic Balancing, Hydro Testing, Valves, Boiler Drums AndHeaders, Pressure Vessels, Air Leak Test, Steam Testing, Safety In Radiography, PersonalMonitoring Devices, Radiation Hazards, Engineering And Administrative Controls, IndianBoilers Regulation.

TOTAL: 45 PERIODS

Text books

1 Charles D. Reese, Occupational Health and Safety Management, CRC Press, 2003.
2 "Safety in Industry" N.V. KrishnanJaicoPublishery House, 1996.

Reference(s)

1. Philip E. Hagan, John Franklin Montgomery, James T. O'Reilly, Accident Prevention Manual NSC,Chicago, 2009
2. John V. Grimaldi and Rollin H. Simonds Safety Management by All India Travelers Book seller,New Delhi, 1969
3. John Davies, Alastair Ross, Brendan Wallace, Safety Management: A Qualitative SystemsApproach, CRC Press 2003.
4. Health and Safety in welding and Allied processes, welding nstitute, UK. High Tech. PublishingLtd., London,2002
5. Anil Mital Advances in Industrial Ergonomics and Safety Taylor and Francis Ltd. London, 1989.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2				1	1		1				2	3	
CO2	2	2				1	1		1				2	3	
CO3	3	2				1	1		1				2	3	
CO4	2	2	3			1	1		1				2	3	
CO5	2	3	1			1	1		1				2	3	
3	High					2	Medium					1	Low		

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Quiz	5	15
Understand	Tutorial Class / Assignment	5	
	Attendance	5	

20PISE21	Safety in Engineering Industry	L	T	P	C
		3	0	0	3
Nature of Course	ProfessionalElective				
Pre requisites	Environmental Safety				

Course Objectives

The course is intended

1. To provide knowledge on safe operation of metal and wood working machineries.
2. To introduce the principles of machine guarding.
3. To learn the safety methods in welding and gas cutting.
4. To provide knowledge safety in cold and hot working of metals.
5. To study safe methods in finishing, inspection and testing.

Course Outcomes

On successful completion of the course, students will be able to

CO No.	Course Outcome	Bloom's Level
CO1	Identify the safe operation of metal and wood working machineries.	Understand
CO2	Demonstrate the principles of machine guarding for relevant machines	Understand
CO3	Apply the safe methods in welding and gas cutting to prevent the hazards.	Apply
CO4	Elaborate the safe methods of cold and hot working of metals to minimize injury.	Apply
CO5	Apply the safe methods in finishing, inspection and testing to prevent accidents.	Apply

Course Contents

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, planning machine and grinding machines, CNC machines. Wood workingmachinery, types, safety principles, electrical guards, work area, material handling, inspection standards and codes- saws, types, hazards. Inspection of material handling equipments.

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, fixedguard, interlock guard, automatic guard, trip guard, electron eye, positional control guard, fixedguard fencing- guard construction- guard opening. Selection and suitability - lathe-drilling,boring-milling-grinding-shaping-sawing-shearing-presses-forge-sprockets wheels and chains-pulleys and belts-authorized entry to hazardous installationsbenefitsof good guarding systems.

UNIT III Safety in Welding and Gas Cutting 9

Gas welding and oxygen cutting, resistance welding, arc welding and cutting, commonhazards, personal protective equipment, training, safety precautions in brazing, soldering andmetalizing - explosive welding, selection, care and maintenance of the associated equipment andinstruments - 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 andcutting mechanism, hand or foot-operated presses, power press electric controls, power press setup and die removal, inspection and maintenance-metal sheers-press brakes - Hot workingsafety in forging, hot rolling mill operation, safe guards in hot rolling mills - hot bending ofpipes, hazards and control measures - Safety in Gas Furnace Operation, Cupola,

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE-I (7.5)	IAE - II (7.5)	IAE - III (10)	
Remember	10	10	10	20
Understand	30	30	30	60
Apply	10	10	10	20
Analyze				
Evaluate				
Create				

CHAIRMAN - BOARD OF STUDIES

20PISE22	Quality Engineering in ProductionSystems	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Total Quality Management				

Course Objectives

The course s intended

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

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Understand the loss function derivation and quality engineering in product design and development processes	Understand
CO2	Develop their knowledge in online quality control systems and process a control parameters.	Apply
CO3	The students will be able to improve the production and process diagnosis and production process	Understand
CO4	The students will be able to gain knowledge in ISO quality management systems.	Apply
CO5	The students will be able to list the roles and responsibilities of leaders.	Apply

Course Contents:

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 controller 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 dont's - readiness of organization – planning-management role- six sigma tools – sustaining six sigma

TOTAL: 45 PERIODS

Text 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: Breakthrough and Beyond", Tata McGraw-Hill, New Delhi, 2005.

