

JK Lakshmipat University

LaliyaKa Vas, P.O. Mahapura, Ajmer Road, Jaipur 302 026 Ph.: +91-141-7107500

INSTITUTE OF ENGINEERING AND TECHNOLOGY

2 Year M. Tech Programme (Branch: Health, Safety, and Environmental Engineering) Batch 2018-2020

Course Structure, Detailed Syllabus & Scheme of Examination

			JK	Laks	hmipat U	nive	rsity, Jaipı	ır			
		Μ	Institut Tech. in Heal	te of lth, S	Engineeri Safety and	ing a Env	ind Techno vironmenta	ology al Engin	eer	ing	
	T		Course	e Str	ucture for	• the	Batch 201	8-20		0	
					~						(L T P S) Credits
Sem.					Course	es					Hrs/
						D	1 . 4				Week
T	Envi al Po Cont	ronment ollution rol	Occupationa l Health and Hygiene	S Eng It	afety in gineering ndustry	fo Sa Env	r Health, afety and vironment	Projec Studio-	t -I	Pedagogy-I	(12 0 10) 19
1	MTI (3	HSE 101 0 4)5	MTHSE 102 (3 0 0) 3	МТ (З	THSE 103 300)3	М7 (3	ГНSE 104 300)3	MTHS 105 (0 0 4 2	E)	MTHSE 10 6 (006)3	26
II	El Envi al A	A and ronment Auditing	Risk Analysis and Managemen t	Ele	ctive-I	El	ective-II	Projec Studio II	t -	Personal Branding & Workplace Communica tion	(1404) 16
	MTI (3	HSE 201 0 0) 3	MTHSE 202 (3 0 0) 3	(:	(3 0 0) 3 (3		300)3	MTHS 203 (0 0 4 2	E)	CCT601 (200)2	18
			Inte	ernsh	nip (6- 8 w	eeks) PS2101				4
	Ele	ective-3	Elective – 4	D	issertation-	-I /In	dustrial Pro Project	(6 0 22) 17			
111	(3	02)4	(300)3			PR2	103/PR210 (0 0 20)	28			
		Diss	sertation-II /Ind	lustri	al Project-	II /E	ntrepreneu	16			
IV]	PR21	106/PR210)7/PF	R2108				
					(0 0 32)	16				Total (Tredits: 72
	Qu	ality and					0.6.			10001	
Electi ve-I	Safety Management inFire Engineering And Explosion (MTHSE 211)Transport Safety (MTHSE 212)Construction (MTHSE 212)Control (MTHSE 212)213)		t ,	Safety in Chemical Industry (MTHSE 214)] pc (Des ollu MT	ign of Air tion control system THSE 215)	Indoor Air Quality (MTHSE 216)			
Electi ve-II	Safety in ConstructionElectrical SafetyDisaster management (MTHSE 222)(MTHSE 221)(MTHSE 222)		Safety i mines (MTHS 224)	n Inc E	dust	rial Noise and Control	Vibration				
Electiv	e-III	Indust	rial Automation	n and	I Internet o	f	Transportation Safety Engineering				
	·-111	a	Things-I (E	E210) <u>1</u>	<u></u>		. (N	ATI	HSE312)	0.00001
Electiv	e-IV	Statist	ical Data Analy	ysis-l	I (AS2101))	Fire Engi	neering a	and	Management	(ME2201)

Course	Course Title	Page No.
Code		
MTHSE 101	Environmental Pollution Control	5
MTHSE 102	Occupational Health and Hygiene	7
MTHSE 103	Safety in Engineering Industry	9
MTHSE 104	Regulation for Health, Safety and Environment	11
MTHSE 105	Project Studio-I	12
MTHSE 106	Pedagogy-I	12
MTHSE 201	EIA and Environmental Auditing	14
MTHSE 202	Risk Analysis and Solid Waste Management	16
	Elective-I	
MTHSE 211	Quality and Safety Management in Construction (E1)	18
MTHSE 212	Fire Engineering And Explosion Control (E1)	19
MTHSE 213	Transport Safety (E1)	21
MTHSE 214	Safety in Chemical Industry (E1)	23
MTHSE 215	Design of Air pollution control system (E1)	25
MTHSE 216	Indoor Air Quality (E1)	26
	Elective-II	
MTHSE 221	Safety in Construction (E2)	27
MTHSE 222	Electrical Safety (E2)	29
MTHSE 223	Disaster Management (E2)	31
MTHSE 224	Safety in Mines (E2)	32
MTHSE 225	Industrial Noise and Vibration Control (E2)	33
MTHSE 203	Project Studio-II	34
CCT601	Personal Branding & Workplace Communication	35
PS2101	Internship	37
	Elective-III	
EE2101	Industrial Automation and Internet of Things-I (E3)	39
MTHSE312	Transportation Safety Engineering (E3)	41
	Elective-IV	
AS2101	Statistical Data Analysis-I (E4)	42
ME2201	Fire Engineering and Management (E4)	44
PR2103/	Dissertation-I/ Industrial Project-I/ Entrepreneurial	46
PR2104/	Project-I	
PR2105		
PR2106/	Dissertation-II / Industrial Project-II /Entrepreneurial	49
PR2107/	Project-II	
PR2108		

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M. Tech HSE (Batch: 2018-2020)



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INSTITUTE OF ENGINEERING AND TECHNOLOGY

2 Year M. Tech Programme (Branch: Health, Safety, and Environment Engineering) Batch 2018-2020 SEMESTER-ONE Detailed Syllabus & Scheme of Examination

Com	rao oodo		Course T			Tea	ching	Teaching Scheme				
Cou	rse coue		Course 1	nue			L	Т	Р	C	redits	
MTI	HSE 101		Environmental	Pollution	Contro	bl	3	0	4		5	
	E	valuati	ation Scheme (Theory) Evaluation Scheme (Practical))				
Mid Ter m Test – I	Mid Term Test – II	End Ter m Test	Class Participation/ Additional Continuous Evaluation*	Total Marks **	Mid Ter m Test - I	End Ter m Test	Cla Add	ass Paı itional Evalı	ticipat Contii ation*	ion/ nuous	Total Marks **	
20	20	50	10	100	20	50			30		100	

**The ratio of weightage between Theory and Practical content will be 60%: 40%

Syllabus (Theory)

AIR POLLUTION Classification and properties of air pollutants – Pollution sources – Effects of air pollutants on human beings, Animals, Plants and Materials - automobile pollution hazards of air pollution-concept of clean coal combustion technology - ultra violet radiation, infrared radiation, radiation from sun-hazards due to depletion of ozone - deforestation-ozone holes-automobile exhausts-chemical factory stack emissions- Chloro Fluoro Carbon(CFC).

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

Hazardous Waste Management 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-dilution-standards and restrictions – recycling and reuse.

ENVIRONMENTAL MEASUREMENT AND CONTROL Basic Principles of pollution control devices, Sampling and analysis – dust monitor – gas analyzer, particle size analyzer – 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.

PERSONAL EXPOSURE TO ENVIRONMENTAL CONTAMINANTS: Methods for assessing the personal exposure to environmental contaminants, Exposure Assessment in Occupational and Environmental Epidemiology.

NOISE POLLUTION AND HEALTH MEASUREMENT, Noise measurement techniques and analysis: worksite, ambient and road transport. Noise predication and modelling, noise impact assessment: scultz fraction impact method; value function curves. Noise abatement measures sound absorption, acoustic barrier, vibration isolation. Vibration damping, muffling, personal protector and green belt principles and design considerations. Noise pollution and management in mines, washeries, Power plants, fertilizer plants, cement plants, etc. Human vibration-whole body vibration problems in opencast mines, health effects and control measures.

TEXT BOOKS & REFERENCES

- 1. Rao, CS, "Environmental pollution engineering:, Wiley Eastern Limited, NewDelhi, 1992.
- 2. S.P.Mahajan, "Pollution control in process industries", Tata McGraw Hill Publishing Company, New Delhi, 1993.
- 3. Varma and Braner, "Air pollution equipment", Springer Publishers, Second Edition.

Con	maa aada		Course T			Tea	ching	Schem	e		
Cou	rse coue		Course 1	lue			L	Т	P	Cı	redits
MTI	HSE 102		Occupational Health	and Hyg	giene		3	0	0		3
	E	valuati	on Scheme (Theory)			Eval	uatio	n Sche	me (Pr	actical)
Mid Ter m Test - I	Mid Term Test – II	End Ter m Test	Class Participation/ Additional Continuous Evaluation*	Total Marks **	Mid Ter m Test - I	End Ter m Test	Cla Add	ass Pai itional Evalı	ticipat Contii ation*	ion/ nuous	Total Marks **
20	20	50	10	100	20	50		,	30		100

**The ratio of weightage between Theory and Practical content will be 60%: 40%

Syllabus (Theory)

PHYSICAL HAZARDS: Noise, compensation aspects, noise exposure regulation, properties of sound, occupational damage, risk factors, sound measuring instruments, octave band analyzer, noise networks, noise surveys, noise control program, industrial audiometry, hearing conservation programs vibration types, effects, instruments, surveying procedure, permissible exposure limit. Ionizing radiation, types, effects, monitoring instruments, control programs, OSHA standard non-ionizing radiations, effects, types, radar hazards, microwaves and radiowaves, lasers, TLV- cold environments, hypothermia, wind chill index, control measures- hot environments, thermal comfort, heat stress indices, acclimatization, estimation and control.

CHEMICAL HAZARDS : Recognition of chemical hazards-dust, fumes, mist, vapour, fog, gases, types, concentration, Exposure vs. dose, TLV - Methods of Evaluation, process or operation description, Field Survey, Sampling methodology, Industrial Hygiene calculations, Comparison with OSHAS Standard. Air Sampling instruments, Types, Measurement Procedures, Instruments Procedures, Gas and Vapour monitors, dust sample collection devices, personal sampling Methods of Control - Engineering Control, Design maintenance considerations, design specifications - General Control Methods - training and education.

BIOLOGICAL AND ERGONOMICAL HAZARDS Classification of Bio hazardous agents –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 neckback injuries.

