KNOWLEDGE INSTITUTE OF TECHNOLOGY, SALEM

(An Autonomous Institution)

Approved by AICTE, Affiliated to Anna University, Chennai.

Accredited by NBA (CSE, ECE, EEE & MECH), Accredited by NAAC with 'A' Grade

KIOT Campus, Kakapalayam – 637 504. Salem Dt., Tamil Nadu, India.

M.E. / M.Tech. Regulations 2023

M.E. – Industrial Safety Engineering

Curriculum and Syllabi

(For the Students Admitted from the Academic Year 2023 – 2024 onwards)

Version: 1.0

CHAIRPERSON
Board of Studies
Faculty of Mechanical Engineering
Knowledge Institute of Technology
KIOT Campus, Kakapalayam
Salem-637 504

	KNOWLEDGE INSTITUTE OF TECHNOLOGY (AUTONOMOUS), SALEM -637504
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	Website: www.kiot.ac.in

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M.E. / M.Tech. REGULATIONS 2023 (R 2023)

CHOICE BASED CREDIT SYSTEM AND OUTCOME BASED EDUCATION

M.E. – INDISTRIAL SAFETY ENGINEERING

VISION OF THE INSTITUTE
To be a world class institution to impart value and need based professional education to the aspiring youth and carving them into disciplined world class professional who have the quest for excellence, achievement orientation and social responsibilities.

MISSION OF THE INSTITUTE	
A	To promote academic growth by offering state-of-art undergraduate, postgraduate and doctoral programs and to generate new knowledge by engaging in cutting – edge research
B	To nurture talent, innovation, entrepreneurship, all-round personality and value system among the students and to foster competitiveness among students
C	To undertake collaborative projects which offer opportunities for long-term interaction with academia and industry
D	To pursue global standards of excellence in all our endeavors namely teaching, research, consultancy, continuing education and support functions

VISION OF THE DEPARTMENT
To create competent and industry relevant Mechanical Engineers with professional and social values to meet global challenges.

MISSION OF THE DEPARTMENT	
M1	Enabling environment for effective teaching - learning and research to meet global challenges.
M2	Motivating students to pursue higher education and to excel in competitive examinations and entrepreneurship.
M3	Establish a continuous Industry Institute Interaction to make the students employable.
M4	Inculcate the students leadership quality with ethical values and spirit of team work.

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PROGRAM EDUCATIONAL OBJECTIVES (PEOs)	
PEO 1	Possess a mastery of Health safety and environment awareness and safety management skills, to reach higher levels in their profession.
PEO 2	Proficient safety Engineer rendering professional expertise to the industrial and societal needs at national and global level subject to legal requirements.
PEO 3	Well communicate the information on Health safety and environment facilitating collaboration with experts across various disciplines so as to create and execute safe methodology in complex engineering activities.
PEO 4	Demonstrate professional and ethical attitude with awareness of current legal issues by rendering expertise to wide range of industries.

PROGRAM OUTCOMES (POs)	
Graduates Engineering will be able to:	
PO1	An ability to independently carry out research /investigation and development work to solve practical problems
PO2	An ability to write and present a substantial technical report/document
PO3	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program
PO4	Create, select, learn and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling to safety, health and environmental engineering activities with an understanding of the limitations.
PO5	Demonstrate the societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to occupational health and safety practices.
PO6	Recognise the need for, and have the preparation and ability to engage in life-long learning independently, with a high level of enthusiasm and commitment to improve knowledge and competence continuously

KNOWLEDGE INSTITUTE OF TECHNOLOGY (AUTONOMOUS), SALEM - 637504												
M.E. INDUSTRIAL SAFETY ENGINEERING									Version : 1.0			
Courses of Study and Scheme of Assessment (Regulations 2023)									Date : 09.09.23			
S. No.	Course Code	Course Title	Periods / Week						Maximum Marks			
			CAT	CP	L	T	P	C	IA	ESE	Total	
SEMESTER I												
-	-	Induction Programme	-	-	-	-	-	-	-	-	-	
	THEORY											
1	ME23MA101	Probability and Statistical Methods	FC	4	3	1	0	4	40	60	100	
2	ME23IS301	Principles of Safety Management	PC	3	3	0	0	3	40	60	100	
3	ME23IS302	Environmental Safety	PC	3	3	0	0	3	40	60	100	
4	ME23IS303	Occupational Health and Industrial Hygiene	PC	3	3	0	0	3	40	60	100	
5	ME23IS304	Industrial Safety, Health and Environment Acts	PC	3	3	0	0	3	40	60	100	
6	ME23IS305	Fire Engineering and Explosion Control	PC	3	3	0	0	3	40	60	100	
7	ME23RM201	Research Methodology and IPR	RM	3	2	1	0	3	40	60	100	
8	ME23AC7XX	Audit Course-I*	AC	2	2	0	0	0	100	-	100	
	PRACTICAL											
9	ME23IS306	Industrial Safety and Simulation Laboratory	PC	2	0	0	2	1	60	40	100	
	EMPLOYABILITY ENHANCEMENT											
10	ME23PT801	Technical Seminar/Case Study Presentation	EEC	2	0	0	2	0	100	-	100	
Total				28	22	2	4	23	540	460	1000	
SEMESTER II												
	THEORY											
1	ME23IS307	System Simulation and Hazard Analysis	PC	4	4	0	0	4	40	60	100	
2	ME23IS308	Safety in Process Industries	PC	3	3	0	0	3	40	60	100	
3	ME23IS4XX	Professional Elective-I	PE	3	3	0	0	3	40	60	100	
4	ME23IS4XX	Professional Elective-II	PE	3	3	0	0	3	40	60	100	
5	ME23XX5XX	Open Elective-I	OE	3	3	0	0	3	40	60	100	
6	ME23MC701	Universal Human Values and Ethics	MC	3	2	1	0	3	40	60	100	
7	ME23AC7XX	Audit Course-II*	AC	2	2	0	0	0	100	-	100	
	EMPLOYABILITY ENHANCEMENT											
8.	ME23PT802	Research Paper Review and Presentation	EEC	2	0	0	2	1	100	-	100	
9.	ME23PT803	Industrial Safety Assessment – Internship	EEC	4	0	0	4	2	100	-	100	
Total				27	20	1	6	22	540	360	900	

*indicates the course is optional

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M.E. INDUSTRIAL SAFETY ENGINEERING											Version : 1.0	
Courses of Study and Scheme of Assessment (Regulations 2023)											Date : 09.09.23	
S. No.	Course Code	Course Title	Periods / Week						Maximum Marks			
			CAT	CP	L	T	P	C	IA	ESE	Total	
SEMESTER III												
	THEORY											
1	ME23IS309	Electrical Safety	PC	3	3	0	0	3	40	60	100	
2	ME23IS4XX	Professional Elective-III	PE	3	3	0	0	3	40	60	100	
3	ME23IS4XX	Professional Elective- IV	PE	3	3	0	0	3	40	60	100	
4	ME23XX5XX	Open Elective-II	OE	3	3	0	0	3	40	60	100	
	PRACTICAL											
5	ME23IS601	Project Work – Phase I	PW	12	0	0	12	6	60	40	100	
		Total		**24**	**12**	**0**	**12**	**18**	**220**	**280**	**500**	
SEMESTER IV												
	PRACTICAL											
1	ME23IS602	Project Work – Phase II	PW	24	0	0	24	12	60	40	100	
		Total		**24**	**0**	**0**	**24**	**12**	**60**	**40**	**100**	
Total Number of Credits: 75												

