ANNAMALAI UNIVERSITY

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF CHEMICAL ENGINEERING

M.Tech.

INDUSTRIAL SAFETY ENGINEERING

HAND BOOK

DEPARTMENT OF CHEMICAL ENGINEERING

VISION

Our vision is to be a leading Chemical Engineering Department in the Nation, to create and develop technocrats, entrepreneurs and business leaders

MISSION

The department fosters chemical engineering as a profession that interfaces engineering and all aspects of basic sciences to disseminate knowledge in order to prepare the students to be successful leaders and practitioners and to meet the present and future needs of the society by highest degree of standards and ethics.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO s):

The objectives of the programme are to train and make known to the students to achieve the following:

1. Prevent accidents in the industries by eradicating the hazard
2. Eliminate accident caused work stoppage and lost production
3. Achieve lower workmen's compensation, insurance rates and reduce all other direct and indirect costs of accidents
4. Prevent loss of life, permanent disability and the loss of income of worker by eliminating causes of accidents
5. Evaluate employee's morale by promoting safe work place and good working condition
6. Educate all members of the organization towards safety consciousness

PROGRAMME OUTCOME (PO s):

After the completion of the programme, students will be able to fulfil the needs of organizations to develop their activities in providing a safe working environment through the following:

1. Identify and eradicate risks and hazards to attain zero accident industry
2. Develop and knowledge to use software for toxic release scenarios
3. Research, analyse and purpose the changes which an organization needs to make to exploit this knowledge for a comfortable, safe and occupational disease free environment
4. Design various parameters with respect to hazard free and environment friendly in the operation of process systems
5. Inspect and Investigate the hazardous situations and take preventive measures
6. Manage and Control emergency situations
7. Implementation of current safety and environment standards such as OHSAS and ISO

Mapping PO with PEO							
PEO s/PO s	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
PEO1	√	√	√	√	√		√
PEO2	√		√	√	√	√	√
PEO3			√		√		√
PEO4	√	√		√	√	√	√
PEO5			√				√
PEO6			√		√		√

ANNAMALAI UNIVERSITY
FACULTY OF ENGINEERING AND TECHNOLOGY
M.E./ M. Tech (Two-Year Full Time& Three-year Part Time) DEGREE

PROGRAMME

CHOICE BASED CREDIT SYSTEM (CBCS)

REGULATIONS

1. **Condition for Admission**
   Candidates for admission to the first year of the four-semester **M.E / M.TechDegree programme in Engineering** shall be required to have passed B.E / B.Techdegree of Annamalai University or any other authority accepted by the syndicate of this University as equivalent thereto. They shall satisfy the condition regarding qualifying marks and physical fitness as may be prescribed by the syndicate of the AnnamalaiUniversity from time to time. The admission for part time programmeis restricted to those working or residing within a radius of **90 km** from Annamalainagar. The application should be sent through their employers.
2. **Branches of Study in M.E / M.Tech**
   The Branch and Eligibility criteria of programmes are given in **Annexure 1**
3. **Courses of study**
   The courses of study and the respective syllabi for each of the M.E / M.Techprogrammes offered by the different Departments of study are given separately.
4. **Scheme of Examinations**
   The scheme of Examinations is given separately.
5. **Choice Based Credit System (CBCS)**
   The curriculum includes three components namely Professional Core, Professional Electives and Open Electives in addition toThesis. Each semester curriculum shall normally have a blend of theory and practical courses.
6. **Assignment of Credits for Courses**
   Each course is normally assigned one credit per hour of lecture / tutorial per week and one credit for two hours or part thereof for laboratory or practical per week.The total credits for the programme will be 65.
7. **Duration of the programme**
   A student of **M.E / M.Tech**programme is normally expected to complete in four semesters for full-time / six semesters for part-time but in any case not more than four years for full-time / six years for part-time from the date of admission.
8. **Registration for courses**
   A newly admitted student will automatically be registered for all the courses prescribed for the first semester, without any option. Every other student shall submit a completed registration form indicating the list of courses intended to be credited during the next semester. This registration will be done a week before the last working day of the current semester.Late registration with the approval of the Dean on the recommendation of the Head

of the Department along with a late fee will be done up to the last working day. Registration for the Thesis Phase - I and II shall be done at the appropriate semesters.

9. Electives

The student has to select two electives in first semester and another two electives in the second semester from the list of Professional Electives. The student has to select two electives in third semester from the list of Open Electives offered by the department/ allied department. A student may be allowed to take up the open elective courses of third semester (Full Time program) in the first and second semester, one course in each of the semesters to enable them to carry out thesis in an industry during the entire second year of study provided they should register those courses in the first semester itself. Such students should meet the teachers offering those elective courses themselvesfor clarifications. No specific slots will be allotted in the time table for such courses.

Further, the two open elective courses to be studied in III semester (Full Time programme) may also be credited through the SWAYAM portal of UGC with the approval of Head of the Department concerned. In such a case, the courses must be credited before the end of III Semester.

10. Assessment

The break-up of continuous assessment and examination marks for theory courses is as follows:

First assessment (Mid-Semester Test-I)	:	10 marks
Second assessment (Mid-Semester Test-II)	:	10 marks
Third Assessment	:	5 marks
End Semester Examination	:	75 marks

The break-up of continuous assessment and examination marks for Practical courses is as follows:

First assessment (Test-I)	:	15 marks
Second assessment (Test-II)	:	15 marks
Maintenance of record book	:	10 marks
End Semester Examination	:	60 marks

The thesis Phase I will be assessed for 40 marks by a committee consisting of the Head of the Department, the guide and a minimum of two members nominated by the Head of the Department. The Head of the Department will be the chairman. The number of reviews must be a minimum of three per semester. 60 marks are allotted for the thesis work and viva voce examination at the end of the third semester. The same procedure will be adopted for thesis Phase II in the fourth semester.