OCCUPATIONAL HEALTH AND TOXICOLOGY Concept and spectrum of health - functional units and activities of occupational health services, pre-employment and post-employment medical examinations - occupational related diseases, levels of prevention of diseases, notifiable occupational diseases such as silicosis, asbestosis, pneumoconiosis, siderosis, anthracosis, aluminosis and anthrax, lead-nickel, chromium and manganese toxicity, gas poisoning (such as CO, ammonia, coal and dust etc) their effects and prevention – cardio pulmonary resuscitation, audiometric tests, eye tests, vital function tests. Industrial toxicology, local, systemic and chronic effects, temporary and cumulative effects, carcinogens entry into human systems.

OCCUPATIONAL PHYSIOLOGY Man as a system component – allocation of functions – efficiency – occupational work capacity – aerobic and anaerobic work – evaluation of physiological requirements of jobs – parameters of measurements – categorization of job

 $heaviness-work\ organization-stress-strain-fatigue-rest\ pauses-shift\ work-personal\ hygiene.$

Text books & References

- 1. Handbook of Occupational Health and Safety, NSC Chicago, 1982
- 2. Encyclopedia of Occupational Health and Safety, Vol. I & II, International LabourOrganisation, Geneva, 1985.
- 3. McCornick, E.J. and Sanders, M.S., Human Factors in Engineering and Design, Tata McGraw-Hill, 1982.

Con	rso oodo		Course T			Tea	ching	Schem	e		
Cou	rse coue		Course 1	lue			L	Т	P	C	redits
MTI	HSE 103		Safety in Engineering Inc	lustry			3	0	0		3
	E	valuati	ion Scheme (Theory)		Evaluation Scheme (Practical))
Mid Ter m Test - I	Mid Term Test – II	End Ter m Test	Class Participation/ Additional Continuous Evaluation*	Total Marks **	Mid Ter m Test - I	End Ter m Test	Cla Add	ass Paı itional Evalı	ticipat Contii ation*	ion/ nuous	Total Marks **
20	20	50	10	100	20	50			30		100

**The ratio of weightage between Theory and Practical content will be 60%: 40%.

Syllabus (Theory)

SAFETY IN METAL WORKING MACHINERY AND WOOD WORKING MACHINES: General safety rules, principles, maintenance, Inspections of turning machines, boring machines, milling machine, planning machine and grinding machines, CNC machines, Wood working machinery, types, safety principles, electrical guards, work area, material handling, inspection, standards and codes- saws, types, hazards.

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

SAFETY IN COLD FORMING AND HOT WORKING OF METALS: Cold working, power presses, point of operation safe guarding, auxiliary mechanisms, feeding and cutting mechanism, hand or foot-operated presses, power press electric controls, power press set up and die removal, inspection and maintenance-metal sheers-press brakes. Hot working safety in forging, hot rolling mill operation, safe guards in hot rolling mills – hot bending of pipes, hazards and control measures. Safety in gas furnace operation, cupola, crucibles, ovens, foundry health hazards, work environment, material handling in foundries, foundry production cleaning and finishing foundry processes.

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

Laboratory Safety: Machine Safety, Cryogenics Safety, Fire Safety, Laser Safety, Radiation Safety, Gas Cylinder Safety, Chemical Safety and Bio Safety

Safety in Water treatment plants: Safety in Effluent Treatment plants (ETP), Hazard Identification, hazards in ETP O & M, Dos and Don'ts in ETP Operation for Safety, Personnel Protective Equipment (PPE) for ETP O & M, Safe Handling of Chemicals, Safe Handling of Chlorine, Toxic Effects of Chlorine, Handling Chlorine equipment, Chlorine Leak detection and control, Safety in Handling of Corrosive substances such as Acids, Alkalis, Corrosive Substances used in ETP, Use and Storage of Corrosives, Health Hazards Associated with Corrosives, First Aid.

Text books & References

- 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 JaicoPublishery 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. Publishing Ltd., London, 1989.

Con	rse code Course Title							Teaching Scheme				
Cou	rse coue		Course 1	lue			L	Т	Р	Cı	redits	
MTI	HSE 104	Re	egulation for Health, Safe	ety and E	nvironn	nent	3	0	0		3	
	E	valuat	ion Scheme (Theory)			Eval	uatio	n Schei	me (Pr	actical)	
Mid Ter m Test - I	Mid Term Test – II	End Ter m Test	Class Participation/ Additional Continuous Evaluation*	Total Marks **	Mid Ter m Test - I	End Ter m Test	Cla Add	ass Par itional Evalu	ticipat Contii ation*	ion/ nuous	Total Marks **	
20	20	50	10	100	20	50			30		100	

The ratio of weightage between Theory and Practical content will be 60%: 40%. **Syllabus (Theory)

Factories act and rules - Workmen compensation act. Indian explosive act - Gas cylinder rules - SMPV Act - Indian petroleum act and rules. Environmental pollution act Manufacture, Storage and Import of Hazardous Chemical rules 1989, Indian Electricity act and rules. Overview of OHSAS 18000 and ISO 14000

Text books & Reference books

- 1. The Factories Act 1948, Madras Book Agency, Chennai, 2000
- The Environment Act (Protection) 1986, Commercial Law Publishers (India) Pvt.Ltd., New Delhi. 3. Water (Prevention and control of pollution) act 1974, Commercial Law publishers (India) Pvt.Ltd., New Delhi.
- 3. Air (Prevention and control of pollution) act 1981, Commercial Law Publishers (India) Pvt.Ltd., New Delhi.
- 4. Explosive Act, 1884 and Explosive rules, 1883 (India), (2002), Eastern Book company, Lucknow, 10th Edition
- 5. The manufacture, storage and import of hazardous chemical rules 1989, Madras Book Agency, Chennai.
- 6. ISO 9000 to OHSAS 18001, Dr. K.C. Arora, S.K. Kataria& Sons, Delhi

Con	ra ada	de Course Title						Tea	ching Sche	me
Cou	rse coue		Course Thie					Т	Р	Credits
MTI	HSE 105		Project Stu	ıdio-I			0	0	4	2
	E	valuat	ion Scheme (Theory)			Eval	uatio	ı Schei	ne (Practic	al)
Mid Ter m Test - I	Mid Term Test – II	End Ter m Test	Class Participation/ Additional Continuous Evaluation*	Total Marks **	Mid Ter m Test - I	End Ter m Test	nd er n est Class Participation/ Additional Continuous Evaluation*			Total Marks **
20	20	50	10	100	20	50			30	100

The ratio of weightage between Theory and Practical content will be 60%: 40%. **Syllabus (Theory)

In this exercise students will work in small groups and undertake studies on environment engineering or Industrial safety and management. The aim of this project is to make students able to understand safety needs of organizations in a variety of occupational environments.

Com	waa aada		Course T		Teaching Scheme					
Cou	rse coue		Course little					Т	Р	Credits
MTH	ISE 106	5	Pedagog	y-I			0	0	6	3
	E	valuati	on Scheme (Theory)			Eval	uatior	n Schei	ne (Practic	al)
Mid Ter m Test - I	Mid Term Test – II	End Ter m Test	Class Participation/ Additional Continuous Evaluation*	Total Marks **	Mid Ter m Test - I	End Ter m Test	Cla Add	ass Par itional Evalu	ticipation/ Continuou ation*	Total s Marks **
20	20	50	10	100	20	50			30	100

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/ Mock Interviews/others

The ratio of weightage between Theory and Practical content will be 60%: 40%. **Syllabus (Theory)

In this exercise students will work in small groups and undertake studies on environment engineering or Industrial safety and management. The aim of this project is to make students able to understand safety needs of organizations in a variety of occupational environments.



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INSTITUTE OF ENGINEERING AND TECHNOLOGY

2 Year M. Tech Programme (Branch: Health, Safety, and Environment Engineering) Batch 2018-2020 SEMESTER-TWO Detailed Syllabus & Scheme of Examination

Course Title and Code: EIA and Environmental Auditing (MTHSE 201)

Hours per Week	L-T-P: 3-0-0
Credits	3
Students who can take	M.Tech Semester-II (Batch: 2018-2020)

Course Objective:

The objective of this course is to familiarize students with the relevant legislation and applications of environmental impact assessments (EIA) and environmental auditing (EA). The focus will be on the assessment of impacts to the natural environment; however, socio-economic impacts will also discusses. Environmental auditing and environmental certification systems will be discussed in detail. Example and case studies from forestry, wildlife biology, and land use will be used to illustrate the principals and techniques presented in the course. Student will acquire "hands-on" experience in impact assessment and environmental auditing through case studies.

On successful completion of this course students will be able to:

- 1) Identify objectives of an environmental impact assessment and environmental audits.
- 2) Use the basic steps and elements of an EIA and Environmental Audit (EA).
- 3) Apply legislation and rules for EIA, EMA, and EA.
- 4) Identify, assess and address environmental concerns and adopt EIA & EA as tools for sustainable development.
- 5) Conduct environmental audits and pollution prevention assessments and critically evaluate its outcomes.

Prerequi	sites	
Sr. No.	Evaluation Component	Marks
1	Attendance	NIL
2	Assignment	10
3	Class Participation	5
4	Quiz	5
5	Theory Exam-I	10
6	Theory Exam-II	10
7	Theory Exam-III	40
8	Report-I	NIL
9	Report-II	NIL
10	Report-III	NIL
11	Project-I	20
12	Project-II	NIL
13	Project-III	NIL
14	Lab Evaluation-I	NIL
15	Lab Evaluation-II	NIL
16	Course Portfolio	NIL
	Total (100)	100

Course Syllabi (Theory):

Introduction: Environmental Assessment process, objectives of EIA, Terminology, and Hierarchy in EIA, Historical Review of EIA, and Concepts related to EIA, Basic data collection for EIA, Strategic environmental assessment (SEA)

Legislation and Procedures: National Environmental Policy Act and Implementation, EIA legislative requirements and administrative procedures in India/Indian States, EIA notification 2006.

Techniques and Methodology: Description of the environmental setting, Methods of Impact Analysis, Environmental risk assessment, baseline data collection for EIA

Public Participation in environmental decision making, regulatory requirement, techniques, advantages and disadvantages of public participation.

Preparation and writing of EIA report.