PROFESSIONAL ELECTIVES											
SEMESTER II (Professional Electives - I & II)											
S. No.	Course Code	Course Title	Periods / Week						Maximum Marks		
			CAT	CP	L	T	P	C	IA	ESE	Total
1.	ME23IS401	Plant Layout and Material Handling	PE	3	3	0	0	3	40	60	100
2.	ME23IS402	Work Study and Ergonomics	PE	3	3	0	0	3	40	60	100
3.	ME23IS403	Human Factors in Engineering	PE	3	3	0	0	3	40	60	100
4.	ME23IS404	Maintenance Engineering	PE	3	3	0	0	3	40	60	100
5.	ME23IS405	Optimization Techniques	PE	3	3	0	0	3	40	60	100
6.	ME23IS406	Transport Safety	PE	3	3	0	0	3	40	60	100
7.	ME23IS407	Fireworks Safety	PE	3	3	0	0	3	40	60	100
8.	ME23IS408	Nuclear Engineering and Safety	PE	3	3	0	0	3	40	60	100
9.	ME23IS409	Safety in construction	PE	3	3	0	0	3	40	60	100

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PROFESSIONAL ELECTIVES											
SEMESTER III (Professional Electives - III & IV)											
1	ME23IS410	Safety in Textile Industry	PE	3	3	0	0	3	40	60	100
2	ME23IS411	Safety in Mines	PE	3	3	0	0	3	40	60	100
3	ME23IS412	Dock Safety	PE	3	3	0	0	3	40	60	100
4	ME23IS413	Safety in Engineering Industry	PE	3	3	0	0	3	40	60	100
5	ME23IS414	Quality Engineering in Production Systems	PE	3	3	0	0	3	40	60	100
6	ME23IS415	ISO 45001 and ISO 14000	PE	3	3	0	0	3	40	60	100
7	ME23IS416	Artificial Intelligence and Data Analytics	PE	3	3	0	0	3	40	60	100
8	ME23IS417	Design of Experiments	PE	3	3	0	0	3	40	60	100
9	ME23IS418	Reliability Engineering	PE	3	3	0	0	3	40	60	100
10	ME23IS419	Logistics and Distribution Management	PE	3	3	0	0	3	40	60	100

OPEN ELECTIVES											
S. No.	Course Code	Course Title	Periods / Week						Maximum Marks		
			CAT	CP	L	T	P	C	IA	ESE	Total
Except M.E. Computer Science and Engineering											
1.	ME23CP501 / ME23CP310	Security Practices	OE	3	3	0	0	3	40	60	100
2.	ME23CP502 / ME23CP401	Cloud Computing Technologies	OE	3	3	0	0	3	40	60	100
3.	ME23CP503 / ME23CP415	Block chain Technologies	OE	3	3	0	0	3	40	60	100
4.	ME23CP504 / ME23CP414	Deep Learning	OE	3	3	0	0	3	40	60	100
5.	ME23CP505	Design Thinking	OE	3	3	0	0	3	40	60	100
6.	ME23CP506	Principles of Multimedia	OE	3	3	0	0	3	40	60	100
Except M.E. Industrial Safety Engineering											
7.	ME23IS501 / ME23IS302	Environmental Safety	OE	3	3	0	0	3	40	60	100
8.	ME23IS502 / ME23IS309	Electrical safety	OE	3	3	0	0	3	40	60	100
9.	ME23IS503 / ME23IS413	Safety in Engineering Industry	OE	3	3	0	0	3	40	60	100
10.	ME23IS504	Design of Experiments	OE	3	3	0	0	3	40	60	100
11.	ME23IS505	Circular Economy	OE	3	3	0	0	3	40	60	100
Except M.E. Embedded System Technologies											
12.	ME23ET501 / ME23ET310	IoT for Smart Systems	OE	3	3	0	0	3	40	60	100
13.	ME23ET502 / ME23ET408	Machine Learning and Deep Learning	OE	3	3	0	0	3	40	60	100
14.	ME23ET503	Renewable Energy Technology	OE	3	3	0	0	3	40	60	100
15.	ME23ET504 / ME23ET423	Smart Grid	OE	3	3	0	0	3	40	60	100

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Except M.E. VLSI Design												
16.	ME23VL501	Big Data Analytics	OE	3	3	0	0	3	40	60	100
17.	ME23VL502	Internet of Things and Cloud	OE	3	3	0	0	3	40	60	100
18.	ME23VL503	Medical Robotics	OE	3	3	0	0	3	40	60	100
19.	ME23VL504	Embedded Automation	OE	3	3	0	0	3	40	60	100

AUDIT COURSES/MANDATORY COURSES

AUDIT COURSES (Optional Courses)

S. No.	Course Code	Course Title	Periods / Week						Maximum Marks		
			CAT	CP	L	T	P	C	IA	ESE	Total
1	ME23AC701	English for Research Paper Writing	AC	2	2	0	0	0	100	-	100
2	ME23AC702	Disaster Management	AC	2	2	0	0	0	100	-	100
3	ME23AC703	Constitution of India	AC	2	2	0	0	0	100	-	100
4	ME23AC704	நற்றமிழ் இலக்கியம் / Classical Tamil literature	AC	2	2	0	0	0	100	-	100
MANDATORY COURSES											
1	ME23MC701	Universal Human Values and Ethics	MC	3	2	1	0	3	40	60	100

Special Electives (For Ph.D Scholars)

S. No.	Course Code	Course Title	Periods / Week						Maximum Marks		
			CAT	CP	L	T	P	C	IA	ESE	Total
1	ME23IS901	Design of Heat Exchangers	SE	3	2	1	0	3	40	60	100
2	ME23IS902	Advanced Materials Technology	SE	3	2	1	0	3	40	60	100
3	ME23IS903	Energy Efficient Buildings	SE	3	2	1	0	3	40	60	100
4	ME23IS904	Advanced Energy Storage Technologies	SE	3	2	1	0	3	40	60	100
5	ME23IS905	Energy Conversion Techniques	SE	3	2	1	0	3	40	60	100
6	ME23IS906	Material Testing and Characterization Techniques	SE	3	2	1	0	3	40	60	100
7	ME23IS907	Tribology in Design	SE	3	2	1	0	3	40	60	100
8	ME23IS908	Measurement and Control for Energy Systems	SE	3	2	1	0	3	40	60	100
9	ME23IS909	Computational Fluid Dynamics	SE	3	2	1	0	3	40	60	100

Special electives for Ph.D. scholars are determined by the recommendations of the Doctoral Committee for each individual scholar. The syllabus for these electives is also provided by the Doctoral Committee members, subject to approval by the Internal Board of Studies (BOS), and subsequently ratified in the next BOS meeting.