11. Student Counsellors (Mentors)

To help the students in planning their course of study and for general advice on the academic programme, the Head of the Department will attach a certain number of students to a member of the faculty who shall function as student counsellor for those students throughout their period of study. Such student counsellors shall advise the students, give preliminary approval for the courses to be taken by the students during each semester,

monitor their progress in SWAYAM courses / open elective courses and obtain the final approval of the Head of the Department.

12. Class Committee

For each of the semesters of M.E / M.Techprogrammes, separate class committees will be constituted by the respective Head of the Departments. The composition of the class committees from first to fourth semestersfor Full time and first to sixth semesters for Part-time will be as follows:

- Teachers of the individual courses.
- A Thesis coordinator (for Thesis Phase I and II) shall be appointed by the Head of the Department from among the Thesis supervisors.
- A thesis review committee chairman shall be appointed by the Head of the Department
- One Professor or Associate Professor, preferably not teaching the concerned class, appointed as Chairman by the Head of the Department.
- The Head of the Department may opt to be a member or the Chairman.
- All counselors of the class and the Head of the Department (if not already a member) or any staff member nominated by the Head of the Department may opt to be special invitees.

The class committee shall meet **three** times during the semester. The first meeting will be held within two weeks from the date of class commencement in which the type of assessment like test, assignment etc. for the third assessment and the dates of completion of the assessments will be decided.

The second meeting will be held within a week after the completion of the first assessment to review the performance and for follow-up action.

The third meeting will be held after all the assessments but before the University semester examinations are completed for all the courses, and at least one week before the commencement of the examinations. During this meeting the assessment on a maximum of 25 marks for theory / 40 marks for practical and project work will be finalized for every student and tabulated and submitted to the Head of the Department for approval and transmission to the Controller of Examinations.

13. Temporary Break Of Study

A student can take a one-time temporary break of study covering the current semester and / or the next semester with the approval of the Dean on the recommendation of the Head of the Department, not later than seven days after the completion of the mid-semester test. However, the student must complete the entire programme within the maximum period of **four years for Fulltime/ six years for Part time.**

14. Substitute Assessments

A student who has missed, for genuine reasons accepted by the Head of the Department, one or more of the assessments of a course other than the end of semester examination may take a substitute assessment for any one of the missed assessments. The substitute assessment must be completed before the date of the third meeting of the respective class committees.

A student who wishes to have a substitute assessment for a missed assessment must apply to the Head of the Department within a week from the date of the missed assessment.

15. Attendance Requirements

The students with 75% attendance and above are permitted to appear for the University examinations. However, the Vice Chancellor may give a rebate / concession not exceeding 10% in attendance for exceptional cases only on Medical Grounds.

A student who withdraws from or does not meet the minimum attendance requirement in a semester must re-register and repeat the same semester in the subsequent academic years.

16. Passing anddeclaration of Examination Results

All assessments of all the courses on an absolute marks basis will be considered and passed by the respective results passing boards in accordance with the rules of the University. Thereafter, the controller of examinations shall convert the marks for each course to the corresponding letter grade as follows, compute the grade point average (GPA) and cumulative grade point average (CGPA) and prepare the mark sheets.

90 to 100 marks	Grade 'S'
80 to 89 marks	Grade 'A'
70 to 79 marks	Grade 'B'
60 to 69 marks	Grade 'C'
55 to 59 marks	Grade 'D'
50 to 54 marks	Grade 'E'
Less than 50 marks	Grade 'RA'
Withdrawn from the Examination	Grade 'W'

A student who obtains less than 30 / 24 marks out of 75 / 60 in the theory / practical examinations respectively or is absent for the examination will be awarded grade RA.

A student who earns a grade of S, A, B, C, D or E for a course is declared to have successfully completed that course and earned the credits for that course. Such a course cannot be repeated by the student.\

A student who obtains letter grade RA / W in the mark sheet must reappear for the examination of the courses.

The following grade points are associated with each letter grade for calculating the grade point average and cumulative grade point average.

S - 10; A - 9; B - 8; C - 7; D - 6; E - 5; RA - 0

Courses with grade RA / W are not considered for calculation of grade point average or cumulative grade point average.

A student can apply for re-totaling of one or more of his examination answer papers within a week from the date of issue of mark sheet to the student on payment of the prescribed fee per paper. The application must be made to the Controller of Examinations with the recommendation of the Head of the Department.

After the results are declared, mark sheets will be issued to the students. The mark sheet will contain the list of courses registered during the semester, the grades scored and the grade point average for the semester.

GPA is the sum of the products of the number of credits of a course with the grade point scored in that course, taken over all the courses for the semester, divided by the sum of the number of credits for all courses taken in that semester.

CGPA is similarly calculated considering all the courses taken from the time of admission.

17. Awarding Degree

After successful completion of the programme, the degree will be awarded with the following classifications based on CGPA.

For First Class with Distinction the student must earn a minimum of 65 credits within four semesters for full-time / six semesters for Part time from the time of admission, pass all the courses in the first attempt and obtain a CGPA of 8.25 or above.

For First Class, the student must earn a minimum of 65 credits within two years and six months for full-time / three years and six months for Part time from the time of admission and obtain a CGPA of 6.75 or above.

For Second class, the student must earn a minimum of 65 credits within four years for full-time / six years for Part time from the time of admission.

18. Ranking Of Candidates

The candidates who are eligible to get the M.E /M.Techdegree in First Class with Distinction will be ranked on the basis of CGPA for all the courses of study from I to IV semester for M.E / M.Tech full-time / I to VI semester for M.E / M.Tech part-time.