Prediction and Assessment of Impacts on Air, Water, Noise, Biological, Cultural and socioeconomic Environment, Mining, blasting

Case studies of EIA for Industries like Oil, Petrochemical, iron and steel, fertilizer, sugar and distillery, projects of road/dams and housing etc.

Environment Management Plan: Planning, selection of appropriate procedures, Introduction to Environmental budget, to minimize environmental Impacts.

Environmental Audit: Definition of Environment Audit and its importance for industries. Types of audits, General audit methodology and basic structure of audit. Elements of an audit process and its importance, Urban Environment Audit, Concept of 1SO14000.

Requirements of Rule 14 for Environmental Audit under Environmental protection Act 1986, Definitions of a. Signatory, b. Consumption Audit, c. Pollution audit, d. Hazardous audit, d. Solid waste audit, e. Disposal audit, f. Cost audit, g. Investment audit, h. Voluntary.

The concept of QSAR and QSBR: Essential steps in Quantitative structure–activity relationship (QSAR) and Quantitative structure–Biological relationship (QSBR) Studies, types, modelling, Evaluation of the quality of QSAR and QSBR models, Application of QSAR and QSBR models especially in risk management.

Text Book(s)/ Reference Book(s)

- 1. Larry W. Canter," Environment Impact Assessment", McGraw-Hill Book Company, New York
- **2.** G.J. Rau and C.D. Weeten, "Environmental Impact Analysis Hand book, McGraw Hill, 1980.
- 3. Vijay Kulkarni and T V Ramchandra. "Environmental management" Capital Publishing Co
- 4. Mhaskar A.K., "Environmental Audit" Enviro Media Publications.
- **5.** S.K. Dhameja, "Environmental Engineering and Management" S.K. Kalaria and Sons Publishers.

Course Title and Code: Risk Analysis and Solid Waste Management (MTHSE 202)							
Hours per Week	L-T-P: 3-0-0						
Credits	3						
Students who can take	M.Tech Semester-II (Batch: 2018-2020)						

Course Objective:

The objective of this course is study risk identification, assessment and management of hazard materials. And how various methods and software's helpful for risk analysis. This course also gives the student an overview of solid and hazard waste management including collection, transfer, transport, and disposal. Methods of processing, basic disposal facilities, disposal options, and the environmental issues of solid waste management will be covered in this course.

On successful completion of this course students will be able to:

- 1) Distinguish the type and source of (hazard) risk in workplace or plant.
- 2) Apply hazard analysis methods (HAZOP, FETI, and HAZAN & FMEA) and software's tools.
- 3) Identify sources and classification of various solids wastes.
- 4) Describe composition of solid waste and select the appropriate method for solid waste collection, transportation, redistribution and disposal.
- 5) Use the physical, chemical, thermal and biological methods of treating hazardous waste and adopt waste minimization and pollution prevention techniques.
- 6) Apply the legal legislation related to solid waste management.

Prerequi	sites	
Sr. No.	Evaluation Component	Marks
1	Attendance	NIL
2	Assignment	10
3	Class Participation	5
4	Quiz	5
5	Theory Exam-I	10
6	Theory Exam-II	10
7	Theory Exam-III	40
8	Report-I	NIL
9	Report-II	NIL
10	Report-III	NIL
11	Project-I	20
12	Project-II	NIL
13	Project-III	NIL
14	Lab Evaluation-I	NIL
15	Lab Evaluation-II	NIL
16	Course Portfolio	NIL
	Total (100)	100

Course Syllabi (Theory):

Unit -1- Risk and Hazard Assessment: Introduction, hazard monitoring-risk issue - Hazard assessment, procedure, methodology; safety audit, checklist analysis, what-if analysis, safety review, preliminary hazard analysis (PHA), hazard operability studies (HAZOP).

Unit-2- Risk Analysis Quantification and Software's: Fault Tree Analysis & 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 Software on Risk analysis, CISCON, FETI, ALOHA.

****Case Studies:** 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,

Unit-3- Sources, Classification & Regulatory Framework: Types and Sources of solid and hazardous wastes - Need for solid and hazardous waste management – Elements of integrated waste management and roles of stakeholders - Salient features of Indian legislations on management and handling of municipal solid wastes, hazardous wastes, biomedical wastes, lead acid batteries, electronic wastes, plastics and fly ash.

Unit-4- Storage, Collection And Transport of Wastes: Handling and segregation of wastes at source – storage and collection of municipal solid wastes – Analysis of Collection systems - Need for transfer and transport – Transfer stations Optimizing waste allocation– compatibility, storage, labeling and handling of hazardous wastes – hazardous waste manifests and transport. **Unit-5- Waste Disposal & Waste Processing Technologies:** Waste disposal options – Disposal in landfills - Landfill Classification, types and methods – site selection - design and operation of sanitary landfills, secure landfills and landfill bioreactors – leachate and landfill gas management – landfill closure and environmental monitoring, Objectives of waste processing – material separation and processing technologies – biological and chemical conversion technologies – methods and controls of Composting - thermal conversion technologies and energy recovery – incineration

Text books &Reference(s)

- 1. Loss Prevention in Process Industries-Frank P. Less Butterworth-Hein UK 1990 (Vol.I, II & III)
- 2. Methodologies for Risk and Safety Assessment in Chemical Process Industries, Commonwealth Science Council, UK
- 3. Hazop and Hazon, by Trevor A Klett, Institute of Chemical Engineering.
- 4. "Guidelines for Chemical Process Quantitative Risk Analysis", second edition, Centre for Chemical Process safety, AICHE, 2000
- **5.** Guidelines for Hazard Evaluation Procedures, Third Edition, Centre for Chemical Process safety, AICHE 2008. 6. Layer of Protection Analysis, Centre for Chemical Process safety, AICHE
- 6. P. Frank. Less Butterworth-Hein, Loss Prevention in Process Industries (Vol.I, II and III), Butterworth-Hein UK 1990.
- 7. F.I. Khan, S.A. Abbasi, Advanced Risk Assessment In Chemical Process Industries, Discovery Publishing House, 2000.
- 8. Center for Chemical Process Safety (CCPS), Quantitative Risk assessment in Chemical Industries, Institute of Chemical Industries, and Centre for Chemical process safety. Second Edition, 2000.
- 9. Guidelines for Hazard Evaluation Procedures, Centre for Chemical Process safety, AICHE 2008.

Con	ra ada		Course T	'itla			Teaching Scheme				
Cou	rse coue		Course I	lue			L	Т	P	C	redits
MTHSE 211 (Elective-I)Quality and Safety Management in Construction					ent in		3	0	0		3
Evaluation Scheme (Theory)					Evaluation Scheme (Practical))
Mid Ter m Test – I	Mid Term Test – II	End Ter m Test	Class Participation/ Additional Continuous Evaluation*	Total Marks **	Mid Ter m Test - I	End Ter m Test	Cla Add	ass Pai itional Evalı	ticipat Contin ation*	ion/ nuous	Total Marks **

**The ratio of weightage between Theory and Practical content will be 60%: 40%

Syllabus (Theory)

Unit 1-Overview: Diverse nature of construction projects, definitions, stakeholders, specifications, compliance, acceptance, relating quality of materials, components and system, factors influencing quality and safety, contracts, inspection, cost of quality and safety, processes and products, archiving records;

Unit 2-Concepts of quality control: Objectives, definitions, systems, ISO 9000 family of standards, third-party certification, QC in construction and large projects (aircraft, ship building);

Unit 3-Basic construction safety: Hazards, human factors in construction safety, introduction to occupational health and safety, problem areas in construction safety, elements of an effective safety program, job-site safety assessment, safety planning, safety audit;

Unit 4- Safety during emergency: Safety during Earthquake, Safety during Building collapsing

Unit 5-Legal issues in quality and safety: Regulatory framework, labour laws, compensation; **Unit 6-Safety engineering:** Training, audit, management practices, safety planning, PPE, construction accidents: nature, causes, and investigation and reporting accidents;

Unit 7-Case studies and examples: Quality and safety issues in steel construction, concrete construction (including pre-cast, pre-stressed), tunnelling, bridges.

REFERENCES

- 1. Tang, S.L., Ahmed, S.M., Aoieong, Raymond T. and Poon, S.W. (2005), Construction quality management, Hong Kong University Press, Hong Kong.*
- 2. Poon, S.W., Tang, S.L. and Wong, Francis K.W. (2008), Management and economics of construction safety in Hong Kong, Hong Kong University Press.*
- 3. International Journal of Quality and Reliability Management. (Emerald's journal)
- 4. The TQM Journal (Emerald's journal)
- 5. Safety Science (Elsevier's journal)

Con	waa aada		Course T	':4]o			Teaching Scheme					
Cou	rse coue		Course The			L	Т	P	Cr	edits		
MTHSE 212 (Elective-I) Fire Engineering And Expl				nd Explos	ad Explosion Control 3 0 0						3	
Evaluation Scheme (Theory)					Evaluation Scheme (Practical)							
Mid Ter m Test – I	Mid Term Test – II	End Ter m Test	Class Participation/ Additional Continuous Evaluation*	Total Marks **	Mid Ter m Test - I	End Ter m Test	Class Participation/ Additional Continuou Evaluation*				Total Mark s**	

**The ratio of weightage between Theory and Practical content will be 60%: 40%

Syllabus (Theory)

Unit 1-PHYSICS AND CHEMISTRY OF FIRE: Fire properties of solid, liquid and gasesfire spread - toxicity of products of combustion - theory of combustion and explosion – vapour clouds – flash fire – jet fires – pool fires – unconfined vapour cloud explosion, shock waves auto-ignition – boiling liquid expanding vapour explosion – case studies – Flixborough, Mexico disaster, Pasedena Texas, Piper Alpha, Peterborough and Bombay Victoria dock ship explosions.

Unit 2-FIRE PREVENTION AND PROTECTION: 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 3-INDUSTRIAL FIRE PROTECTION SYSTEMS: Sprinkler-hydrants-stand pipes – special fire suppression systems like deluge and emulsifier, selection criteria of the above installations, reliability, maintenance, evaluation and standards – alarm and detection systems. Other suppression systems – CO2 system, foam system, dry chemical powder (DCP) system, halon system – need for halon replacement – smoke venting. Portable extinguishers – flammable liquids – tank farms – indices of in flammability-firefighting systems.