Reference(s)

1. Pyzdek T and Berger R W,"Quality Engineering Handbook", Tata-McGraw Hill, New Delhi, 1996.
2. Taguchi G, Elsayed E A and Hsiang, T C.,"Quality Engineering in Production Systems", Mc-Graw-Hill Book company, Singapore, International Edition, 1989.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2			1	1		1				2	3	
CO2	2	2	2			1	1		1				2	3	
CO3	3	2	2			1	1		1				2	3	
CO4	2	2	2			1	1		1				2	3	
CO5	2	3	2			1	1		1				2	3	
3	High					2	Medium					1	Low		

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Quiz	5	15
Understand	Tutorial Class / Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination
	IAE - I (7.5)	IAE - II (7.5)	IAE - III (10)	(60)
Remember	10	10	10	20
Understand	30	30	30	60
Apply	10	10	10	20
Analyze				
Evaluate				
Create				

CHAIRMAN - BOARD OF STUDIES

20PISE23	Disaster Management	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Environmental Science				

Course Objectives

The course is intended

1. To demonstrate a critical understanding of key concepts in disaster risk reduction andhumanitarian response.
2. To critically evaluate disaster risk reduction and humanitarian response policy and practice frommultiple perspectives.
3. To develop an understanding of standards of humanitarian response and practical relevance inspecific types of disasters and conflict situations.
4. To critically understand the strengths and weaknesses of disaster management approaches,planning and programming in different countries, particularly their home country or thecountries they work in
5. To evaluate the risk assessmentin engineering industries.

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Understanding the key concepts in disaster risk reduction and humanitarian response	Understand
CO2	Understand about the repercussions of disasters and hazards.	Understand
CO3	Identify the disaster prone areas in India.	Understand
CO4	Understand the strengths and weaknesses of disaster management approaches.	Understand
CO5	Evaluate the risk assessment in engineering industries.	Apply

Course Contents:

UNIT I Introduction 9

Disaster: Definition, Factors and Significance; Difference between: Hazard and Disaster; Natural andMan-made Disasters: Difference, Nature, Types and Magnitude.

UNIT II Repercussions of Disasters and Hazards 9

Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters:Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides andAvalanches. Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks andSpills, Outbreaks of Disease and Epidemics, War and Conflicts.

UNIT III Disaster Prone Areas in India 9

Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides and Avalanches; AreasProne To Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post Disaster Diseasesand Epidemics.

UNIT IV Disaster Preparedness and Management 9

Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk:Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports:Governmental And Community Preparedness.

UNIT V Risk Assessment 9

Disaster Risk: Concept and Elements. Disaster Risk Reduction. Global and National Disaster RiskSituation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning,People's Participation in Risk Assessment Strategies for Survival.

TOTAL: 45 PERIODS

Text books

1. R. Nishith, Singh AK. "Disaster Management in India: Perspectives, issues and strategies ",New Royal book Company.
2. Sahni, PardeepEt.Al. (Eds.)." Disaster Mitigation Experiences and Reflections". Prentice HallOf India, New Delhi.

Reference(s)

1. Goel S. L., "Disaster Administration And Management Text And Case Studies" ,Deep &DeepPublication Pvt Ltd., New Delhi.
2. Model Curriculum of Engineering & Technology PG Courses [Volume-II]42].

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2				1		1				2	3	
CO2	2	2	3				1		1				2	3	
CO3	3	2	2				1		1				2	3	
CO4	2	3	2				1		1				2	3	
CO5	2	3	2				1		1				2	3	
3	High			2	Medium				1	Low					

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Quiz	5	15
Understand	Tutorial Class / Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE- I (7.5)	IAE - II (7.5)	IAE - III (10)	
Remember	10	10	10	20
Understand	30	30	30	60
Apply	10	10	10	20
Analyze				
Evaluate				
Create				

20PISE24	OHSAS 18000 and ISO 14000	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Total Quality Management				

Course Objectives

The course is intended

1. To provide the basic knowledge on Occupational Health and Safety Management System and Environmental Management System standards
2. To inculcate the knowledge on various terms and terminologies which are used in the Occupational Health, Safety and Environmental Management system.
3. To practice the quality certification implementation procedures.
4. To educate about the various steps to be taken for certification of Occupational Health and Safety Assessment Series (OHSAS) and ISO14001 (Environmental Management Systems) standards.
5. To impart knowledge on Environment Impact Assessment (EIA), Life Cycle Assessment of product and principles of Eco labelling.