The candidates passing with First Class and without failing in any subject from the time of admission will be ranked next to those with distinction on the basis of CGPA for all the courses of study from I to IV semester for full-time / I to VI semester for M.E / M.Tech part-time.

19. Transitory Regulations

If a candidate studying under the old regulations M.E. / M.Techcould not attend any of the courses in his/her courses, shall be permitted to attend equal number of courses, under the new regulation and will be examined on those subjects. The choice of courses will be decided by the concerned Head of the department. However he/she will be permitted to submit the thesis as per the old regulations. The results of such candidates will be passed as per old regulations.

The University shall have powers to revise or change or amend the regulations, the scheme of examinations, the courses of study and the syllabi from time to time.

ANNEXURE 1

S.No.	Department		Programme (Full Time & Part time)	Eligible B.E./B.TechProgramme *
1	**Civil Engineering**	i.	Environmental Engineering	B.E. / B.Tech – Civil Engg, Civil & Structural Engg, Environmental Engg, Mechanical Engg, Industrial Engg, Chemical Engg, BioChemicalEngg, Biotechnology, Industrial Biotechnology, Chemical and Environmental Engg.
		ii.	Environmental Engineering & Management	
		iii.	Water Resources Engineering & Management	B.E. / B.Tech – Civil Engg, Civil & Structural Engg, Environmental Engg, Mechanical Engg, Agricuturalanf irrigation Engg, Geo informatics, Energy and Environmental Engg.
2	**Civil & Structural Engineering**	i.	Structural Engineering	B.E. / B.Tech – Civil Engg, Civil & Structural Engg.
		ii.	Construction Engg. and Management	
		iii.	Geotechnical Engineering	
		iv.	Disaster Management &Engg.	
3	**Mechanical Engineering**	i.	Thermal Power	B.E. / B.Tech – Mechanical Engg, Automobile Engg, Mechanical Engg (Manufacturing).
		ii.	Energy Engineering & Management	B.E. / B.Tech – Mechanical Engg, Automobile Engg, Mechanical (Manufacturing) Engg, Chemical Engg
4	**Manufacturing Engineering**	i.	Manufacturing Engineering	B.E. / B.Tech – Mechanical Engg, Automobile Engg, Manufacturing Engg, Production Engg, Marine Materials science Engg, Metallurgy Engg, Mechatronics Engg, Industrial Engg.
		ii.	Welding Engineering	
		iii.	Nano Materials and Surface Engineering	B.E. / B.Tech – Mechanical Engg, Automobile Engg, Manufacturing Engg, Production Engg, Marine Materials science Engg, Metallurgy Engg, Chemical Engg
5	**Electrical Engineering**	i.	Embedded Systems	B.E. / B.Tech – Electrical and ElectronicsEngg, Control and Instrumentation Engg, Information technology, Electronics and communication Engg, Computer Science and Engg
		ii.	Smart Energy Systems	B.E. / B.Tech – Electrical and Electronics Engg, Control and Instrumentation Engg, Electronics and communication Engg,
		iii.	Power System	
		i.	Process Control & Instrumentation	B.E. / B.Tech – Electronics and Instrumentation Engg, Electrical and ElectornicsEngg, Control and

				Instrumentation Engg, Instrumentation Engg
6	**Electronics & Instrumentation Engineering**	ii.	Rehabilitative Instrumentation	B.E. / B.Tech – Electronics and Instrumentation Engg, Electrical and ElectornicsEngg, Electronics and communication Engg, Control and Instrumentation Engg, Instrumentation Engg, Bio Medical Engg, Mechatronics.
		iii.	Micro Electronics and MEMS	B.E. / B.Tech –B.E. / B.Tech – Electronics and Instrumentation Engg, Electrical and ElectornicsEngg, Electronics and communication Engg, Control and Instrumentation Engg, Instrumentation Engg, Bio Medical Engg, Mechatronics, Telecommunication Engg
7	**Chemical Engineering**	i.	Chemical Engineering	B.E. / B.Tech – Chemical Engg, Petroleum Engg, Petrochemical Technology
		ii.	Food Processing Technology	B.E. / B.Tech - Chemical Engg, Food Technology, Biotechnology, Biochemical Engg, Agricultural Engg.
		iii.	Industrial Bio Technology	B.E. / B.Tech - Chemical Engg, Food Technology, Biotechnology, Leather Technology
		iv.	Industrial Safety Engineering	B.E. / B.Tech – Any Branch of Engineering
8	**Computer Science & Engineering**	i.	Computer Science & Engineering	B.E. / B.Tech - Computer Science and Engineering, Information Technology, Electronics and Communication Engg, Software Engineering
9	**Information Technology**	i	Information Technology	B.E. / B.Tech - Computer Science and Engineering, Information Technology, Electronics and Communication Engg, Software Engineering
10	**Electronics & Communication Engineering**	i.	Communication Systems	B.E. / B.Tech -Electronics and Communication Engg, Electronics Engg.