Unit 4-BUILDING FIRE SAFETY: Concept of building Design to ensure evacuation in case of Fire, 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 5-EXPLOSION PROTECTING SYSTEMS: 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 gasrupture disc in process vessels and lines explosion, suppression system based on carbon dioxide (CO2) and halons-hazards in LPG, ammonia (NH3), sulphur dioxide (SO2), chlorine (CL2) etc.

TEXT BOOK

1. Derek, James, "Fire Prevention Hand Book", Butter Worths and Company, London, 1986

REFERENCES

- 1. Gupta, R.S., "Hand Book of Fire Technology" Orient Longman, Bombay 1977.
- 2. "Accident Prevention manual for industrial operations" N.S.C., Chicago, 1982.
- 3. DinkoTuhtar, "Fire and explosion protection"
- 4. "Davis Daniel et al, "Hand Book of fire technology"
- 5. Fire fighters hazardous materials reference book Fire Prevention in Factories", an Nostrand Rein Hold, New York, 1991.
- 6. "Fire Prevention and firefighting", Loss prevention Association, India.
- 7. Relevant Indian Acts and rules, Government of India.

Con	maa aada		Course T	' :4]				Tea	ching S	Scheme	<u>;</u>
Cou	rse coue		Course rule				L	Т	Р	Cr	edits
MTH (Ele	ISE 213 ective-I)	3	Transport S	ansport Safety 3 0					0	3	
Evaluation Scheme (Theory)						Evaluation Scheme (Practical)					
Mid Ter m Test – I	Mid Term Test – II	End Ter m Test	Class Participation/ Additional Continuous Evaluation*	Mid Ter m Test - I	End Ter m Test	Cla Add	ass Par itional Evalu	ticipat Contin ation*	ion/ nuous	Total Mark s**	

**The ratio of weightage between Theory and Practical content will be 60%: 40%

Syllabus (Theory)

Unit 1-TRANSPORTATION OF HAZARDOUS GOODS 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 2-ROAD TRANSPORT Introduction – factors for improving safety on roads – causes of accidents due to drivers and pedestrians-design, selection, operation and maintenance of motor trucks-preventive maintenance-check lists-motor vehicles act – motor vehicle insurance and surveys.

Unit 3-DRIVER AND SAFETY Driver safety programme – selection of drivers – driver training-tacho-graph-driving testdriver'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 4-ROAD and RAILWAY SAFETY Road alignment and gradient-reconnaissance-ruling gradient-maximum rise per k.m.- factors influencing alignment like tractive resistance, tractive force, direct alignment, vertical curves breaking characteristics of vehicle-skidding-restriction of speeds-significance of speeds Pavement conditions – Sight distance – Safety at intersections – Traffic control lines and guide posts-guard rails and barriers – street lighting and illumination overloading concentration of driver. Plant railway: Clearance-track-warning methods-loading and unloading-moving cars-safety practices.

Unit 5-SHOP FLOOR AND REPAIR SHOP SAFETY Transport precautions-safety on manual, mechanical handling equipment operations-safe driving-movement of cranesconveyors etc., servicing and maintenance equipment-grease rack operation-wash rack operation-battery charging-gasoline handling-other safe practices off the road motorized equipment.

TEXT BOOKS

- 1. Popkes, C.A. "Traffic Control and Road Accident Prevention" Chapman and Hall Limited, 1986.
- 2. Babkov, V.F., "Road Conditions and Traffic Safety" MIR Publications, Moscow, 1986.

REFERENCES

- 1. Kadiyali, "Traffic Engineering and Transport Planning" Khanna Publishers, New Delhi, 1983.
- 2. Motor Vehicles Act, 1988, Government of India.
- 3. "Accident Prevention Manual for Industrial Operations", NSC, Chicago, 1982.
- 4. Pasricha, "Road Safety guide for drivers of heavy vehicle" Nasha Publications, Mumbai, 1999.
- 5. K.W.Ogden, "Safer Roads A guide to Road Safety Engineering"

Course T	itle and Code: Safety in Chemical I	ndustry (MTHSE 214)								
Hours per	Week	L-T-P: 3-0-0								
Credits		3								
Students v	who can take	M.Tech Semester-II (Batch: 2018-2020)								
Course O	bjective:									
The objec	tive of this course is to study risk iden	ntification and management in process plant integrity								
managem	ent. Process integrity management of	or process safety management is important because								
accidents	in process plants can cause signific	ant casualties and serious financial losses with the								
potential	impact on the community over a wide	e radius from the plant itself. This course focuses on								
high cons	equence and low probability events.									
On succe	ssful completion of this course stude	ents will be able to:								
1. Disting	guish the typical sources of risk in a pr	cocess plant by;								
2. Assess	2. Assess the severity of the consequences of incidents;									
3. Undert	3. Undertake a Hazard and Operability Study (HAZOP);									
4. Explain	n the legal framework controlling pro-	cess plant safety in India;								
5. Analyz	te the root cause of accidents in chemi	cal industry.								
Prerequis	sites	Occupational Health and Safety								
Sr. No.	Evaluation ComponentMarks									
1	Attendance	NIL								
2	Assignment	10								
3	Class Participation	5								
4	Quiz	5								
5	Theory Exam-I	10								
6	Theory Exam-II	10								
7	Theory Exam-III	40								
8	Report-I	NIL								
9	Report-II	NIL								
10	Report-III	NIL								
11	Project-I	20								
12	Project-II	NIL								
13	Project-III	NIL								
14	Lab Evaluation-I	NIL								
15	Lab Evaluation-II	NIL								
16	Course Portfolio	NIL								
	Total (100)	100								

Syllabus (Theory)

SAFETY IN PROCESS DESIGN AND PRESSURE SYSTEM DESIGN: 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.

PLANT COMMISSIONING AND INSPECTION 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.

PLANT MAINTENANCE, MODIFICATION AND EMERGENCY PLANNING 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

STORAGES AND TRASPORTATION 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 Hazards during transportation – pipeline transport

PLANT OPERATIONS 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. Specific safety consideration for Cement, paper, pharmaceutical, petroleum, petro- chemical, rubber, fertilizer and distilleries.

Text Book 1. Lees, F.P. "Loss Prevention in Process Industries" Butterworths and Company, 1996.

References

1. "Quantitative Risk Assessment in Chemical Process Industries" American Institute of Chemical Industries, Centre for Chemical Process safety.

2. Fawcett, H.h. and Wood, "Safety and Accident Prevention in Chemical Operations" Wiley inters, Second Edition.

3. "Accident Prevention Manual for Industrial Operations" NSC, Chicago, 1982.

4. GREEN, A.E., "High Risk Safety Technology", John Wiley and Sons, 1984.

5. Petroleum Act and Rules, Government of India. 6. Carbide of Calcium Rules, Government of India.

Con	raa aada		Course 7	Sitle			Teaching Scheme				
Cou	rse coue		Course Thie				L	Т	Р	Cr	edits
MTH (Ele	HSE 215 ective-I)	5	Design of Air pollution control system				3	0	0	3	
Evaluation Scheme (Theory)						Evaluation Scheme (Practical)					
Mid Ter m Test – I	Mid Term Test – II	EndClass Participation/ Additional mTotal Marks **TestEvaluation*				End Ter m Test	Cla Add	ass Par itional Evalu	ticipat Contin ation*	ion/ nuous	Total Mark s**

**The ratio of weightage between Theory and Practical content will be 60%: 40%

Syllabus (Theory)

Unit 1-Industrial sources of Air Pollution – Emission factors – Regulations – Control Strategies – Policies.

Unit 2-Particulate pollutant control: Settling chambers – Laminar and Turbulent flow - Filtration – Interception – Impaction – Convective diffusion – Collection of particles by fibers and Granular beds – Electrostatic precipitation – Cyclones – Wet Collectors.

Unit 3-Gaseous Pollutant control: Gas absorption in tray and packed towers – Absorption with / Without chemical reaction – Removal of SO2 – Absorption in fixed blades-Breakthrough. Removal of HCs / VOCs – NOx removal – Wet scrubbers. Integrated Air pollution control systems.

- 1. Lawrence. K. Wang, Norman. C Perelra, Yung-Tse-Hung., Air Pollution Control Engineering, Tokyo.
- 2. Noel de Nevers, Air Pollution Control Engineering. McGraw Hill, New York.

Con	rso oodo		Cour	so Titlo				T	eaching	g Schei	me
Cou	ise coue		Cour	se mile			L	Т	Р	C	redits
MTHSE 216 (Elective-I) Indoor Air Quality						3	0	0	3		
Evaluation Scheme (Theory) Evaluation					ion Scheme (Practical)						
Mid Ter m Test – I	Mid Term Test – II	End Ter m Test	Class Participation/ Additional Continuous Evaluation*	Total Marks **	MidEndClass Participation/ AdditionalTermTermClass Participation/ AdditionalTest - ITestClass Participation/ Evaluation*				ation/ ll ıs ı*	Total Marks **	

**The ratio of weightage between Theory and Practical content will be 60%: 40%

Syllabus (Theory)

Indoor activities of inhabitants - Levels of pollutants in indoor and outdoor air- Design and operation of buildings for improvements of public health- IAQ policy issues- sustainability. **Air pollutants in indoor environments**- private residences- offices- schools-public buildings-ventilation. Control of several pollutant classes- radon- toxic organic gases- combustion by-products microorganisms such as molds and infectious bacteria.

Concepts and tools- exposure- material balance models- statistical models.