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SEMESTER WISE CREDITS DISTRIBUTION

SUMMARY							
S.No.	Course Category	Credits per Semester				Credits	Credit %
		I	II	III	IV		
1.	FC	4	-	-	-	4	5.32
2.	RM	3	-	-	-	3	4
3.	PC	16	7	3	-	26	34.68
4	PE	-	6	6	-	12	15
5.	OE	-	3	3	-	6	8
6.	PW	-	-	6	12	18	24
7.	AC/MC	✓	3	-	-	3	4
8.	EEC	-	3	-	-	3	4
	Total	**23**	**22**	**18**	**12**	**75**	**100**

NOMENCLATURE

CAT	Category of Course	**FC**	Foundation Courses	**AC/ MC**	Audit Courses / Mandatory Courses
CP	Contact Periods	**RM**	Research Methodology & IPR	**EEC**	Employability Enhancement Courses
L	Lecture Periods	**PC**	Professional Core Courses	**IA**	Internal Assessment
T	Tutorial Periods	**PE**	Professional Elective Courses	**ESE**	End Semester Examination
P	Laboratory Periods	**OE**	Open Elective Courses		
C	Credits	**PW**	Project Work Courses		

ME23IS309	ELECTRICAL SAFETY	Version: 1.0				
Programme & Branch	M.E. INDUSTRIAL SAFETY ENGINEERING	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

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.

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's-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 arcignition energy-national electrical safety code ANSI.

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

UNIT– III	PROTECTION SYSTEMS	9

Fuse, circuit breakers and overload relays – protection against over voltage and under voltage– safe limits of amperage – voltage –safe distance from lines-capacity and protection of conductor-joints-and connections, overload and short circuit protection-no load protection-earth fault protection.

FRLS insulation-insulation and continuity test-system grounding-equipment grounding-earth leakage circuit breaker (ELCB)-cable wires-maintenance of ground-ground fault circuit interrupter-use of low voltage-electrical guards-Personal protective equipment– safety in handling hand held electrical appliances tools and medical equipment's.

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		

OPEN ENDED PROBLEMS / QUESTIONS

Course specific open ended problems will be solved during the classroom teaching. Such problems can be given as assignments and evaluated as internal assessment only and not for the end semester examination

COURSE OUTCOMES: Upon completion of this course the students will be able to:		**BLOOM'S Taxonomy**
CO1	Summarize the basic concepts in electrical circuit and its operations.	L2 - Understand
CO2	Outline the electrical hazards in an Industries.	L2 - Understand
CO3	To choose various protection systems from different electrical operations.	L3 - Apply
CO4	Apply the knowledge for safe selection, installation, operation and maintenance of electrical systems.	L3 - Apply
CO5	Summarize the different hazardous zones in an Industries	L2 - Understand

REFERENCE BOOKS:

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

VIDEO REFERENCES:

1.	https://www.youtube.com/watch?v=tt80OiM1N9s
2.	https://www.youtube.com/watch?v=MEk68_veQYM

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WEB REFERENCES:	
1.	https://www.osha.gov/electrical#:~:text=Electricity%20has%20long%20been%20recognized,electrocution%2C%20fires%2C%20and%20explosions.
2.	https://www.ncbi.nlm.nih.gov/books/NBK580528/
ONLINE COURSES:	
1.	https://onlinecourses.swayam2.ac.in/nou20_cs08/preview
2.	https://www.tcsion.com/courses/ve/safety/siemens/electrical-safety-online-course-and-training/

Mapping of COs with POs						
COs	**POs**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1		2	3			2
CO2		2	3			
CO3		2	3	1		
CO4	1	2	3	1		1
CO5	2	2	3	1	1	1
Average	1.5	2	3	1	1	1.33
1–Low, 2 –Medium, 3–High.						

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ME23IS601	PROJECT WORK – PHASE I	Version: 1.0				
Programme & Branch	M.E. INDUSTRIAL SAFETY ENGINEERING	CP	L	T	P	C
		12	0	0	12	6

Course Objectives:

1	To identify relevant research problems by searching academic databases and literature.
2	To design and conduct preliminary studies to explore identified problems.
3	To compile and present research findings effectively.

COURSE CONTENT:

The Student will identify and select a problem based on comprehensive literature survey. The student should submit a proposal and get it approved by the Head of the department.

Three reviews will be conducted by Project review committee. Students will be evaluated by the committee during the review and suggestions will be offered by members.

The report for PHASE -I should be submitted by the students at the end of course

Course Outcomes: Upon completion of this course the students will be able to:		BLOOM'S Taxonomy
CO1	Identify the research problem.	L3 - Apply
CO2	Collect, analyze the relevant literature and finalize the research problem.	L4 - Analyze
CO3	Design the experiment, conduct preliminary experiment, analyze the data and conclude.	L4 - Analyze
CO4	Prepare project report and present.	L5 - Evaluate

Mapping of COs with POs

COs	POs					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	3	3	1		
CO2	3	3	3	2	2	
CO3	3	3	3	3	2	
CO4		3				1
Average	2	3	3	2	2	1

1–Low, 2 –Medium, 3–High.

ME23IS602	PROJECT WORK – PHASE II	Version: 1.0				
Programme & Branch	M.E. INDUSTRIAL SAFETY ENGINEERING	CP	L	T	P	C
		24	0	0	24	12

Course Objectives:

1	To develop the skill of students for analysing safety problems to control the hazard.
2	To expose the students to identify and evaluate the hazards in an industry under study.
3	To expose the students to assess the Compliance level of safety norms and procedures.

COURSE CONTENT:

It is the continuation of Phase I project Three reviews will conducted by Project review committee. Students will be evaluated by the committee during the review and suggestions will be offered by members.

At least one paper should be published by the student in international / national conference.

The report should be submitted by the students at the end of course.

Course Outcomes: Upon completion of this course the students will be able to:		**BLOOM'S Taxonomy**
CO1	Conduct hazard analysis and suggest solutions to control risks.	L4 - Analyze
CO2	Outline the norms and standards for an Industry.	L2 - Understand
CO3	Recognize hazards and assess or evaluate them by using various techniques.	L5 - Evaluate
CO4	Choose suitable measures to prevent hazards by referring the literature and comprehensive hazard analysis.	L3 – Apply
CO5	Prepare project report and present	L5 - Evaluate

Mapping of COs with POs

COs	POs					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	3	3	3		
CO2		3	3			
CO3	3	3	3	2		
CO4	3	3	3	3	2	
CO5		3			2	1
Average	2.66	3	3	2.66	2	1
1–Low, 2 –Medium, 3–High.						

ME23IS410	SAFETY IN TEXTILE INDUSTRY	Version: 1.0				
Programme & Branch	M.E. INDUSTRIAL SAFETY ENGINEERING	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

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 fibers.
3	To understand the various hazards of processing textile fibers by using various activities.
4	To inculcate the knowledge on health and welfare activities specific to the Textile industries as per the Factories Act.
5	To provide the student about the basic knowledge about the textile industries and its products by using various machineries.

UNIT–I	INTRODUCTION	9

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

UNIT–II	TEXTILE HAZARDS I	9

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

UNIT– III	TEXTILE HAZARDS II	9

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

UNIT – IV	HEALTH AND WELFARE	9

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

UNIT–V	SAFETY STATUS	9

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

TOTAL: 45 PERIODS

OPEN ENDED PROBLEMS / QUESTIONS

Course specific open ended problems will be solved during the classroom teaching. Such problems can be given as assignments and evaluated as internal assessment only and not for the end semester examination.