*** AMIE in the relevant discipline is considered equivalent to B.E**

COURSES OF STUDY AND SCHEME OF EXAMINATIONS
Full-Time

Sl. No.	Category	Course Code	Course	L	P	T	CA	FE	Total	Credits
Semester – I										
1	PC-I	ISEC 101	Probability and Statistics	4		-	25	75	100	3
2	PC-II	ISEC 102	Safety Management	4		-	25	75	100	3
3	PC-III	ISEC 103	Occupational Health and Hygiene	4		-	25	75	100	3
4	PC-IV	ISEC 104	Safety in Chemical Industries	4		-	25	75	100	3
5	PE-I	ISEE 105	Professional Elective – I	4		-	25	75	100	3
6	PE-II	ISEE 106	Professional Elective – II	4		-	25	75	100	3
7	PCLab-I	ISEP 107	Industrial Safety Engineering Laboratory-I	-	3	-	40	60	100	2
			Total	**24**	**3**	**-**	**190**	**510**	**700**	**20**

Sl. No.	Category	Course Code	Course	L	P	T	CA	FE	Total	Credits
Semester – II										
1	PC-V	ISEC 201	Computer Aided Risk Analysis	4	-	-	25	75	100	3
2	PC-VI	ISEC 202	Safety in Material Handling	4	-	-	25	75	100	3
3	PC-VII	ISEC 203	Fire Engineering and Explosion Control	4	-	-	25	75	100	3
4	PC-VIII	ISEC 204	Regulations for Health, Safety and Environment	4	-	-	25	75	100	3
5	PE-III	ISEE 205	Professional Elective – III	4	-	-	25	75	100	3
6	PE-IV	ISEE 206	Professional Elective – IV	4	-	-	25	75	100	3
7	PCLab-II	ISEP 207	Industrial Safety Engineering Laboratory-II	-	3	-	40	60	100	2
8	Seminar	ISES 208	Seminar	-	2	-	100	-	100	1
			Total	**24**	**5**	**-**	**290**	**510**	**800**	**21**

Sl. No.	Category	Course Code	Course	L	P	T	CA	FE	Total	Credits
Semester – III										
1	OE-I	ISEE 301	Open Elective – I	4	-	-	25	75	100	3
2	OE-II	ISEE 302	Open Elective – II	4	-	-	25	75	100	3
3	Thesis	ISET 303	Thesis Phase-I	-	-	4	40	60	100	4
4	Ind Training	ISEI 304	Industrial Training		*	-	100	-	100	2
			Total	**8**	**-**	**4**	**90**	**210**	**300**	**12**

Note: * - Four weeks during the summer vacation at the end of IInd Semester.

Sl. No.	Category	Course Code	Course	L	P	T	CA	FE	Total	Credits
S e m e s t e r – IV										
1	Thesis	ISET 401	Thesis Phase-II	-	-	8	40	60	100	13
			Total	**-**	**-**	**8**	**40**	**60**	**100**	**13**

L-Lecture ;**P-**Practical; **T-**Thesis; **CA-**Continuous Assessment; **FE-**Final Examination

Part Time

Sl. No.	Category	Course Code	Course	L	P	T	CA	FE	Total	Credits	Equivalent Course Code in M.Tech. Full Time
S e m e s t e r – I											
1	PC-I	PISEC 101	Probability and Statistics	4	-	-	25	75	100	3	ISEP 101
2	PC-II	PISEC 102	Safety Management	4	-	-	25	75	100	3	ISEP 102
3	PC-III	PISEC 103	Occupational Health and Hygiene	4	-	-	25	75	100	3	ISEP 103
			Total	**12**	**-**	**-**	**75**	**225**	**300**	**9**	

Sl. No.	Category	Course Code	Course	L	P	T	CA	FE	Total	Credits	Equivalent Course Code in M.Tech. Full Time
S e m e s t e r – II											
1	PC-IV	PISEC 201	Safety in Chemical Industries	4	-	-	25	75	100	3	ISEP 201
2	PC-V	PISEC 202	Computer Aided Risk Analysis	4	-	-	25	75	100	3	ISEP 202
3	PC-VI	PISEC 203	Safety in Material Handling	4	-	-	25	75	100	3	ISEP 203
			Total	**12**	**-**	**-**	**75**	**225**	**300**	**9**	

Sl. No.	Category	Course Code	Course	L	P	T	CA	FE	Total	Credits	Equivalent Course Code in M.Tech. Full Time
S e m e s t e r – III											
1	PC-VII	PISEC 301	Fire Engineering and Explosion Control	4	-	-	25	75	100	3	ISEP 104
2	PE-I	PISEE 302	Professional Elective – I	4	-	-	25	75	100	3	ISEE 105
3	PE-II	PISEE 303	Professional Elective – II	4	-	-	25	75	100	3	ISEE 106
4	PC Lab-I	PISEP 304	Industrial Safety Engineering Laboratory-I	-	3	-	40	60	100	2	ISEP 107
			Total	**12**	**3**	**-**	**115**	**285**	**400**	**11**	

S.No	Category	Course Code	Course	L	P	T	CA	FE	Total	Credits	Equivalent Course Code in M.Tech. Full Time
S e m e s t e r – IV											
1	PC-VIII	PISEC 401	Regulations for Health, Safety and Environment	4	-	-	25	75	100	3	ISEP 204
2	PE-III	PISEE 402	Professional Elective – III	4	-	-	25	75	100	3	ISEE 205
3	PE-IV	PISEE 403	Professional Elective – IV	4	-	-	25	75	100	3	ISEE 206
4	PC Lab-II	PISEP 404	Industrial Safety Engineering Laboratory-II	-	3	-	40	60	100	2	ISEP 207
5	Seminar	PISES 405	Seminar	-	2	-	100	-	100	2	ISES 208
			Total	**12**	**5**	**-**	**215**	**285**	**500**	**12**	

Sl. No.	Category	Course Code	Course	L	P	T	CA	FE	Total	Credits	Equivalent Course Code in M.Tech. Full Time
S e m e s t e r – V											
1	OE-I	PISEE 501	Open Elective – I	4	-	-	25	75	100	3	ISEE 301
2	OE-II	PISEE 502	Open Elective – II	4	-	-	25	75	100	3	ISEE 302
3	Thesis	PISET 503	Thesis Phase-I	-	-	4	40	60	100	4	ISET 303
4	Ind Training	PISEI 504	Industrial Training		*	-	100		100	2	ISEI 304
			Total	**8**	**-**	**4**	**90**	**210**	**300**	**12**	

Note: * - Four weeks during the summer vacation at the end of IVth Semester.