Indoor air pollution from outdoor sources- particulate matter and ozone- Combustion byproducts- Radon and its decay products- Volatile organic compounds- odors and sick-building syndrome- Humidity- Bio aerosols- infectious disease transmission- Special indoor environments- A/C units in indoor Measurement methods- Control technologies- Control strategies

- 1. Thaddes Godish, Indoor air and Environmental Quality, CRC press, 2000.
- 2. Nazaroff W.W. and L. Alvarez-Cohen, Environmental Engineering Science, Wiley sons, Newyork, 2001.
- 3. Hinds, W. C., Aerosol technology: Properties, behavior, and measurement of airborne particles, Wiley (1999)
- 4. Morawska, L. and Salthammer, T., Indoor environment: airborne particles and settled dust, Wiley-VCH (2003)
- 5. Salthammer, T. and Uhde, E., Organic Indoor Air Pollutants: occurrence, measurement, evaluation, Wiley-VCH (2009)
- 6. Seinfeld, J. H. and Pandis, S. N., Atmospheric chemistry and physics: from air pollution to climate change, Wiley (2006)
- 7. Spengler, J., McCarthy, J., and Samet, J. Indoor air quality handbook, McGraw-Hill Professional (2001)

Con	raa aada		Course	Title			Teaching Scheme					
Cou	rse coue		Course Thie				L	Т	Р	Cı	redits	
MTH (Ele	HSE 221 ctive-II)		Safety in	Safety in Construction				0	0	3		
Evaluation Scheme (Theory)						Evaluation Scheme (Practical)						
Mid Ter m Test – I	Mid Term Test – II	End Ter m Test	Class Participation/ Additional Continuous Evaluation*	Mid Ter m Test - I	End Ter m Test	Cla Add	ass Par itional Evalu	ticipat Contin ation*	ion/ nuous	Total Marks **		

**The ratio of weightage between Theory and Practical content will be 60%: 40%

Syllabus (Theory)

Unit 1-ACCIDENTS CAUSES AND MANAGEMENT SYSTEMS: Problems impeding safety in construction industry- causes of fatal accidents, types and causes of accidents related to various construction activities, human factors associated with these accident – construction regulations, contractual clauses – Pre contract activates, preconstruction meeting - design aids for safe construction – permits to work – quality assurance in construction - compensation – Recording of accidents and safety measures – Education and training

Unit 2-HAZARDS OF CONSTRUCTION AND PREVENTION: Excavations, basement and wide excavation, trenches, shafts – scaffolding, types, causes of accidents, scaffold inspection checklist – false work – erection of structural frame work, dismantling – tunneling – blasting, pre blast and post blast inspection – confined spaces – working on contaminated sites – work over water - road works – power plant constructions – construction of high rise buildings.

Unit 3-WORKING AT HEIGHTS: Fall protection in construction OSHA 3146 – OSHA requirement for working at heights, Safe access and egress – safe use of ladders- Scaffoldings , requirement for safe work platforms, stairways, gangways and ramps – fall prevention and fall protection , safety belts, safety nets, fall arrestors, controlled access zones, safety monitoring systems – working on fragile roofs, work permit systems, height pass – accident case studies.

Unit 4-CONSTRUCTION MACHINERY: Selection, operation, inspection and testing of hoisting cranes, mobile cranes, tower cranes, crane inspection checklist - builder's hoist, winches, chain pulley blocks – use of conveyors - concrete mixers, concrete vibrators – safety in earth moving equipment, excavators, dozers, loaders, dumpers, motor grader, concrete pumps, welding machines, use of portable electrical tools, drills, grinding tools, manual handling scaffolding, hoisting cranes – use of conveyors and mobile cranes – manual handling. **Unit 5-SAFETY IN DEMOLITION WORK:** Safety in demolition work, manual, mechanical, using explosive - keys to safe demolition, pre survey inspection, method statement, site supervision, safe clearance zone, health hazards from demolition - Indian standard - trusses, girders and beams – first aid – fire hazards and preventing methods – interesting experiences at the construction site against the fire accidents.

- 1. Hudson, R.,"Construction hazard and Safety Hand book, Butter Worth's, 1985.
- 2. JnatheaD.Sime, "Safety in the Build Environment", London, 1988.

- 3. V.J.Davies and K.Thomasin "Construction Safety Hand Book" Thomas Telford Ltd., London, 1990.
- 4. Handbook of OSHA Construction safety and health charles D. Reese and James V. Edison
- 5. Fulman, J.B., Construction Safety, Security, and Loss Prevention, John Wiley and Sons, 1979.

Course Title and Code: Electrical Safety (MTHSE 222)									
Hours per Week L-T-P: 3-0-0									
Credits	3								
Students who can take	M.Tech Semester-II (Batch: 2018-2020)								

Course Objective:

The goal of this course is to discuss electrical hazards, Safety standards, protection issues, identification of sensors for protection and develop understanding of the CEA regulations for Electrical safety. This course will facilitate students to find solutions of electrical hazards.

On successful completion of this course students will be able to:

- 1) Identify the hazards associated with electricity: shock and fire.
- 2) Investigative the cause of electrical accidents and fires.
- 3) Identify and explain how to respond to electrical emergencies.
- 4) Identify safe work practices when exposed to electrical hazards (including risk assessment)
- 5) Apply the acts in accordance with the risk and safety issues, legal obligations codes of safety practice.
- 6) Explain the Indian electricity safety code and rules
- 7) Plan and take measures to minimize hazards
- 8) Formulate the suitable methodologies to determine safety risks in relevant practical applications.
- 9) Review the design of existing electrical systems as per the standard electrical safety code.
- 10) Integrate the sensors for the monitoring and automation of electrical systems.

Prerequi	sites	Basics of Electrical Engineering,
Sr. No.	Evaluation Component	Marks
1	Attendance	-
2	Assignment	05
3	Class Participation	05
4	Quiz	10
5	Theory Exam-I	10
6	Theory Exam-II	10
7	Theory Exam-III	30
8	Report-I	05
9	Report-II	05
10	Report-III	-
11	Project-I	10
12	Project-II	10
13	Project-III	-
14	Lab Evaluation-I	-
15	Lab Evaluation-II	-
16	Course Portfolio	-
	Total (100)	100

Syllabus (Theory)

Unit I: Concepts and Statutory Requirements

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

Primary and secondary hazards-shocks, burns, scalds, falls-human safety in the use of electricity. Energy leakage-clearances and insulation-classes of insulation-voltage

classifications-excess energy-current surges-Safety in handling of war equipments-over current and short circuit current-heating effects of current-electromagnetic forces-corona effect-static electricity –definition, sources, hazardous conditions, control, electrical causes of fire and explosion-ionization, spark and arc-ignition energy-national electrical safety code ANSI. Lightning, hazards, lightning arrestor, installation –earthing, specifications, earth resistance, earth pit maintenance.

Unit III: Protection Systems

Fuse, circuit breakers and overload relays –protection against over voltage and under voltage –safe limits of amperage –voltage –safe distance from lines-capacity and protection of conductor-joints-and connections, overload and short circuit protection-no load protection-earth fault protection. FRLS insulation-insulation and continuity test-system grounding-equipment grounding-earth leakage circuit breaker (ELCB)-cable wires-maintenance of ground-ground fault circuit interrupter-use of low voltage-electrical guards-Personal protective equipment –safety in handling hand held electrical appliances tools and medical equipments.

Unit IV: Selection, Installation, Operation and Maintenance

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

Classification of hazardous zones-intrinsically safe and explosion proof electrical apparatusincrease safe equipment-their selection for different zones-temperature classification-grouping of gases-use of barriers and isolators-equipment certifying agencies.

- 1. Mary Capelli-Schellpfeffer, Dennis Neitzel, John Cadick, Al Winfield, "Electrical Safety Handbook" McGraw-Hill Education.
- 2. Mohamed A. El-Sharkawi, "Electric Safety: Practice and Standards" CRC Press.
- 3. Krishnan, N.V., Safety Management in Industry, Jaico Publishing House,
- 4. Cooper W.F., Electrical Safety Engineering, Newnes.
- 5. Cadick, J., et. al., Electrical Safety Handbook, McGraw Hill Education.
- 6. Bureau of Indian Standards, National Electrical Code 2011, Bureau of Indian Standards, New Delhi, 2011.

Con	ra ada		Course T	'itla				Tea	ching	Schem	e
Cou	rse coue		Course 1	lue			L T P Cr				redits
MTHSE 223 (Elective-II)Disaster management					3 0 0 3					3	
Evaluation Scheme (Theory)					Evaluation Scheme (Practical))
Mid Ter m Test – I	Mid Term Test – II	End Ter m Test	Class Participation/ Additional Continuous Evaluation*	Mid Ter m Test - I	End Ter m Test	Cla Add	ass Par itional Evalu	ticipat Contin ation*	ion/ nuous	Total Marks **	

**The ratio of weightage between Theory and Practical content will be 60%: 40%

Syllabus (Theory)

Unit 1-Philosophy of Disaster management: Introduction to Disaster mitigation-Hydrological, Coastal and Marine Disasters-Atmospheric disasters-Geological, meteorological phenomena Mass Movement and Land Disasters-Forest related disasters-Wind and water related disasters-deforestation-Use of space technology for control of geological disasters-Master thesis

Unit 2-Technological Disasters: Case studies of Technology disasters with statistical details Emergencies and control measures-APELL-Onsite and Offsite emergencies-Crisis management groups-Emergency centers and their functions throughout the country-Software's on emergency controls-Monitoring devices for detection of gases in the atmosphere-Right to know act

Unit 3-Introduction to Sustainable Development: Bio Diversity-Atmospheric pollution-Global warming and Ozone Depletion-ODS banking and phasing out-Sea level rise-El Nino and climate changes-Eco friendly products-Green movements-Green philosophy-Environmental Policies-Environmental Impact Assessment-case studies-Life cycle

Unit 4-Offshore and onshore drilling: control of fires-Case studies-Marine pollution and control Toxic, hazardous & nuclear wastes-state of India's and Global environmental issues carcinogens-complex emergencies-Earthquake disasters-the nature-extreme event analysis the immune system-proof and limits

Unit 5-Environmental education: Population and community ecology-Natural resources conservation-Environmental protection and law-Research methodology and systems analysis Natural resources conservation-Policy initiatives and future prospects-Risk assessment process, assessment for different disaster types-Assessment data use, destructive capacity-risk adjustment-choice-loss acceptance-disaster aid- public liability insurance-stock taking and vulnerability analysis-disaster profile of the country-national policies-objectives and standards-physical event modification-preparedness, forecasting and warning, land use planning, Water Supply and Sanitation under emergency

- 1. Introduction to Environmental Engineering and Science, Gilbert, M. Masters
- 2. Environmental Science, Miller, G. Tylor
- 3. Environmental Science sustaining the earth, G. Tylor, Miller
- 4. Principles of Environmental Science and Engineering, Bagad Vilas.
- 5. Principles of Environmental Science and Engineering, R. Sivakumar

Cou	nco oodo		Course T	Sitle			Teaching Scheme				
Cou	rse coue		Course 1	Course The				Т	P	Cı	redits
MTHSE 224 (Elective-II) Safety in Mines						3 0 0 3					
Evaluation Scheme (Theory)					Evaluation Scheme (Practical))
Mid Ter m Test – I	Mid Term Test – II	End Ter m Test	Class Participation/ Additional Continuous Evaluation*	Total Marks **	Mid Ter m Test - I	End Ter m Test	Cla Add	ass Paı itional Evalı	ticipat Contin ation*	tion/ nuous	Total Marks **

**The ratio of weightage between Theory and Practical content will be 60%: 40%

Syllabus (Theory)

Unit 1-OPENCAST MINES Causes and prevention of accident from: Heavy machinery, belt and bucket conveyors, drilling, hand tools-pneumatic systems, pumping, water, dust, electrical systems, and fire prevention. Garage safety – accident reporting system-working condition-safe transportation – handling of explosives.