Course Outcomes: Upon completion of this course the students will be able to:		BLOOM'S Taxonomy
CO1	Identify potential accident hazards associated with various stages of textile manufacturing processes.	L3 - Apply
CO2	Apply Safety Precautions in Loom Operations.	L3 - Apply
CO3	Summarize the specific accident hazards present in loom shed environments, including hazards associated with both shuttle looms.	L2 - Understand
CO4	Demonstrate control measures to mitigate health hazards in the textile industry and use of personal protective equipment (PPE)	L2 - Understand
CO5	Apply the knowledge of waste disposal in the textile industry, including solid waste, hazardous waste, and wastewater sludge, in accordance with regulatory requirements.	L3 - Apply

REFERENCE BOOKS:

1. 100 Textile fires – analysis, findings and recommendations LPA.
2. Groover and Henry DS, "Hand book of textile testing and quality control".
3. "Quality tolerances for water for textile industry", BIS.
4. Shenai, V.A. "A technology of textile processing", Vol.I, Textile Fibres.
5. Little, A.H.,"Water supplies and the treatment and disposal of effluent".
6. "Safety in Textile Industry" Thane Belapur Industries Association, Mumbai.

VIDEO REFERENCES:

1. https://www.youtube.com/watch?v=j-XNzBUKOoE
2. https://www.youtube.com/watch?v=XADuwFDOyz0&pp=ygUPaGF6YXJkIGFuYWx5c2lz

WEB REFERENCES:

1. https://www.graphicproducts.com/articles/hazard-analysis-risk-assessment/
2. https://www.aiche.org/ccps/introduction-hazard-identification-and-risk-analysis

ONLINE COURSES:

1. https://onlinecourses.nptel.ac.in/noc23_mg98/preview?user_email=tdmech@kiot.ac.in
2. https://onlinecourses.swayam2.ac.in/nou23_ge81/preview

Mapping of COs with POs

COs	POs					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1		1	3		2	
CO2		2	3	3		2
CO3		1	3			
CO4		2	3	2		
CO5		1	2		2	
Average		1.4	2.8	2.5	2	2

1–Low, 2 –Medium, 3–High.

ME23IS411	SAFETY IN MINES	Version: 1.0				
Programme & Branch	M.E. INDUSTRIAL SAFETY ENGINEERING	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1	To provide in depth knowledge on Safety of mines of various types.
2	To understand the different types of mines and risks involved in the mining operations.
3	To gain knowledge on types of accidents in mines and how to manage during accidents.
4	To assess the Hazardous nature of mining activities and develop a safety system to reduce the risk
5	To implement the Emergency preparedness in the working environment of mines and to plan for the disaster management.

UNIT–I	OPEN CAST MINES	9

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

UNIT–II	UNDERGROUND MINES	9

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

UNIT– III	TUNNELLING	9

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

UNIT – IV	RISK ASSESSMENT	9

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

UNIT–V	ACCIDENT ANALYSIS AND MANAGEMENT	9

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

Total : 45 PERIODS

OPEN ENDED PROBLEMS / QUESTIONS		
Course specific open ended problems will be solved during the classroom teaching. Such problems can be given as assignments and evaluated as internal assessment only and not for the end semester examination		
COURSE OUTCOMES: **Upon completion of this course the students will be able to:**		**BLOOM'S Taxonomy**
CO1	Interpret the concept of safety aspects in the miningindustries.	L2 - Understand
CO2	Summarize the hazards and control measure in an underground mining activity	L2 - Understand
CO3	Summarize the hazards and control measure of a tunneling activity	L2 - Understand
CO4	To assess the severity of risk in mines to take the required remedial action.	L5 - Evaluate
CO5	Utilize the risk assessment techniques, Disaster management and emergency preparedness to prevent accidents.	L3 - Apply
REFERENCE BOOKS:		
1.	DGMS Circulars-Ministry of Labour, Government of India press, OR Lovely Prakashan - DHANBAD, 2002.	
2.	Kejiriwal, B.K. Safety in Mines, Gyan Prakashan, Dhanbad, 2001.	
3.	"Mine Health and Safety Management", Michael Karmis ed., SME, Littleton, Co.2001.	
VIDEO REFERENCES:		
1.	https://www.youtube.com/watch?v=fEFZw7bXSmk&list=PLB3JRydr2LBWmZ0n54wDrJHqzlsaf4bF0	
2.	https://www.youtube.com/watch?v=VE_xMqMp0k&list=PL8sSTcOtMi6a5saSaUnpQjlFtjQ3qw2lt	
WEB REFERENCES:		
1.	https://www.dgms.gov.in/	
2.	https://coal.gov.in/sites/default/files/2020-09/Chapter11-en.pdf	
ONLINE COURSES:		
1.	https://onlinecourses.nptel.ac.in/noc22_mm47/preview	
2.	https://www.classcentral.com/course/mining-the-university-of-queensland-health-safety-22045	

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Mapping of COs with POs						
COs	POs					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	2	3			
CO2	1	2	3			
CO3	1	2	3	1		
CO4	2	2	3			1
CO5	2	2	3	1	1	1
Average	1.4	2	3	1	1	1
1–Low, 2 –Medium, 3–High.						

ME23IS412	DOCK SAFETY	Version: 1.0				
Programme & Branch	M.E. INDUSTRIAL SAFETY ENGINEERING	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1	To understand safety legislation related to dock activities 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.

UNIT–I	HISTORY OF SAFETY LEGISLATION	9

History of dock safety statues in India-background of present dock safety statues- dock workers (safety, health and welfare) act 1986 and the rules and regulations framed there under, other statues like marking of heavy packages act 1951 and the rules framed there under - manufacture, storage and import of hazardous chemicals. Rules 1989 framed under the environment (protection) act, 1989-few cases laws to interpret the terms used in the dock safety statues.

Responsibility of different agencies for safety, health and welfare involved in dock work – responsibilities of port authorities – dock labour board – owner of ship master, agent of ship – owner of lifting appliances and loose gear etc. – employers of dock workers like stevedores – clearing and forwarding agents – competent persons and dock worker. Forums for promoting safety and health in ports – Safe Committees and Advisory Committees. Their functions, training of dock workers.

UNIT–II	WORKING ON BOARD THE SHIP	9

Types of cargo ships – working on board ships – Safety in handling of hatch beams – hatch covers including its marking, Mechanical operated hatch covers of different types and its safety features – safety in chipping and painting operations on board ships – safe means of accesses – safety in storage etc. – illumination of decks and in holds – hazards in working inside the hold of the ship and on decks – safety precautions needed – safety in use of transport equipment - internal combustible engines like fort-lift trucks-pay loaders etc. Working with electricity and electrical management – Storage – types, hazardous cargo.

UNIT– III	LIFTING APPLIANCES	9
Different types of lifting appliances – construction, maintenance and use, various methods of rigging of derricks, safety in the use of container handling/lifting appliances like portainers, transtainer, top lift trucks and other containers – testing and examination of lifting appliances – portainers – transtainers 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.		
UNIT – IV	**TRANSPORT EQUIPMENT**	**9**
The different types of equipment for transporting containers and safety in their use-safety in the use of self loading container vehicles, container side lifter, fork lift truck, dock railways, conveyors and cranes. Safe use of special lift trucks inside containers – Testing, examination and inspection of containers – carriage of dangerous goods in containers and maintenance and certification of containers for safe operation Handling of different types of cargo – stacking and unstacking both on board the ship and ashore – loading and unloading of cargo identification of berths/walking for transfer operation of specific chemical from ship to shore and vice versa – restriction of loading and unloading operations.		
UNIT–V	**EMERGENCY ACTION PLAN AND DOCK WORKERS (SHW)REGULATIONS 1990**	**9**
Emergency action Plans for fire and explosions - collapse of lifting appliances and buildings, sheds etc., - gas leakages and precautions concerning spillage of dangerous goods etc., - Preparation of on- site emergency plan and safety report. Dock workers (SHW) rules and regulations 1990-related to lifting appliances, Container handling, loading and unloading, handling of hatch coverings and beams, Cargo handling, conveyors, dock railways, forklift.		
		TOTAL: 45 PERIODS
OPEN ENDED PROBLEMS / QUESTIONS		
Course specific open ended problems will be solved during the classroom teaching. Such problems can be given as assignments and evaluated as internal assessment only and not for the end semester examination.		