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Remember the various standards which is meant mainly for maintaining the Health of the employee and for the maintenance of the Environment	Understand
CO2	Understand the basic difference between the ISO 9000 series and OHSAS 18001 and ISO 14000 standards and the various clauses which governs the system in maintaining the standard.	Understand
CO3	Practice the quality certification implementation procedures.	Apply
CO4	Provide the sufficient knowledge on various clauses and subsequent preparation of procedures and related documents and could be able to apply their knowledge in preparing the OHSAS manual for getting the certification from the external certifying agencies.	Analyze
CO5	Course could help the students in acquiring the knowledge on various standards and provide the skill in analyzing the various clauses and its suitability and applicability on the nature of organization	Apply

Course Contents:

UNIT I OHSAS Standard 9

Introduction – Development of OHSAS standard – Structure and features of OSHAS 18001 – Benefits of certification-certification procedure – OH and S management system elements, specification and scope - correspondence between OHSAS 18001, ISO 14001:1996 and ISO 9001:1994 – Guidelines (16002 2000) for implementing OHSAS 18001.

UNIT II OHSAS 18001 Policy and Planning 9

Developing OH and S policy– Guidelines – Developments - procedure - Content of OH and S policy – General principle strategy and planning, specific goals, compliance – methodology.

Planning – Guidelines, methodology steps developing action plan – Analysis and identify the priorities, objective and Targets, short term action plan, benefits and cost of each action, Development of action plan

UNIT III Implementation and Operation, Checking and Review 9

Guidelines for structure and Responsibilities, Top Management, middle level management, co-ordinator and employees - Developing procedures, identifying training needs, providing training, documentation of training. Training methodology consultation and communications.

Checking and Review; performance measurement and monitoring, Proactive and Reactive monitoring, measurement techniques, inspections measuring equipment - Accidents reports, Process and procedures, recording, investigation corrective action and follow up

UNIT IV ISO 14001 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 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.

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.

TOTAL: 45 PERIODS

Reference(s)

1. ISO 9000 to OHSAS 18001, Dr. K C Arora, S K Kataria and Sons, Delhi.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)																
COs	POs												PSOs			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO1	3	2	2			1	1		1				2	3		
CO2	2	2	2			1	1		1				2	3		
CO3	3	2	2			1	1		1				2	3		
CO4	2	2	2			1	1		1				2	3		
CO5	2	3	2			1	1		1				2	3		
3	High					2	Medium					1	Low			

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Quiz	5	15
Understand	Tutorial Class / Assignment	5	
	Attendance	5	

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Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination
	IAE-I (7.5)	IAE - II (7.5)	IAE - III (10)	(60)
Remember	10	10	10	20
Understand	30	30	30	60
Apply	10	10	10	20
Analyze				
Evaluate				
Create				

20PISE25	Artificial Intelligence and Expert Systems	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Basic Computer Science				

Course Objectives

The course is intended

1. To know the fundamental concepts and applications of Artificial intelligence.
2. To familiarize with cognitive technology.
3. To know the methods for knowledge engineering.
4. To understand the various features of expert system.
5. To have knowledge about Neural Network and corresponding selection of parameters.

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Understand the fundamental concepts and applications of Artificial intelligence	Understand
CO2	Apply and familiarize with cognitive technology	Apply
CO3	Understand the methods for knowledge engineering	Understand
CO4	To list out the applications of expert system To develop a simple expert system related to industrial safety Engineering.	Apply
CO5	To apply neural network concepts in safety engineering discipline	Apply

Course Contents:

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 9

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 9

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

TOTAL: 45 PERIODS

Text books

1. Charniak. 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.

Reference(s)

1. Elaine R., and Kevir, "Artificial Intelligence", 2nd Edition, Tata McGraw Hill, 1994.
2. Nilsson, N.J., "Principles of AI", Narosa Publishing House, 1990
3. Rajasekaran S and VijayalakshmiPai, G A, "Neural Networks, Fuzzy Logic and Genetic Algorithms – Synthesis and Applications", PHI, 2003.
4. Schalkoff, R.J., "Artificial Intelligence" – An Engineering Approach", McGraw Hill International Edition, Singapore, 1992
5. Winston, P H. "Artificial Intelligence", Addison Wesley, 1993