Unit 2-UNDERGROUND MINES Fall of roof and sides-effect of gases-fire and explosionswater flooding-warning sensors-gas detectors-occupational hazards-working conditionswinding and transportation.

Unit 3-TUNNELLING 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 4-RISK ASSESSMENT 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 5-ACCIDENT ANALYSIS AND MANAGEMENT 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. Safety regulations for mines

Unit 6- Notifiable diseases, Nationally Notifiable Diseases, Silicosis problem: Symptoms, Causes, and Risk Factors.

TEXT BOOK

1. "Mine Health and Safety Management", Michael Karmis ed., SME, Littleton, Co.2001. **REFERENCES**

- 1. Kejiriwal, B.K. Safety in Mines, Gyan Prakashan, Dhanbad, 2001.
- 2. DGMS Circulars-Ministry of Labour, Government of India press, OR Lovely Prakashan DHANBAD, 2002.

Course code			Sitle				Tea	ching	Schem	e	
Course code			Course I	Ine			L	Т	P	C	redits
MTHSE 225 (Elective-II) Industrial Noise and Vibra			ibration	Contro	l	3	0	0		3	
Evaluation Scheme (Theory)					Eval	uatio	n Schei	me (Pr	actical)	
Mid Ter m Test – I	Mid Term Test – II	End Ter m Test	Class Participation/ Additional Continuous Evaluation*	Total Marks **	Mid Ter m Test - I	End Ter m Test	Cla Add	ass Par itional Evalu	ticipat Contin ation*	tion/ nuous	Total Marks **

**The ratio of weightage between Theory and Practical content will be 60%: 40%

Syllabus (Theory)

Unit 1-INTRODUCTION: Basic definitions and terminology used in Vibrations and acoustics – Mathematical concepts and degrees of freedom in vibratory systems – Natural frequencies and vibration modes – continuous systems and wave theory concept – wave equation and relation to acoustics - theory of sound propagation and terminology involved – Plane wave and spherical waves – Concepts of free field and diffuse field, nearfield and farfield – frequency analysis and vibration and noise spectrum – Signature analysis and condition monitoring.

Unit 2-INSTRUMENTATION AND AUDITORY: Sensors used in vibration and measurements – Frequency and spectrum analysers – Weighting networks – Hearing mechanism – relation between subjective and objective sounds – Auditory effects of noise and audiometric testing – Speech interference levels and its importance.

Unit 3-SOURCES OF NOISE AND RATINGS: Mechanism of noise generation and propagation in various machinery and machine components, vehicles etc. – Directivity index – Concept of Leq and estimation – Noise ratings and standards for various sources like industrial, construction, traffic, aircraft community etc. – industrial safety and OSHA regulations – Noise legislations and management.

Unit 4-NOISE CONTROL Energy transferring and dissipating devices Source: Structure borne and flow excited. Vibration isolation and absorption. Spring and damping materials, Dynamic absorbers, Mufflers and silencers, Path: Close filter and loosely covered enclosures – Acoustic treatment and materials – Transmission loss and absorption coefficient of materials and structures and their estimation – Reverberation time and room constant – Design of rooms / industrial halls/ auditorium for minimum noise. Receiver: Measure to control at the receiver end – use of enclosures, ear muffs and other protective devices.

Unit 5-ABATEMENT OF NOISE Active noise attenuators and scope for abatement of industrial noise.

Text Book

1. Irwin, J.D and Graf, E. R, Noise and Vibration Control, Prentice Hall Inc. New Jercy, 1979. **References**

- 1. Irwing B Crandall, Theory of Vibrating Systems and Sound, D. Vannostrand Company, New Jercy, 1974.
- 2. Cyril M. Harris, Hand Book of Noise Control, McGraw Hill Book Company, New York, 1971.
- 3. White R. G. Walker J. G, "Noise and Vibration", John Wiley and sons New York, 1982.

Course T	itle and Code: Project Studio-II (M	THSE 203)			
Hours per	Week	L-T-P: 0-0-4			
Credits		2			
Students v	who can take	M.Tech Semester-II (Batch: 2018-2020)			
Course Objective:					
The object	tive of this course is to study analyz	e and assess the pollution in air, water and soil and			
subsequer	ntly predict the mitigation measures.				
On succe	essful completion of this course stud	ents will be able to:			
1. Disting	uish the typical sources of air, water a	and soil pollution.			
2. Assess the severity of the consequences of pollution by measuring it either in field or in labs.					
3. Predict	the impacts of industrial pollution.				
4. Sugges	t the impact mitigation measures of in	dustrial pollution.			
5. Explain	the legal framework of pollution con	trolling boards/authority.			
Prerequisites					
Sr. No.	Evaluation Component	Marks			
1	Attendance				
2	Assignment	20			
3	Class Participation				
4	Quiz				
5	Theory Exam-I				
6	Theory Exam-II				
7	Theory Exam-III				
8	Report-I	10			
9	Report-II	10			
10	Report-III				
11	Project-I	30			
12	Project-II	30			
13	Project-III				
14	Lab Evaluation-I				
15	Lab Evaluation-II				
16	Course Portfolio				
	Total (100)	100			

Syllabus (Theory)

In this exercise students will work in small groups and undertake studies on environment engineering or Industrial safety and management. The aim of this project is to make students able to understand safety needs of organizations in a variety of occupational environments.

Course Title and Code: Personal Brandin	ng & Workplace Communication: CCT601
Hours per Week	L-T-P: 2-0-0
Credits	2
Students who can take	B. Tech Semester-VI (Batch: 2016-20) & M. Tech
	Semester-II (Batch: 2018-20) / Core
Prerequisites	N/A

Course Objective:

This course helps students to identify and craft their personal brand to face the potential employer and prepare them for the workplace.

Learning Outcomes:

The students will be able to:

- 1. Identify their brand, craft their brand statement and articulate their brand, using their strengths.
- 2. Create standout resumes and cover letters.
- 3. Craft an influential pitch and express their professional journey.
- 4. Perform well in GDs and Interviews.
- 5. Identify and correct common communication errors for better branding.
- 6. Create strong brand on social media platforms like LinkedIn, Job Portals, Facebook and Twitter.
- 7. Start building their professional network (online and offline) by identifying their areas of interest and use communication skills to connect with and maintain their networks.

Sr. No	Specifications	Weightage
01	Attendance	10
02	Assignment(s)	40
03	Class Participation	15
04	Quiz	Nil
05	Theory Exam	Nil
06	Theory Exam	Nil
07	Theory Exam	Nil
08	Report-1	15
09	Report-2	Nil
10	Report-3	Nil
11	Project -1	20
12	Project -2	Nil
13	Project -3	Nil
14	Lab Evaluation	Nil
15	Lab Evaluation	Nil
16	Course portfolio	Nil
	Total (100)	100

Syllabus:

Identify your brand: Personal branding: meaning, importance and how to create and use it; the three Cs' of personal branding and personal branding through social media.

Language for better branding: Importance of language in communication and how language can build brand. Avoiding common errors in verbal and written English language, and dos and don'ts of non-verbal language

Professional Story Mapping: Articulation practice on the various aspects of their professional persona – such as background, interests, achievements, education, internships, and so on. Use of story map to create professional journey and prepare for all kinds of FAQs.

The Art of Networking: Meaning and benefits of networking and use of various networking styles. Offline and online networking – offline one-minute talk and ice-breaking

conversations and online – professional messaging, invitation & emailing.

Resume: Resume types, structure of a resume, writing tips on resume – drafting, formatting and editing resume to create their final resume.

Cover Letter: Purpose of a cover letter, types of cover letter, structure of a cover letter and tips on cover letter, to craft their cover letter to be used for placements.

Elevator Pitch: Elevator Pitch: Meaning and use of an elevator pitch in interview and workplace; techniques to craft and improve their pitch.

Group Discussion prep: Practice different types of group discussions, dos and don'ts of group discussions and use of techniques to perform well in GDs.

Interview and FAQs prep: Practice FAQs and other behavioral questions, use of elevator pitch, refine GDs and PIs by using communication checklist - more practice of this in 7th semester.

References:

Reading Material will be provided by the facilitator to the students. Students can refer the following links.

WEBLINKS:

- o https://www.fastcompany.com/28905/brand-called-you
- o https://hbr.org/2015/03/how-to-separate-the-personal-and-professional-on-social-media
- https://brandyourself.com/definitive-guide-to-personal-branding
- o http://pwgmarketing.com/2008/10/what-does-branding-mean-to-you/
- https://cra.org/cra-w/wp-content/uploads/sites/5/2015/05/Building-Your-Professional-Persona.pdf
- $\circ \quad https://www.inc.com/marc-ecko/be-a-brand-not-a-label.html$
- $\circ \quad https://www.inc.com/marc-ecko/be-a-brand-not-a-label.html$
- o https://www.youtube.com/watch?v=rGbsb6aXbzc

Course code	Course T	Sitle	Teaching Scheme		
Course coue	Course 1	lue	Total Duration	Credits	
PS2101	Internsh	ıip	4—6 Weeks	4	
Evaluation Scheme:					
Expert Evaluation		Evaluation (Final Term		
External Supervisor (50)		Based on Feedback		50	
		Reporting Activity Fortnightly		10	
Faculty Supervisor (50)		(10))		
		Report (20)		20	
		Presentation &Viva (20)		20	
	100				

Course Syllabi:

This course is for 6 weeks at the end of 2^{nd} semester during summer term of 2 year full time M.Tech. Program in all the engineering disciplines.