Course Outcomes: Upon completion of this course the students will be able to:		BLOOM'S Taxonomy
CO1	Explain the background and evolution of present dock safety statutes, including the factors that contributed to their enactment.	L2 - Understand
CO2	Summarize the importance of safety measures when handling hatch beams and hatch covers on cargo ships.	L2 - Understand
CO3	Outline the principles of safe rigging practices, including the selection and placement of rigging equipment and the calculation of load capacities.	L2 - Understand
CO4	Choose the safety measures to prevent accidents and ensure the safe handling of containers and cargo during transportation operations.	L3 - Apply
CO5	Make use of the protocols and procedures for responding to emergencies effectively, including evacuation plans, emergency response teams.	L3 - Apply

REFERENCE BOOKS:	
1.	"Dock Safety" Thane Belapur Industries Association, Mumbai.
2.	Bindra SR "Course in Dock and Harbour Engineering".
3.	Safety and Health in Dock work, IInd Edition, ILO, 1992.
4.	Srinivasan "Harbour, Dock and Tunnel Engineering".
5.	Taylor D.A., ""Introduction to Marine Engineering".
VIDEO REFERENCES:	
1.	https://www.youtube.com/watch?v=b9cTL5JakVc
2.	https://www.youtube.com/channel/UC7j-KnWLS8at_Z0c0ZbunoA
WEB REFERENCES:	
1.	https://www.ehs.uci.edu/safety/_pdf/loading-dock-safety-reference-guide.pdf
2.	https://dgfasli.gov.in/dock-safety-view
ONLINE COURSES:	
1.	https://nptel.ac.in/courses/114105003
2.	https://archive.nptel.ac.in/courses/114/105/114105003/

Mapping of COs with POs						
COs	POs					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1		1	3		3	
CO2		1	3	1		
CO3		1	3	1		
CO4		1	3	2	2	
CO5		1	2			2
Average		1	2.8	0.8	1	0.4
1-Low, 2-Medium, 3-High.						

ME23IS413	SAFETY IN ENGINEERING INDUSTRY	Version: 1.0				
Programme & Branch	M.E. INDUSTRIAL SAFETY ENGINEERING	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

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

UNIT–I	SAFETY IN METAL WORKING MACHINERY AND WOOD WORKING MACHINES	9

General safety rules, principles, maintenance, Inspections of turning machines, boring machines, milling machine, planning machine and grinding machines, CNC machines,

Wood working machinery, types, safety principles, electrical guards, work area, material handling,inspection, standards and codes- saws, types, hazards.

UNIT–II	PRINCIPLES OF MACHINE GUARDING	9

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

Selection and suitability: lathe-drilling-boring-milling-grinding-shaping-sawing-shearing-presses-forge hammer-flywheels-shafts-couplings-gears-sprockets wheels and chains-pulleys and belts-authorized entry to hazardous installations-benefits of good guarding systems.

UNIT– III	SAFETY IN WELDING AND GAS CUTTING	9

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

UNIT – IV	SAFETY IN COLD FARMING AND HOT WORKING OF METALS	9

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

Hot working safety in forging, hot rolling mill operation, safe guards in hot rolling mills – hot bending of pipes, hazards and control measures.

Safety in gas furnace operation, cupola, crucibles, ovens, foundry health hazards, work environment, material handling in foundries, foundry production cleaning and finishing foundry processes.

UNIT–V	SAFETY IN FINISHING, INSPECTION AND TESTING	9

Heat treatment operations, electro plating, paint shops, sand and shot blasting, safety in inspection and testing, dynamic balancing, hydro testing, valves, boiler drums and headers, pressure vessels, air leak test, steam testing, safety in radiography, personal monitoring devices, radiation hazards, engineering and administrative controls, Indian Boilers Regulation.

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

Total : 45 PERIODS

OPEN ENDED PROBLEMS / QUESTIONS

Course specific open ended problems will be solved during the classroom teaching. Such problems can be given as assignments and evaluated as internal assessment only and not for the end semester examination

	COURSE OUTCOMES: **Upon completion of this course the students will be able to:**	**BLOOM'S Taxonomy**
CO1	Infer safety rules, standards and codes in various mechanical engineering processes	L2 - Understand
CO2	Choose the suitable machine guarding systems for various machines such as lathe, drilling, boring, milling etc.,	L3 - Apply
CO3	Make use of the safety concepts in welding, gas cutting, storage and handling of gas cylinders, metal forming processes etc.,	L3 - Apply
CO4	Demonstrate the knowledge in testing and inspection as per rules in boilers, heat treatment operations etc.,	L2 - Understand
CO5	Apply preventive measures in health and welfare of workers aspects in engineering industry.	L3 - Apply

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REFERENCE BOOKS:	
1.	"Accident Prevention Manual" – NSC, Chicago, 1982.
2.	"Occupational safety Manual" BHEL, Trichy, 1988.
3.	"Safety Management by John V. Grimaldi and Rollin H. Simonds, All India Travelers Book seller,New Delhi, 1989.
4.	"Safety in Industry" N.V. Krishnan Jaico Publishery House, 1996.
5.	Indian Boiler acts and Regulations, Government of India.
6.	Safety in the use of wood working machines, HMSO, UK 1992.
7.	Health and Safety in welding and Allied processes, welding Institute, UK, High Tech. PublishingLtd., London, 1989.
VIDEO REFERENCES:	
1.	https://www.youtube.com/watch?v=p9tJtV-SDXY
2.	https://www.youtube.com/watch?v=bAPMLwi0a88
WEB REFERENCES:	
1.	https://www.osha.gov/woodworking
2.	https://www.osha.gov/sites/default/files/publications/osha3157.pdf
ONLINE COURSES:	
1.	https://www.aws.org/Certification-and-Education/Education/Safety-in-Welding/
2.	https://www.classcentral.com/subject/woodworking

Mapping of COs with POs

COs	POs					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1		2	3		1	
CO2		2	3		1	1
CO3		2	3		1	
CO4		2	3		1	
CO5	2	2	3	2	1	
Average	2	2	3	2	1	1
1–Low, 2 –Medium, 3–High.						

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ME23IS414	QUALITY ENGINEERING IN PRODUCTION SYSTEMS	Version: 1.0				
Programme & Branch	M.E. INDUSTRIAL SAFETY ENGINEERING	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1	To understand safety legislation related to dock activities 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

UNIT–I	INTRODUCTION TO QUALITY ENGINEERING AND LOSS FUNCTION	9

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

UNIT–II	ON-LINE QUALITY CONTROL	9

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

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

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

UNIT – IV	QUALITY ENGINEERING AND TPM	9

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

UNIT–V	SIX SIGMA AND ITS IMPLEMENTATION	9

Introduction- definition-methodology- impact of implementation of six sigma-DMAIC method-roles and responsibilities –leaders, champion, black belt, green belts. Do's and dont's - readiness of organization – planning-management role- six sigma tools – sustaining six sigma.