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2				1	1		1				2	3	
CO2	3	2				1	1		1				2	3	
CO3	3	2				1	1		1				2	3	
CO4	2	2	2			1	1		1				2	3	
CO5	2	3	2			1	1		1				2	3	
3	High					2	Medium					1	Low		

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Quiz	5	15
Understand	Tutorial Class / Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE- I (7.5)	IAE - II (7.5)	IAE - III (10)	
Remember	10	10	10	20
Understand	30	30	30	60
Apply	10	10	10	20
Analyze				
Evaluate				
Create				

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20PISE26	Research Methodology	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Basic Research Knowledge				

Course Objectives

The course is intended

1. To introduce the basics of research methodology.
2. To know the sampling methods used in research methodology.
3. To know the methods of data collection techniques.
4. To understand aboutmultivariate statistical techniques.
5. To have knowledge of writing research report.

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Understand the fundamental of research methodology	Understand
CO2	Apply sampling methods used in research methodology	Apply
CO3	Apply various data collection techniques in research field	Apply
CO4	Evaluate research by using multivariate statistical techniques	Analyze
CO5	To apply knowledge on writing research report	Apply

Course Contents:

UNIT I Introductionto Research 9

The hallmarks of scientific research - Building blocks of science in research – Concept of Applied and Basic research – Quantitative and Qualitative Research Techniques –Need for theoretical frame work – hypothesis development – Hypothesis testing with quantitative data Research design - Purpose of the study: Exploratory Descriptive, Hypothesis Testing

UNIT II Experimental Design 9

Laboratory and the Field Experiment – Internal and External Validity – Factors affecting internal validity. Measurement of variables Scales and measurements of variables. Developing scales – Rating scale and attitudinal scales – Validity testing of scales –Reliability concept in scales being developed – Stability Measures.

UNIT III Data Collection Methods 9

Interviewing, Questionnaires, etc. Secondary sources of data collection. Guidelines for Questionnaire Design – Electronic Questionnaire Design and Surveys. Special Data Sources Focus Groups. Static and Dynamic panels. Review of Advantages and Disadvantages of various Data-Collection Methods and their utility. Sampling Techniques – Probabilistic and non-probabilistic samples. Issues of Precision and Confidence in determining Sample Size. Hypothesis testing, Determination of Optimalsample size.

UNIT IV Multivariate Statistical Techniques 9

Data Analysis – Factor Analysis – Cluster Analysis – Discriminant Analysis – Multiple Regression and Correlation – Canonical Correlation Application of Statistical (SPSS) Software Package in Research.

UNIT V Research Report 9

Purpose of the written report – Concept of audience – Basics of written reports. Integral parts of a report – Title of a

report, Table of contents, Abstract, Synopsis, Introduction, Body of a report – Experimental, Results and Discussion – Recommendations and Implementation section – Conclusions and Scope for future work.

TOTAL: 45 PERIODS

Text books

1. C.R.Kothari, Research Methodology, WishvaPrakashan, New Delhi, 2001.
2. Donald H McBurney, Research Methods, Thomson Asia Pvt. Ltd. Singapore, 2002.

Reference(s)

1. Donald R. Cooper and Pamela S. Schindler, Business Research Methods, Tata McGraw- Hill Publishing Company Limited, New Delhi 2000
2. G.W Tirehurst and A J Veal Business Research Methods, Longman, 1999
3. Ranjit Kumar Research Methodology Sage Publications, London, New Delhi, 1999
4. Raymond-Alain Thietart, et.al. Doing Management Research, Sage Publications, London, 1999
5. Uma Sekaran, Research Methods for Business, John Wiley and Sons Inc , New York, 2000

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	2	1			2	1		1				2	3	
CO2	1	2	1			2	1		1				2	3	
CO3	3	2				1	1		1				2	3	
CO4	2	2	2			1	1		1				2	3	
CO5	2	3	2				1		1				2	3	
3	High					2	Medium					1	Low		

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Quiz	5	15
Understand	Tutorial Class / Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination
	IAE- I (7.5)	IAE - II (7.5)	IAE - III (10)	(60)
Remember	10	10	10	20
Understand	30	30	30	60
Apply	10	10	10	20
Analyze				
Evaluate				
Create				

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