Sl. No.	Category	Course Code	Course	L	T	P	CA	FE	Total	Credits	Equivalent Course Code in M.Tech. Full Time
S e m e s t e r – VI											
1	Thesis	PISET 601	Thesis Phase-II	-	-	8	40	60	100	13	ISET 401
			Total	**-**	**-**	**8**	**40**	**60**	**100**	**13**	

L-Lecture ;**P-**Practical; **T-**Thesis; **CA-**Continuous Assessment; **FE-**Final Examination

LIST OF PROFESSIONAL ELECTIVES

S.No	Subject
1	Human Factors Engineering
2	Environmental Pollution Control
3	Safety in On and Off shore Drilling
4	Safety in Engineering Industry, Safety in Metal Working Machinery and Wood Working Machines
5	Safety in Mines
6	Safety in Textile Industry
7	Dock Safety
8	Nuclear Engineering and Safety
9	Disaster Management
10	OHSAS 18001and ISO 14001:2015

LIST OF OPEN ELECTIVES

S.No	Open Elective
1	Safety in Construction
2	Electrical Safety
3	Environmental Impact Assessment
4	Work Study and Ergonomics

ISEC 101	PROBABILITY AND STATISTICS	L	T	P
		4	0	0

COURSE OBJECTIVES:

To acquaint the student with the concepts in

- Random variable
- Special and sampling distributions
- Curve fitting and reliability

Random variable – Two dimensional random variables – Standard probability distributions– Binomial, Poisson and Normal distributions - Moment generating function.

Special distributions – Uniform, Geometric, Exponential, Gamma, Weibull and Beta distributions – Mean, Variance, Raw moments from moment generating functions of respective distributions.

Sampling distributions – Confidence interval estimation of population parameters – Testing of hypotheses – Large sample tests for mean and proportion – t-test, F-test and Chi-square test.

Curve fitting - Method of least squares - Regression and correlation – Rank correlation – Multiple and partial correlation – Analysis of variance - One way and two way classifications – Time series analysis.

Basics concepts of reliability - Failure rate analysis – Reliability of systems – Series, Parallel – Maintenance - Preventive and corrective – Maintainability equation – Availability – Quality and Reliability.

REFERENCES:

1. BOWKER and LIBERMAN, Engineering Statistics, Prentice-Hall.
2. GUPTA, S.C. and KAPOOR, V.K., Fundamentals of Mathematical Statistics, Sultan Chand and Sons.

COURSE OUTCOMES:

1. This course equips students to have knowledge and understanding in random variable, special distribution and sampling distribution
2. Students will be able to do curve fitting and ANOVA

Mapping with Programme Outcomes							
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1			√				
CO2			√				

ISEC 102	SAFETY MANAGEMENT	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To know the history of safety movement and modern concepts in safety
- To learn the various techniques involved in identifying the hazards
- To know the methods of accident investigating and reporting
- To assess the performance of safety in industries
- To promote safety education and training among workers

Concepts: History of Safety movement –Evolution of modern safety concept- general concepts of management – planning for safety for optimization of productivity -line and staff functions for safety- budgeting for safety- safety policy.

Techniques: Incident Recall Technique (IRT), disaster management, job safety analysis, safety survey, safety inspection, safety sampling, Safety Audit, Onsite and off site emergency plans.

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

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

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

REFERENCES:

1. Heinrich H.W. "Industrial Accident Prevention" McGraw-Hill Company, New York, 1980.
2. 2.John Ridley, "Safety at Work", Butterworth & Co., London, 1983.
3. Krishnan N.V. "Safety Management in Industry" Jaico Publishing House, Bombay,1997.
4. Accident Prevention Manual for Industrial Operations", N.S.C.Chicago, 1982
5. Blake R.B., "Industrial Safety" Prentice Hall, Inc., New Jersey, 1973

COURSE OUTCOMES:

After completing the course, the students shall be able to

1. explain the modern concepts in safety
2. techniques to identify the hazards and risks in the organization
3. investigate accidents and identify the causes of the accidents and take necessary preventive measures
4. calculate the performance indices of safety which helps improving safety
5. organize safety seminar and training programmes in motivating the workers

Mapping with ProgrammeOutcomes							
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	√	√	√	√			√
CO2	√	√		√		√	√
CO3	√	√			√		
CO4			√		√		√
CO5	√	√			√	√	√

ISEC 103	OCCUPATIONAL HEALTH AND HYGIENE	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To know the importance of health and hygiene at work place
- To understand the concept ofPhysical, chemical,Biological and ergonomical hazards
- To know the various threshold limit values and its significance

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-nonionizing radiations, effects, types, radar hazards,

microwaves and radiowaves, lasers, TLV- cold environments, hypothermia, wind chill index, control measureshot 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 Biohazardous 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 Musculoskeltal Disorders -carpal tunnel syndrome CTS- Tendon paindisorders of the neck- back 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, modifiable occupational diseases such as silicosis,

asbestosis, pneumoconiosis, siderosis, anthracnose, 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.

REFERENCES:

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

COURSE OUTCOMES:
After learning the course, the students
1. Get a clear idea about occupational health and hygiene
2. Know about the hazards such as Physical hazards, chemical hazards, Biological and ergonomical hazards
3. Will be able to take control measures from occupational diseases

Mapping with Programme Outcomes							
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	√		√	√	√		√
CO2	√	√	√	√	√	√	√
CO3	√		√	√			√

ISEC 104	SAFETY IN CHEMICAL INDUSTRIES	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To develop and evaluate appropriate strategies designed to mitigate risk;
- To take all reasonably practicable measures to prevent accidents in nuclear installations and to mitigate their consequences.
- To identify the hazards in erection, commissioning, storage, habndling, etc, of chemical industries

Safety in the design process of chemical plants- safety in erection and commissioning of chemical plants- safety in material handling – Pressure and leak testing.