TOTAL: 45 PERIODS

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OPEN ENDED PROBLEMS / QUESTIONS		
Course specific open ended problems will be solved during the classroom teaching. Such problems can be given as assignments and evaluated as internal assessment only and not for the end semester examination.		
Course Outcomes: Upon completion of this course the students will be able to:		**BLOOM'S Taxonomy**
CO1	Outline the role of quality engineering in the design phase of products, emphasizing the integration of quality considerations from the outset.	L2 - Understand
CO2	Summarize the role of process parameters in influencing product quality and how to adjust them in real-time to maintain quality standards.	L2 - Understand
CO3	Make use of various methods and techniques for improving production processes to enhance product quality and efficiency.	L3 - Apply
CO4	Appling fault tree analysis, event tree analysis, and failure mode and effect analysis (FMEA) to identify potential failure modes.	L3 - Apply
CO5	Outline the importance of strategic planning and change management in preparing the organization for Six Sigma implementation.	L2 - Understand
REFERENCE BOOKS:		
1.	Brue G, "Six Sigma for Managers", Tata-McGraw Hill, New Delhi, Second reprint, 2002.	
2.	De Feo J A and Barnard W W, "Six Sigma: Breaktrough and Beyond", Tata McGraw-Hill, New Delhi, 2005.	
3.	Pyzdek T and Berger R W,"Quality Engineering Handbook", Tata-McGraw Hill, New Delhi, 1996.	
4.	Taguchi G, Elsayed E A and Hsiang, T.C.,"Quality Engineering in Production Systems", Mc-Graw- Hill Book company, Singapore, International Edition, 1989.	
VIDEO REFERENCES:		
1.	https://www.youtube.com/watch?v=SoUjQpIO3YY&list=PLeGWvtOKhUv78mHlxeyPtqjhmaWZQNmyK	
2.	https://www.youtube.com/watch?v=H2z4pi0KZSs&list=PLeGWvtOKhUv78mHlxeyPtqjhmaWZQNmyK&index=4.	
WEB REFERENCES:		
1.	https://quality-one.com/qualityengineering/#:~:text=Quality%20Engineering%20consists%20of%20analysis,the%20customer's%20requirements%20and%20 expectations.	
2.	http://www1.iitkgp.ac.in/downloads/sm_gian_1617_qe.pdf	
ONLINE COURSES:		
1.	https://onlinecourses.nptel.ac.in/noc20_mg18/preview	
2.	https://nptel.ac.in/courses/110105088	

Mapping of COs with POs						
COs	POs					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1		1	2			
CO2		1	2			
CO3		1	2		1	
CO4	1	2	3		1	1
CO5	2	2	3	2	1	
Average	1.5	1.4	2.4	2	1	1
1–Low, 2 –Medium, 3–High.						

ME23IS415	ISO 45001 AND ISO 14000	Version: 1.0				
Programme & Branch	M.E. INDUSTRIAL SAFETY ENGINEERING	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1	The course could 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 inculcate the knowledge on performance evaluation methods based on iso45001.
4	To educate about the various steps to be taken for certification of ISO 45001(Occupational health and safety management systems) and ISO14001 (Environmental Management Systems) standards.
5	To impart knowledge on Environment Impact Assessment (EIA), Life Cycle Assessment of productand principles of Eco labelling.

UNIT–I	OH & S MANAGEMENT SYSTEM STANDARD	9

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

UNIT–II	PLANNING	9

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

UNIT– III	PERFORMANCE EVALUATION	9

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

UNIT – IV	ISO 14001& ISO 19011	9

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

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Implementation plan, Registration, Importance of ISO 14000 to the Management. Auditing ISO14000- General principles of Environmental Audit, Auditor, steps in audit, Audit plan.

ISO 19011- Guidelines for auditing management Systems-General principles, managing audit programme- audit activities, steps in audit, audit plan-competence of auditors.

UNIT–V	**ENVIRONMENT IMPACT ASSESSMENT**	**9**

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

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

Total : 45 PERIODS

OPEN ENDED PROBLEMS / QUESTIONS

Course specific open ended problems will be solved during the classroom teaching. Such problems can be given as assignments and evaluated as internal assessment only and not for the end semester examination

COURSE OUTCOMES: Upon completion of this course the students will be able to:		**BLOOM'S Taxonomy**
CO1	Outline the various standards which is meant mainly for maintaining the Health of the employee and for the maintenance of the Environment.	L2 - Understand
CO2	Interpret the basic difference between the ISO 9000 series and ISO 45001 and ISO 14000 standards and the various clauses which governs the system in maintaining the standard.	L2 - Understand
CO3	Outline various clauses and subsequent preparation of procedures and related documents of ISO45001 AND 1S014000.	L3 - Apply
CO4	Apply the knowledge for preparing the ISO manual for getting the certification from the external certifying agencies.	L3 - Apply
CO5	Demonstrate knowledge on various standards various clauses and its suitability and applicability on the nature of organization.	L2 - Understand

REFERENCE BOOKS:

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

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4.	"BS 8800: 2004 Occupational Health and Safety Management Systems- Guide" BSI, UK, 2004.
5.	"ISO 19011:2011 Guidelines for Auditing Management Systems", ISO, 2011.
6.	"ISO 14040:2006 Environmental Management- Life Cycle Assessment - Principles and Framework" ISO,2006.
7.	"ISO 14025:2006 Environmental Labels and Declarations -Type III Environmental Declarations -Principles and Procedures", ISO,2006.
8.	"ISO 14021:1999 Environmental Labels and Declarations - Self- Declared Environmental Claims (Type II environmental labeling)", ISO, 1999.
9.	"ISO 14020:2000 Environmental Labels and Declarations-General Principles", ISO, 2000.
VIDEO REFERENCES:	
1.	https://www.youtube.com/watch?v=7utZfepa140&list=PLO8v5ESo95YMlWanVt2nw1S8ZhzlAchs-
2.	https://www.youtube.com/watch?v=_3dNjtuqbmY
WEB REFERENCES:	
1.	https://www.iso.org/iso-45001-occupational-health-and-safety.html
2.	https://www.iso.org/standards/popular/iso-14000-family
ONLINE COURSES:	
1.	https://www.bsigroup.com/en-IN/occupational-health-and-safety-iso-45001/iso-45001-training-courses/
2.	https://www.bsigroup.com/en-IN/ISO-14001-Environmental-Management/Training-courses-for-ISO-14001/

Mapping of COs with POs

COs	POs					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1		2	3		2	
CO2		2	3		2	
CO3		2	3		2	
CO4		2	3		2	
CO5		2	3		2	
Average		2	3		2	

1–Low, 2 –Medium, 3–High.

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ME23IS416	ARTIFICIAL INTELLIGENCE AND DATA ANALYTICS	Version: 1.0				
Programme & Branch	M.E. INDUSTRIAL SAFETY ENGINEERING	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1	To understand data science fundamentals and its safety applications.
2	To learn data acquisition, cleaning, and exploratory analysis for safety.
3	To apply statistical concepts for safety evaluation and monitoring.
4	To explore machine learning algorithms for safety event prediction and anomaly detection.
5	To utilize visualization and communication techniques for safety data insights.