The objective of this programme is to provide the students an understanding of working of corporate world in various functions associated with an Industry/Organization. During this programme, they will observe and learn various real world applications of their curricula and develop an understanding of vast engineering operations and its various facets such as inventory, productivity, management, information systems, human resource development, data analysis etc. The general nature of internship assignments is of study and orientation.



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INSTITUTE OF ENGINEERING AND TECHNOLOGY

2 Year M. Tech Programme (Branch: Health, Safety, and Environment Engineering) Batch 2018-2020 SEMESTER-THREE Detailed Syllabus & Scheme of Examination

Course Title and Code: Industrial Automation and Internet of Things-I (EE2101)			
Hours per Week	L-T-P: 3-0-2		
Credits	4		
Students who can take	M.Tech Semester-I (Batch: 2019-2021) Core		
	M.Tech Semester-III (Batch:2018-2020) Elective-III		

Course Objective: Industrial automation is the application of technology to control the production and delivery of industrial products and services. On the other hand, the Internet of Things (IoT) is transforming the way we work and live, extending the power of the Internet to a whole range of objects different from computers or smartphones. This course aims to provide an introduction to industrial automation and IoT technologies and standards.

After course completion, the student will be able to:

- 1. Analyze the link between Information Technology and Operational Technology.
- 2. Explain the key components that make up an Industrial automation & IoT system.
- 3. Discuss protocols and standards employed at each layer of the Industrial automation & IoT stack. Choose technology for communication and real-time data collection.
- 4. Design, deploy and test a basic Industrial automation & IoT system.
- 5. Apply recommended engineering practices to meet desired requirements for applications. Consider sustainability and cybersecurity as design constraints.

	Prerequisites	
Sr. No	Specifications	Marks
1	Attendance	Nil
2	Assignment	10
3	Class Participation	10
4	Quiz	10
5	MID-TERM Theory Exam	10
6	END TERM Theory Exam	30
7	Theory Exam-III	Nil
8	Report-I	Nil
9	Report-II	Nil
10	Report-III	Nil
11	Project-I	05
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I	30
15	Lab Evaluation-II	Nil
16	Course Portfolio	Nil
	Total (100)	100

Syllabus (Theory)

UNIT1: Introduction. Classical hierarchical industrial automation model. Essential functions of each level. Elements of industrial control (sensors, actuators, transmitters, controllers, etc.). ISA 95 – Enterprise integration. Emergent architectures.

UNIT2: Instrumentation. Characteristics of instruments: accuracy, precision, sensitivity, etc. Units and standards. Voltage, current and electrical power measurements. Measurement of temperature, position, speed, force, pressure, light, level, humidity and other variables. Signal conditioning and transmission. Indicators, recorders. Actuators. Valves and motors. Instrumentation symbols. Functional identification. Standards: ISA 5.1 – Instrument symbols and identification. IEC 61511 Safety Instrumented Systems.

UNIT3: IoT Fundamentals. The genesis of IoT. Digitization vs IoT. Impact. IoT architecture. **UNIT4:** Industrial IoT Fundamentals. The convergence of IT and OT. 4th industrial revolution. Architecture. Design methodology. Industrial communication: principles, protocols, and technologies.

UNIT5: CASE STUDIES

Design and test a basic IIoT system involving prototyping, programming, and data analysis. Application to sustainability problems: health, energy, water, smart cities, etc.

Syllabus (Practical)

1. Characteristics of sensors. Calibration. Temperature, moisture, displacement, voltage, current, etc. Signal conditioning and processing.

- 2. Interfacing LEDs. Serial port. DC-motor.
- 3. IoT communication. Standards: MODBUS, OPC, MQTT, etc.
- 4. Mini-project

Text Book(s)

- 1. Bahga and Madisetti (2014). "Internet of Things: a hands-on approach". CreateSpace Independent Publishing Platform, 1st edition. ISBN: 978-0996025515.
- Hanes, Salgueiro, Grossetete, Barton, and Henry (2017). "IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things". Cisco Press
- 3. William C. Dunn. Fundamentals of Industrial Instrumentation and Process Control, Second Edition. McGraw-Hill Education, 2018

Reference Book(s)

- 1. Gilchrist (2016). "Industry 4.0: The Industrial Internet of Things". Apress.
- 2. John P. Bentley. Principles of Measurement Systems. 4th Edition, Addison Wesley Longman Ltd., UK, 2004

Web Resources: Lectures By S. Mukhopadhyay.

https://www.youtube.com/watch?v=oxMdDsud5vg&list=PL874F91C0180417C3

Course code Course ritie L T P	~
	Credits
MTHSE 312 Transportation Safety Engineering 2 0 2	4
(Elective-III) Transportation Safety Engineering 5 0 2	4

Syllabus:

Transportation Of Hazardous Goods: Transport emergency card (TREM), driver training, parking of tankers on the highways, speed of the vehicle, warning symbols, design of the tanker Lorries, earth chains, static electricity, responsibilities of driver, inspection and maintenance of vehicles, check list-decanting procedures, communication.

Road Transport: Introduction, factors for improving safety on roads, causes of accidents due to drivers and pedestrians, design, selection, operation and maintenance of motor trucks, preventive maintenance, check lists, motor vehicles act, motor vehicle insurance and surveys.

Driver and Safety: Driver safety programme, selection of drivers, driver training tachograph 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, road transport act and rules, driver relaxation and rest pauses, speed and fuel conservation, emergency planning.

Road Safety: Road alignment and gradient, reconnaissance, ruling gradient, maximum rise per K.M. factors influencing alignment like tractive resistance, tractive force, direct alignment, vertical curves, breaking characteristics of vehicle, skidding, restriction of speeds, significance of speeds, Ground speed, 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.

Shop Floor and Repair Shop Safety: Transport precautions-safety on manual mechanical handling equipment operations, safe driving, and 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.

TEXT BOOKS

- 1. Popkes, C.A. "Traffic Control and Road Accident Prevention" Chapman and Hall Limited, 1986.
- 2. Babkov, V.F., "Road Conditions and Traffic Safety" MIR Publications, Moscow, 1986.

REFERENCES

- 1. Kadiyali, "Traffic Engineering and Transport Planning" Khanna Publishers, New Delhi, 1983.
- 2. Motor Vehicles Act, 1988, Government of India.
- 3. "Accident Prevention Manual for Industrial Operations", NSC, Chicago, 1982.
- 4. Pasricha, "Road Safety guide for drivers of heavy vehicle" Nasha Publications, Mumbai, 1999.
- 5. K.W.Ogden, "Safer Roads A guide to Road Safety Engineering"

Course Title and Code: Statistical Data Analysis (AS2101)					
Hours per Week L-T-P		L-T-P	: 3-0-4		
Credits 5		5			
Students who can take M.Teo		M.Tec	h Semester-I (Batch: 2019-2021) Core		
M.Tec			h Semester-III (Batch:2018-2020) Elective-IV		
Course O	bjective:				
This cours	se aims to introduce bas	ic cond	cepts in descriptive and inferential statistics, as well as data		
exploratio	on methods. Topics cove	red inc	lude probability distributions, hypothesis testing, frequency		
analysis, c	correlation, regression a	nd desi	gn of experiments.		
After course completion, the student will be able to:					
1. Frame real world analysis problems using statistical concepts and solve them using					
standard techniques.					
2. Us	se professional level tool	ls to su	pport the study of statistics.		
3. Co	ommunicate quantitative	ideas	to a range of audiences.		
4. Ap	4. Apply recommended practices for data analysis.				
~ ~ ~ ~	Prerequisites				
Sr. No	Specifications		Marks		
1	Attendance		Nil		
2	Assignment		Nil		
3	Class Participation		10		
4	Quiz		10		
5	Theory Exam-I		Nil		
6	Theory Exam-II		Nil		
7	Theory Exam-III		30		
8	Report-I		Nil		
9	Report-II		Nil		
10	Report-III		Nil		
11	Project-I		20		
12	Project-II		Nil		
13	Project-III		Nil		
14	Lab Evaluation-I		30		
15	Lab Evaluation-II		Nil		
16	Course Portfolio		Nil		
	Total (100)		Nil		

SYLLABUS

Principles of Statistical Data Analysis: Data Elements, Variables, and Data categorization, Levels of Measurement: Nominal, Ordinal, Interval, or Ratio, Data management and indexing, Tabular data, Measures of dispersions, Skewness – Karl Pearson and Bowley, Skewness – Kelly coefficient of Skewness and Kurtosis,

Probability Theory, Mathematical expectation, moments, probability and moment generating function, Chebyshev's inequality, Mean and Variance of a Random Variable, product moments, independence of random variables, Joint, marginal and conditional distributions, Discrete and continuous distribution function, Introduction to statistical learning using R-Programming/Python

Basic Statistical Techniques: Sampling Theory and Distributions for Normal and Non-normal Populations, Central Limit Theorem, Point and Interval Estimates, Estimator and Estimates, Sample size calculations Sample Size for Estimating Means and Proportions, Maximum likelihood test, The Central Limit Theorem, p-values and power, Parametric and NonParametric test of Hypothesis, Goodness of fit, Analysis of contingency tables, Non-parametric tests of location and dispersion, Statistical inference using R/Python

Analysis of Continuous and Categorical Data: Estimation Using the Regression Line, Method of Least Squares, Standard Error of Estimate, Prediction Intervals, Multi Variate regression, generalized linear models, Logistic regression, Ordinal logistic regression, Proportional odds models, Multinomial logistic regression, Poisson regression, negative binomial regression, zero-inflated models, Log linear models for (paired) tables. Procedures for stepwise building of a regression model, Introduction to random intercept models, penalized linear regression methods, Graphical and formal diagnostic methods for the inspection of residuals, Correlation Analysis, autocorrelation and cross correlation, Regression and Correlation analysis using R/Python

Design of experiments: Basic principles of experimental designs, Analysis of variance: oneway, Two-way classifications, Latin square design, Two Factorial Design.