Safety in operational and maintenance – Exposure of personnel, Operational activities and hazards – Work permit systems entry into confined space where toxic contaminants are present.

Safety in storage and Handling of chemical and gases – Hazards during transportation – pipeline transport – safety in chemical laboratories.

Toxic release and control methodologies – toxic effects- threshold limit values – Awareness and preparedness for energy at local level Specific safety consideration for Cement, paper, pharmaceutical, petroleum, petrochemical, rubber, fertilizer and distilleries.

Safety in nuclear plants - Objectives and concepts , technical requirements, safety functions , accident prevention and plant safety characteristics , radiation protection,

Safety analysis, safety requirements for reactor core and associated features , reactor coolant system, containment system ,Waste treatment and control systems, fuel handling and storage systems.

REFERENCES:

1. Lees, F.P., Loss Prevention in Process Industries, Butterworths, NewDelhi, 1986
2. Accident Prevention Manual for Industrial Operations, NSC, Chicago, 1982.

COURSE OUTCOMES:

After learning the course the studentswill be able to

1. Recommend safety parameters required for the design process of equipment
2. Develop safety precautions to be followed in the erection and commissioning of plants
3. Develop emergency preparedness plans for various industries at toxic release scenario

Mapping with Programme Outcomes							
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1		√	√	√			
CO2	√	√			√		√
CO3		√	√			√	√

ISEP 107	INDUSTRIAL SAFETY ENGINEERING LABORATORY - I	L	T	P
				3

COURSE OBJECTIVES:

- To provide basic knowledge to carry out field investigations
- To demonstrate the operational features of fire extinguishers
- To understand the usage and importance of Personal Protective Equipment

List of Experiments

1) Measurement of Sound level
2) Measurement of illumination level
3) Measurement of humidity
4) A study on Fire Fighting Equipment
5) A study on Personal Protective Equipment

COURSE OUTCOMES:

After learning the course, the students should be able to

1. Carryout field investigations such as measurement of noise, illuminatiuon and humidity
2. Identify and advise the type of extinguisher required for different fires
3. Advise the workers on the usage and importance of PPE.

Mapping with Programme Outcomes							
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	√		√	√	√		√
CO2	√		√			√	√
CO3	√				√	√	√

ISEC 201	COMPUTER AIDED RISK ANALYSIS	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To develop and understand the significance of risk analysis and its types
- To know the procedures involved in the usage of software
- To learn about the pool fire/jetfire/explosion and the method of calculating safe zones

Introduction, hazard, hazard monitoring-risk issue - Hazard assessment, procedure,methodology; safety audit, checklist analysis, what-if analysis, safety review, preliminaryhazard analysis (PHA), hazard operability studies (HAZOP)

Applications of Advanced Equipments and Instruments, Thermo Calorimetry,Differential Scanning Calorimeter (DSC), Thermo Gravimetric Analyzer (TGA), AcceleratedRate

Calorimeter (ARC), Principles of operations, Controlling parameters, Applications,advantages.Explosive testing, Deflagration Test, Detonation Test, Ignition Test, Minimumignition energy Test, Sensitiveness Test, Impact Sensitiveness Test(BAM) and FrictionSensitiveness Test (BAM), Shock Sensitiveness Test, Card Gap Test.

Fault Tree Analysis & Event Tree Analysis, Logic symbols, methodology, minimalcut 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

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

REFERENCES:

1. Methodologies for Risk and Safety Assessment in Chemical Process Industries, Commonwealth Science Council, UK.
2. Hazop and Hazon, by Trevor A Klett, Institute of Chemical Engineering.
3. Quantitative Risk assessment in Chemical Industries, Institute of Chemical Industries,
4. Centre for Chemical process safety.
5. Loss Prevention in Process Industries-Frank P. Less Butterworth-Hein UK 1990 (Vol.I, II & III)
6. Guidelines for Hazard Evaluation Procedures, Centre for Chemical Process safety, AICHE 1992.

COURSE OUTCOMES:

After learning the course the students should be able to

1. Understand the fundamentals of hazard analysis, concepts of hazards evaluation procedure.
2. Able to apply softwares for hazard analysis procedure.
3. Understand the principles of risk analysis quantification methods.
4. Understand the use of various instruments and testing methods.

Mapping with Programme Outcomes							
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	√		√	√	√	√	√
CO2		√	√	√		√	
CO3			√	√			√
CO4			√	√			

		L	T	P
ISEC 202	**SAFETY IN MATERIAL HANDLING**	**4**	**0**	**0**

COURSE OBJECTIVES:

- To learn the various types of material handling techniques and its hazards
- To know the ergonomics of various conveying mechanisms

- To identify the hazards involved in the material handling and to suggest precautions in the operation of heavy equipment

Material handling
General safety consideration in material handling - Ropes, Chains, Sling, Hoops, Clamps, Arresting gears – Prime movers.

Ergonomics of conveying mechanisms
Ergonomic consideration in material handling, design, installation, operation and maintenance of Conveying equipments, hoisting, travelling and slewing mechanisms.

Ergonomics of hoisting mechanisms
Ergonomic consideration in material handling, design, installation, operation and maintenance of driving gear for hoisting mechanism – Travelling mechanism

Handling of heavy equipments
Selection, operation and maintenance of Industrial Trucks – Mobile Cranes – Tower crane – Checklist - Competent persons.

Storage of goods and equipments
Storage and Retrieval of common goods of various shapes and sizes in a general store of a big industry.