UNIT–I	DATA SCIENCE AND SAFETY	9

Introduction -Terminology in data science-. Application of data science- Overview of data science and its applications in safety-risk analysis, anomaly detection and safety optimization -Introduction to safety analysis and risk assessment

UNIT–II	DATA COLLECTION AND PRE PROCESSING	9

Data acquisition methods and sources relevant to Safety-Operators - Variables - data types - Conditional statements-Looping - Function -. Data structure - Lists, Dictionary and Tuple - Regular Expression - File Reading (CSV, Excel etc.) - Basics Class and Objects concepts- data cleaninghandling missing values--dealing with outliers- Exploratory data analysis techniques.

UNIT– III	STATISTICAL ANALYSIS	9

Probability theory and statistical concepts relevant to safety analysis-statistical analysis, data visualization, and predictive modelling techniques-Descriptive and inferential statistics - Hypothesis testing and confidence intervals- Safety Program Evaluation, Comparative Analysis, Reliability Analysis, Incident Investigation, Safety Performance Monitoring.

UNIT – IV	MACHINE LEARNING	9

Introduction to supervised and unsupervised learning algorithms-Feature engineering and selection -Model evaluation and performance metrics -Regression models --Classification models -Ensemble methods and model optimization -Techniques for identifying anomalies and outlier detection-Time series analysis and forecasting for safety events - Event prediction using machine learning algorithms.

UNIT–V	VISUALIZATION AND COMMUNICATION OF SAFETY DATA	9

Data visualization techniques for safety insights-Storytelling with data and effective communication of safety findings-Interactive dashboards and reporting tools for safety analysis-Ethical issues in working with safety data-Privacy and security concerns in data science for safety-Legal and regulatory frameworks related to safety data- Data science to safety problems.

TOTAL: 45 PERIODS

OPEN ENDED PROBLEMS / QUESTIONS

Course specific open ended problems will be solved during the classroom teaching. Such problems can be given as assignments and evaluated as internal assessment only and not for the end semester examination.

Course Outcomes: Upon completion of this course the students will be able to:		**BLOOM'S Taxonomy**
CO1	Interpret the benefits for improving safety measures and preventing accidents in various industries with the help of data science.	L2 - Understand
CO2	Summarize significant impact on the quality and effectiveness of data analysis.	L2 - Understand
CO3	Illustrate the understanding of safety-related data and drawing meaningful insights from it.	L2 - Understand
CO4	Identify the trends, patterns, and correlations with experimental data.	L3 - Apply
CO5	Organize data into a form easier to understand, highlighting the trends and outliers	L3 - Apply

REFERENCE BOOKS:

1.	"Safety Critical Systems Handbook: A Straightforward Guide to Functional Safety, IEC 61508 (2010 Edition) and Related Standards" by David J. Smith
2.	"Safety Critical Systems: Problems, Process and Practice" by Tim Kelly
3.	"System Safety Engineering and Risk Assessment: A Practical Approach" by Nicholas J. Bahr
4.	"Applied Artificial Intelligence: A Handbook For Business Leaders" by Mariya Yao, Adelyn Zhou, and Marlene Jia 9
5.	"Handbook of Safety and Health for the Service Industry" edited by Charles D. Reese and James P. Nelson
6.	"Data Science for Transport: A Self-Study Guide with Computer Exercises" by Jose L. Munoz and Luis F. Miranda-Moreno
7.	"Foundations of Data Science" by Avrim Blum, John Hopcroft, and Ravindran Kannan

VIDEO REFERENCES:

1.	https://www.youtube.com/watch?v=3K-vJlVMi5A
2.	https://www.youtube.com/watch?v=pKeVMlkFpRc&list=PLwdnzlV3ogoXaceHrrFVZCJKbm_laSHcH

WEB REFERENCES:	
1.	https://dl.acm.org/doi/pdf/10.1145/3550473
2.	https://www.coursera.org/articles/data-analytics
ONLINE COURSES:	
1.	https://onlinecourses.nptel.ac.in/noc22_cs56/preview
2.	https://onlinecourses.swayam2.ac.in/nou23_ge81/preview

Mapping of COs with POs						
COs	**POs**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1				1		
CO2		1		2	2	
CO3		1		2	1	
CO4	1	1		2	1	
CO5	1	1		2	1	
Average	1	1		1.8	1.25	
1–Low, 2 –Medium, 3–High.						

ME23IS417	DESIGN OF EXPERIMENTS	Version: 1.0				
Programme & Branch	M.E. INDUSTRIAL SAFETY ENGINEERING	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1.	Impart knowledge on principles and steps in designing a statistically designed experiment.
2.	Build foundation in analysing the data in single factor experiments and to perform post hoc tests.
3.	Provide knowledge on analysing the data in factorial experiments.
4.	Educate on analysing the data analysis in special experimental designs and Response Surface Methods.
5.	Impart knowledge in designing and analysing the data in Taguchi's Design of Experiments to improve Process/Product quality.

UNIT–I	EXPERIMENTAL DESIGN FUNDAMENTALS	9

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

UNIT–II	SINGLE FACTOR EXPERIMENTS	9

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

UNIT– III	MULTIFACTOR EXPERIMENTS	9

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

UNIT – IV	SPECIAL EXPERIMENTAL DESIGNS	9

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

UNIT–V	TAGUCHI METHODS	9

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

TOTAL: 45 PERIODS

OPEN ENDED PROBLEMS / QUESTIONS		
Course specific open ended problems will be solved during the classroom teaching. Such problems can be given as assignments and evaluated as internal assessment only and not for the end semester examination.		
Course Outcomes: Upon completion of this course the students will be able to:		**BLOOM'S Taxonomy**
CO1	Apply Analysis of Variance (ANOVA) enabling them to assess the significance of differences among treatment means and identify sources of variation in experimental data.	L3 - Apply
CO2	Identify the model parameters in various experimental designs, using appropriate statistical methods such as least squares estimation.	L3 - Apply
CO3	Plan and conduct experiments with random factors, understanding the implications of randomization for estimating treatment effects and improving the generalizability of experimental results.	L3 - Apply
CO4	Design and analyze nested designs, which involve hierarchical structures, understanding the implications for experimental design and statistical analysis.	L4 - Analyze
CO5	Develop skills in multi-response optimization, which involves optimizing multiple response variables simultaneously to achieve a ptimal process settings.	L3 - Apply
REFERENCE BOOKS:		
1.	Krishnaiah, K. and Shahabudeen, P. Applied Design of Experiments and Taguchi Methods, PHI learning private Ltd., 2012.	
2.	Montgomery, D.C., Design and Analysis of experiments, John Wiley and Sons, Eighth edition, 2012.	
3.	NicoloBelavendram, Quality by Design; Taguchi techniques for industrial experimentation, Prentice Hall, 1995.	
4.	Phillip J.Rose, Taguchi techniques for quality engineering, McGraw Hill, 1996.	
5.	Montgomery, D.C., Design and Analysis of Experiment, Minitab Manual, John Wiley and Sons, Seventh edition, 2010.	
VIDEO REFERENCES:		
1.	https://www.youtube.com/watch?v=IEUTRhyoHNc&list=PLPjSqITyvDeWS9Lxp4jreGJ7eNsxHxJA8	
2.	https://www.youtube.com/watch?v=pKeVMlkFpRc&list=PLwdnzlV3ogoXaceHrrFVZCJKbm_IaSHcH	
WEB REFERENCES:		
1.	https://home.iitk.ac.in/~shalab/anova/chapter4-anova-experimental-design-analysis.pdf	
2.	https://www.itl.nist.gov/div898/handbook/pmd/section3/pmd31.htm	
ONLINE COURSES:		
1.	https://onlinecourses.nptel.ac.in/noc21_mg48/preview	
2.	https://onlinecourses.swayam2.ac.in/aic23_ge17/preview	

Mapping of COs with POs						
COs	POs					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	1				
CO2			1	1		
CO3			1	1		
CO4			1	1	1	
CO5	2	1	1			
Average	0.6	0.4	0.8	0.6	0.2	
1-Low, 2-Medium, 3-High.						