Text Book(s)

- 1. Prem S Mann. Introductory statistics. Wiley. Edition: 7th ed. 2010.
- 2. Ronald E Walpole, Raymond H Myers, Sharon L Myers and Keying Ye. Probability and statistics for engineers and scientists. 8th ed New Delhi. Pearson. 2007.

Web Resources

1. Statistics full Course for Beginners.

https://www.youtube.com/watch?v=74oUwKezFho

Introduction to R and RStudio. https://www.youtube.com/watch?v=lL0s1coNtRk

Hours per Week		L-T-P: 3-0-0		
Credits		3		
Students who can take		M.Tech Semester-III (Batch: 2018-2020) Elective		
Course	Objective:			
The goal	of this course is to impart	knowledge of the Fire Chemistry, Major Organizations in th		
Field of Organiza	Fire Safety, Fire Detection tion, and Legislation, Eme	Systems, Care, Maintenance, and Inspection, Legal Aspectargency Response Planning for Safety Professionals, and Fin		
Codes ar	nd Standards.			
After co	urse completion, the stude	nt will be able to:		
1. Io	dentify agency resources for	fire service operations and aid students with information base		
0	n the Fire Protection.			
2. D	Determine organizational pat	terns for fire service operations.		
3. C	Describe the uses and operati	ons of various types of fire control equipment.		
4. C	Determine and identify mater	rials considered hazardous.		
5. R	ecognize the training and ec	ducational experiences needed for fire service personnel.		
6. A	Ascertain the components of	fire service communications and dispatching.		
7. C	Demonstrate accepted manage	gement practices needed to establish and improve fire service		
0	peration.			
	Prerequisites	Engineering Chemistry, Chemical Process Calculation, Mass Transfer, Heat Transfer		
Sr. No	Specifications	Marks		
1	Attendance	05		
2	Assignment	10		
3	Class Participation	05		
4	Quiz	10		
5	Theory Exam-I	10		
6	Theory Exam-II	10		
7	Theory Exam-III	30		
8	Report-I	10		
9	Report-II	Nil		
10	Report-III	Nil		
11	Project-I	10		
12	Project-II	Nil		
13	Project-III	Nil		
	Lab Evaluation-I	Nil		
14	Lab Evaluation-II	Nil		
<u>14</u> 15				
14 15 16	Course Portfolio	Nil		

PHYSICS AND CHEMISTRY OF FIRE: 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; Understanding & Implementing Standards National Fire Protection Act 1407 and 1021. Case studies: Flixborough, Mexico disaster, Pasedena Texas, Piper Alpha, Peterborough, and Bombay Victoria dock ship explosions.

FIRE PREVENTION AND PROTECTION: 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 standpipes, fire station, fire alarms and sirens; maintenance of fire trucks, foam generators, escape from fire rescue operations, fire drills, notice-first aid for burns.

INDUSTRIAL FIRE PROTECTION SYSTEMS: Sprinkler, hydrants, standpipes, 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 system, foam system, dry chemical powder (DCP) system, halon system; the need for halon replacement, smoke venting. Portable extinguishers, flammable liquids, tank farms, indices of inflammability, firefighting systems.

BUILDING FIRE SAFETY: Objectives of fire-safe building design, Fire load, fire-resistant material and fire testing, structural fire protection, structural integrity, the concept of egress design, exists, width calculations; fire certificates, fire safety requirements for high rise buildings, snooker.

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

Text Book

- 1. Derek, James, Fire Prevention Hand Book, Butterworths and Company, London, 1986.
- 2. Daniel E. Della-Giustina, Fire Safety Management Handbook, Third Edition, CRC Press, Taylor & Francis Group, 2014

- 1. Gupta, R.S., Hand Book of Fire Technology, Orient Longman, Bombay 1977.
- 2. Accident Prevention manual for industrial operations, N.S.C., Chicago, 1982.
- 3. Dinko Tuhtar, Fire and explosion protection A System Approach, Ellis Horwood Ltd, Publisher, 1989
- 3. William E. Clark, "Firefighting Principles & Practices", Fire Engineering Books and Videos, 2nd edition 1991.
- 4. Dennis P. Nolan, "Handbook of Fire & Explosion Protection Engineering Principles for Oil, Gas, Chemical, & Related Facilities ", William Andrew Publishers, 1997
- 5. Firefighter's hazardous materials reference book, Fire Prevention in Factories, a Nostrand Rein Hold, New York, 1991.

Course Title and Code: Industrial Project-I (PR2104)					
Hours per Week	L-T-P: 0-0-20				
Credits	10				
Students who can take	M.Tech Semester-III (Batch: 2018-2020) Core				
Comme Ohio stimu					

Course Objective:

The purpose of the Industry Project is to give students the opportunity to gain an insight into the operation of their field of study and develop an understanding of their profession in a professional context. By enabling students to observe the day-to-day operations of an organization and to prepare a research project based on these observations, with the guidance of a work place and academic supervisor, students will develop a critical perspective of their profession. Students will attend pre and post placement classes to guide the development of their research project, the sourcing of their host organization and the protocols associated with the placement.

After course completion, the student will be able to:

- 1. Identify skills and capabilities that intersect effectively with the needs of industry.
- 2. Apply and practice good communication skills in the workplace setting.
- 3. Reflect and evaluate on experiences that might lead to future employment.
- 4. Report research findings in written and verbal forms.
- 5. Demonstrate and apply research skills to complete a project.

	Prerequisites	
Sr. No	Specifications	Marks
1	Attendance	Nil
2	Assignment	Nil
3	Class Participation	Nil
4	Quiz	Nil
5	Theory Exam-I	Nil
6	Theory Exam-II	Nil
7	Theory Exam-III	Nil
8	Report-1 (Synopsis)	10
9	Report-II	Nil
10	Report-III	Nil
11	Project-I (Mid Term Exam)	20
12	Project -2 (Day to Day work) (30
12	Demo, Presentation, Viva, Report)	
13	Project -3 (End Term) (Demo,	40
15	Presentation, Viva, Report)	
14	Lab Evaluation-I	Nil
15	Lab Evaluation-II	Nil
16	Course Portfolio	Nil
	Total (100)	100

Syllabus:

Dissertation-I/ Industrial Project-I/ Entrepreneurial Project-I, Research and development projects based on problems of practical and theoretical interest. Students may choose a project based on any subject of Health, safety and Environmental Engineering. The student will submit a synopsis at the beginning of the semester for approval from the departmental committee in a specified format. Evaluation will be based on student seminars, written reports, and evaluation of the developed system and/or theories.

Operation Procedure

- Student has to devote full semester for Dissertation-I/ Industrial Project-I/ Entrepreneurial Project-I.
- Student has to report to the Supervisor regularly.

- Seminars evaluation has to be carried out in the presence of a two member Committee comprising.
- Experts in the relevant area constituted by the Supervisor.
- Final Dissertation-I/ Industrial Project-I/ Entrepreneurial Project-I Report to be submitted has to be in formal hard bound cover bearing of the Institute emblem.

Reference Books and Tools:

Based on literature survey to be done with peer reviewed journals and magazines and relevant tools required to build the project.



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INSTITUTE OF ENGINEERING AND TECHNOLOGY

2 Year M. Tech Programme (Branch: Health, Safety, and Environment Engineering) Batch 2018-2020 SEMESTER-FOUR Detailed Syllabus & Scheme of Examination

Course Title and Code: Industrial Project-II (PR2107)			
Hours per Week	4 months		
Credits	16		
Students who can take	M.Tech Semester-IV (Batch: 2018-2020) Core		

Course Objective:

The purpose of the Industry Project is to give students the opportunity to gain an insight into the operation of their field of study and develop an understanding of their profession in a professional context. By enabling students to observe the day-to-day operations of an organization and to prepare a research project based on these observations, with the guidance of a work place and academic supervisor, students will develop a critical perspective of their profession. Students will attend pre and post placement classes to guide the development of their research project, the sourcing of their host organization and the protocols associated with the placement.

After course completion, the student will be able to:

- 1. Identify skills and capabilities that intersect effectively with the needs of industry.
- 2. Apply and practice good communication skills in the workplace setting.
- 3. Reflect and evaluate on experiences that might lead to future employment.
- 4. Report research findings in written and verbal forms.
- 5. Demonstrate and apply research skills to complete a project.

Evaluation Scheme:

Expert Evaluation	Evaluation Component	Mid-Term	Final Term
Industry Expert	Day to Day Task Record	20	40
	Report Content & Presentation	10	30
JKLU faculty	Reporting Activity Fortnightly	08	18
	Presentation, Viva, Report	20	50
	Coordinator Feedback	02	02
Total		60	140

Course Syllabi:

Dissertation-II/ Industrial Project-II/Entrepreneurial Project-II - The students who work on a project are expected to work towards the goals and milestones set in Dissertation-II / Industrial Project-II/ Entrepreneurial Project-II. The problem can be extension of Dissertation-I/ Industrial Project-I /Entrepreneurial Project-I or a new problem. The student will submit a synopsis at the beginning of the semester for approval from the departmental committee in a specified format. At the end there would be a demonstration of the solution and possible future work on the same problem. The student will have to present the progress of the work through seminars and progress reports.

Operation Procedure

- Student has to devote full semester for Dissertation/Industrial Project/Entrepreneurial Project.
- Student has to report to the Supervisor regularly.
- Dissertation-II/ Industrial Project-II/Entrepreneurial Project-II evaluation has to be carried out in the presence of a two member Committee comprising.
- Experts in the relevant area constituted by the Supervisor.
- Final Seminar Report to be submitted has to be in formal hard bound cover bearing of the Institute emblem.

<u>Reference Books and Tools:</u> Based on literature survey to be done with peer reviewed journals and magazines and relevant tools required to build the project.