REFERENCES:

1. Accident Prevention Manual for Industrial Operations, NSC, Chicago, 1982.
2. Alexandrov, M.P., Material Handling Equipment, Mir Publishers, Moscow, 1981.
3. Rudenko N., Material Handling Equipments, Mir Publishers, Moscow, 1981.

COURSE OUTCOMES:
After learning the course the students should be able to
1.Understand the Basic principles of safety in Material handling
2. Know the safe operation and maintenance of Trucks and cranes

Mapping with Programme Outcomes							
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	√			√	√	√	
CO2	√					√	√

		L	T	P
ISEC 203	**FIRE ENGINEERING AND EXPLOSION CONTROL**	**4**	**0**	**0**

COURSE OBJECTIVES:
- To provide necessary knowledge about the fire and fuels; mechanism of fire and impart information about different fire extinguishing mechanisms and systems.
- Helps to familiarize about the explosion and its control.
- Provide knowledge about the evaluation and design of buildings for fire safety.
- To give information about the rules and regulations regarding fire and explosion safety at national level.

Fire dynamics
Fire chemistry - Dynamics of fire behavior - Fire properties of solid, liquid and gas -Fire spread - Toxicity of products of combustion

Fire protection systems
Industrial fire protection systems -Sprinkler - Hydrants- Stand pipe- Special fire suppression system like deluge and emulsifier.

Building safety
Building evaluation for fire safety - Fire load - Fire resistance materials and fire testing - Structural Fire protection - Exits and egress.

Explosion & control
Explosion protection systems - Explosion parameters - Explosion suppression system based on CO_2 and Halon - Hazards in L.P.G handling.

Fire safety – rules & regulations
Statutory Rules and Techniques of fire fighting - Indian Explosive acts and rules -Techniques of fire fighting and demonstration.

REFERENCES:
1. James, D., Fire Prevention Handbook, Butterworths, London, 1986.
2. Gupta R.S., Handbook of Fire Technology, Orient Longman, Bombay, 1997.

COURSE OUTCOMES:
By the end of the course, a student should be able to:
1. Know the chemistry and mechanism of fire and explosion and the methods to prevent and control them.
2. Evaluate the fire safety of buildings and design the measures to ensure the safety of buildings.
3. Implement the rules and regulations of fire safety for specific sites.

Mapping with Programme Outcomes							
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	√	√	√	√	√	√	
CO2	√		√	√	√	√	√
CO3			√	√	√		

ISEC 204	REGULATIONS FOR HEALTH, SAFETY AND ENVIRONMENT	L	T	P
		4	0	0

COURSE OBJECTIVES:
- To study various Safety legislations
- To know about Health Regulations
- To know about Environmental Safety Acts

Factories Act And Rules - Employees Compensation Act.

Indian Explosive Act - Gas Cylinder Rules - SMPV Act - Indian Petroleum Act and Rules.

Environmental Pollution Act - Water Act 1974 - Air Act 1981

Manufacture, Storage and Import of Hazardous Chemical Rules 1989 - Indian Electricity Act and Rules.

Overview of OHSAS18000 and ISO 14000

REFERENCES:

1. The Factories Act 1948, Madras Book Agency, Chennai, 2000
2. 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.
4. Air (Prevention and control of pollution) act 1981, Commercial Law Publishers (India)Pvt. Ltd., New Delhi.
5. Explosive Act, 1884 and Explosive rules, 1883 (India), (2002), Eastern Book company, Lucknow, 10th Edition
6. The manufacture, storage and import of hazardous chemical rules 1989, Madras Book Agency, Chennai.
7. ISO 9000 to OHSAS 18001, Dr. K.C. Arora, S.K. Kataria& Sons, Delhi

COURSE OUTCOMES:

After learning the course the students should be able to

1. Understand the fundamentals of Factories Act .
2. Knowledge about Health Regulations.
3. Know about Environment Legislations.
4. Knowledge about Employees Compensation.

Mapping with Programme Outcomes							
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	√	√					
CO2			√	√			
CO3			√	√			√
CO4						√	

ISEP207	**INDUSTRIAL SAFETY ENGINEERING LABORATORY - II**	**L**	**T**	**P**
				3

COURSE OBJECTIVES:

- To learnprocedures to estimate the air pollutants
- To demonstrate the operational features of fire alarm and detecting mechanisms
- To understand and use the software tool to estimate the level of concerns in the leakage of gases/fires/explosions

List of Experiments

1) Estimation of dust in atmosphere by gravimetric method
2) Estimation of sulphur dioxide in the atmosphere
3) Estimate the amount of ammonia in the atmosphere
4) Estimation of carbon disulphide in atmosphere
5) Estimation of Nitrogen dioxide in atmosphere
6) Study of Fire Alarm
7) QRA study using ALOHA

COURSE OUTCOMES:

After learning the course, the students should be able to

1. Estimate the pollutants level in atmosphere
2. Test and instruct the mechanism of fire /smoke detectors
3. Use the software tool and calculate the level of concerns in the case of leakage of gases/fires/explosions
4. Take preventive measures during emergency situations such as toxic release, fire, etc.,

Mapping with Programme Outcomes							
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1			√	√	√	√	√
CO2	√		√		√	√	√
CO3		√		√	√	√	
CO4		√		√	√	√	

ISET 303	THESIS PHASE – I	L	T	P
			4	

COURSE OBJECTIVES:

- To learnthe ability to take data through literature survey
- To observe and assess the various unsafe acts and conditions prevailing in an industrial environment
- To document and present one's own work, for a given target group, with strict requirements on structure, format, and language usage

A thesis work on a specialized topic in Industrial safety should be taken at the beginning of the Third Semester in consultation with the Head of the Department. A report must be submitted at the end of the Third semester and there will be a Viva Voce examination on the thesis.