ME23IS418	RELIABILITY ENGINEERING	Version: 1.0				
Programme & Branch	M.E. INDUSTRIAL SAFETY ENGINEERING	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

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

UNIT–I	RELIABILITY CONCEPTS	9

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

UNIT–II	LIFE DATA ANALYSIS	9

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

UNIT– III	PERFORMANCE EVALUATION	9

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

UNIT – IV	RELIABILITY MONITORING	9

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

UNIT–V	RELIABILITY IMPROVEMENT	9

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

Total : 45 PERIODS

OPEN ENDED PROBLEMS / QUESTIONS

Course specific open ended problems will be solved during the classroom teaching. Such problems can be given as assignments and evaluated as internal assessment only and not for the end semester examination.

COURSE OUTCOMES: Upon completion of this course the students will be able to:		BLOOM'S Taxonomy
CO1	Understand the basic concepts of reliability engineering.	L2 - Understand
CO2	Apply the different techniques to perform life data analysis on a system.	L3 - Apply
CO3	Apply the knowledge to conduct reliability assessment and failure analysis on any complex systems.	L3 - Apply
CO4	Apply techniques to monitor reliability of the system.	L3 - Apply
CO5	Analyze various techniques to improve reliability of the system.	L4 - Analyze
REFERENCE BOOKS:		
1.	Charles E. Ebeling, "An introduction to Reliability and Maintainability engineering", TMH, 2000.	
2.	Roy Billington and Ronald N. Allan, "Reliability Evaluation of Engineering Systems", Springer, 2007.	
VIDEO REFERENCES:		
1.	https://www.youtube.com/watch?v=BQXnKpP2lrI&t=15s	
2.	https://www.youtube.com/watch?v=uutg8jKrL9w&t=30s	
WEB REFERENCES:		
1.	https://reliably.com/blog/what-is-reliability-engineering/	
2.	https://study.com/academy/lesson/reliability-engineering-definition-purpose.html	
ONLINE COURSES:		
1.	https://onlinecourses.nptel.ac.in/noc23_ge20/preview	
2.	https://reliability-academy.com/	

Mapping of COs with POs

COs	POs					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1		1	3		1	2
CO2	2	1	3		1	1
CO3	2	1	3			
CO4	1	1	3	2		
CO5	1	1	3		1	
Average	1.5	1	3	2	1	1.5
1–Low, 2 –Medium, 3–High.						

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ME23IS419	LOGISTICS AND DISTRIBUTION MANAGEMENT	Version: 1.0				
Programme & Branch	M.E. INDUSTRIAL SAFETY ENGINEERING	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1	Impart the basic knowledge on the concepts on logistics and distribution.
2	Inculcate knowledge in Logistics Process, Planning and Materials Management.
3	Teach the principles and activities in warehousing and storage.
4	Provide knowledge on modes of transportation and international transport.
5	Inculcate knowledge on performance monitoring, outsourcing and ICT application in logisticsand distribution.

UNIT–I	REL CONCEPTS OF LOGISTICS AND DISTRIBUTION IABILITY CONCEPTS	9

Introduction to logistics and distribution- Integrated logistics and the supply chain- Integrated logistics and the supply chain- Customer service and logistics- Channels of distribution - Key issues anchallenges for logistics.

UNIT–II	PLANNING FOR LOGISTICS	9

Planning framework for logistics -Logistics processes -Supply chain segmentation- Logistics network planning - Logistics management and organization - Manufacturing and materials management.

UNIT– III	WAREHOUSING AND STORAGE	9

Principles of warehousing Storage and handling systems (palletized and non-palletized) - Order picking and replenishment- Receiving and dispatch - Warehouse design- Warehouse management and information.

UNIT – IV	FREIGHT TRANSPORT	9

International logistics: modal choice - Maritime transport - Air transport - Rail and intermodal transport- Road freight transport: vehicle selection, vehicle costing and planning and resourcing International transportation systems in Global perspective.

UNIT–V	OPERATIONAL MANAGEMENT	9

Cost and performance monitoring- Benchmarking- Information and communication technology in supply chain- Outsourcing: services and decision criteria, the selection process — Outsourcing management- Security and safety in distribution - Logistics and the environment.

Total : 45 PERIODS

OPEN ENDED PROBLEMS / QUESTIONS		
Course specific open ended problems will be solved during the classroom teaching. Such problems can be given as assignments and evaluated as internal assessment only and not for the end semester examination		
COURSE OUTCOMES: **Upon completion of this course the students will be able to:**		**BLOOM'S Taxonomy**
CO1	Infer the concepts of logistics and distribution	L2 - Understand
CO2	Demonstrate knowledge in logistics planning	L2 - Understand
CO3	Apply various principles of Storage and handling concepts in warehousing	L3 - Apply
CO4	Apply the knowledge of vehicle costing and planning and resourcing International transportation systems of logistics for	L3 - Apply
CO5	Summarize the concepts in outsourcing, benchmarking and safety in distribution	L2 - Understand
REFERENCE BOOKS:		
1.	Alan Rushton,PhilCroucher and Peter Baker(Eds.)The Handbook of Logistics and Distribution Management, Kogan Page,4th Edition,2010.	
2.	Jean-Paul Rodrigue, Claude Comtois and Brian Slack, "The geography of transport systems" (2009), New York: Routledge.	
VIDEO REFERENCES:		
1.	https://www.youtube.com/watch?v=kKTHRW_ucig	
2.	https://www.youtube.com/watch?v=4-QU7WiVxh8	
WEB REFERENCES:		
1.	https://industri.fatek.unpatti.ac.id/wp-content/uploads/2019/03/149-The-Handbook-of-Logistics-and-Distribution-Management-Understanding-the-Supply-Chain-Alan-Rushton-Phil-Croucher-Peter-Baker-Edisi-1-2014.pdf	
2.	https://www.emeraldgrouppublishing.com/journal/ijpdlm	
ONLINE COURSES:		
1.	https://onlinecourses.nptel.ac.in/noc24_hs128/preview	
2.	https://www.coursera.org/learn/supply-chain-logistics	

Mapping of COs with POs						
COs	POs					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1		2	3		1	
CO2		2	3		2	
CO3		2	3		2	
CO4		1	3		2	
CO5		1	3		2	1
Average		1.3	3		1.8	0.2
1–Low, 2 –Medium, 3–High.						

Note:

Syllabus for the courses offered from 3rd Semester to 4th Semester, will be added after the approval of the Board of Studies (BoS) & Academic Council (AC) in due course.

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