COURSE OUTCOMES:

After learning the course, the students should be able to

1. Come across different literatures relevant to his study
2. Reflect on, evaluate, and critically assess one's own and others' scientific results
3. Apply the relevant knowledge and skills, which are acquired within the technical area, to solve a given problem

Mapping with Programme Outcomes							
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	√		√	√	√		
CO2		√	√	√	√		
CO3	√	√	√	√	√	√	

ISEI 304	INDUSTRIAL TRAINING	L	T	P
		0	0	2

COURSEOBJECTIVES

- To train the students in the field work related the Industrial Safety Engineering and to have a practical knowledge in carrying out Industrial Safety field related works.
- To train and develop skills in solving problems during execution of certain works related to Industrial Safety Engineering.

The students individually undergo a training program in reputed concerns in the field of Process Control and Instrumentation during the summer vacation (at the end of second semester for full – time / fourth semester for part – time) for a minimum stipulated period of four weeks. At the end of the training, the student has to submit a detailed report on the training they had, within ten days from the commencement of the third semester for Full-time / fifth semester for part-time. The students will be evaluated by a team of staff members nominated by head of the department through a viva-voce examination.

COURSE OUTCOMES

1. The students can face the challenges in the practice with confidence.
2. The student will be benefited by the training with managing the situation arises during the execution of works related to Industrial Safety Engineering.

ISET 401	THESIS PHASE - II	L	T	P
			8	

COURSE OBJECTIVES:

- To learnthe ability to take data through literature survey
- To observe and assess the various unsafe acts and conditions prevailing in an industrial environment
- To document and present one's own work, for a given target group, with strict requirements on structure, format, and language usage
- To identify one's need for further knowledge and continuously develop one's own competencies

The thesis work on a specialized topic in Industrial safety, already selected in the Third Semester will be continued in the fourth semester. A report must be submitted at the end of the Fourth semester and there will be a Viva Voce examination on the thesis.

COURSE OUTCOMES:

After learning the course, the students should be able to

1. Manage the selection and initiation of individual projects
2. Conduct project planning activities that accurately forecast the risk scenarios
3. Reflect on, evaluate, and critically assess one's own and others' scientific results
4. Apply the relevant knowledge and skills, which are acquired within the technical area, to solve a given problem
5. Demonstrate control techniques that result in accident free environment

Mapping with Programme Outcomes							
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1		√	√	√	√		
CO2	√	√	√	√	√	√	
CO3	√		√	√	√	√	
CO4	√	√	√	√	√	√	√
CO5	√	√	√	√	√	√	√

PROFESSIONAL ELECTIVES

ISEE XXX	HUMAN FACTORS ENGINEERING	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To understand the man-machine concept
- To know the relation between human behavior and its causes for accidents
- To know the principles of ergonomics and motion economy
- To understand the importance of PPE

Concept of Man-Machine system – Applications of human factors engineering – Man as Sensor – Man as Information Processor – Man as Controller

Human behavior – Individual difference – Unsafe Action Factors - Personal Factors – Psychological and Psychosocial Factors -Motivation

Frustration and Conflicts – Attitudes – Learning concepts

Principles of Ergonomics – Application of ergonomics in a work system – Principle of Motion Economy – Effects of Environment

Personal Protective Equipment – types – specifications – standards – testing procedures – maintenance

REFERENCES:

1. Mc Cornick, E. J. Human Factors in Engineering and Design, Tata Mc Graw Hill, 1982
2. Accident Prevention Manual for Industrial Operations, NSC, Chicago, 1982.
3. Introduction to Ergonomics, R. S. Bridger, Taylor & Francis.

COURSE OUTCOMES:

1. The students will be able to understand the concept of man-machine system and thence design the various parameters which would be user friendly and hazard free.
2. Students will learn how the human factors are contributing for accidents and the various ways to overcome those factors. Students can understand the necessity of ergonomic design of work places and thus the musculo skeletal disorders can be prevented.
3. The students will learn the necessity of PPE in the work place and its types and standards

Mapping with Programme Outcomes							
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	√		√	√	√		√
CO2	√		√	√	√		√
CO3			√	√	√		

ISEE XXX	ENVIRONMENTAL POLLUTION CONTROL	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To understanding about pollution control methods
- To understand the principles of air pollution and water pollution control methods.
- To understand the concept of waste water treatment methods
- To understand the solid waste management methods

Air pollution– Classification and properties of Air pollutants-Pollution sources-Control of air pollution – Gravitational settling chambers-Cyclone separators, ESP, Wetscrubber.

Dispersion of Air pollutants-Plume behavior-Control of gaseous pollutants, sulphurdioxides, nitrogen oxides, Carbon monoxide and Hydrocarbons. Air pollution laws andStandards.

Water pollution- Classification of water pollutant and their effects on receivingbodies. Advanced wastewater treatments by physical, chemical, biological and thermalmethods-Effluent quality standards.

Solid waste management- methods of collection – Disposal of solid waste, landfilling, Handling of toxic and radio active wastes –Incineration and vitrification.

Pollution control in process industries – Cement, paper, petroleum, fertilizer andpetrochemical.

REFERENCES:

1. Rao, CS, "Environmental pollution engineering:, Wiley Eastern Limited, New Delhi, 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.

COURSE OUTCOMES:

After learning the course the students shall be able to

1. Advise pollution control methods to industries
2. Overcome the issues related to air and water pollution
3. Advise for zero discharge

Mapping with Programme Outcomes							
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	√	√	√	√		√	
CO2	√	√	√	√	√		√
CO3			√	√	√		√

ISE XXX	SAFETY IN ON AND OFFSHORE DRILLING	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To understand the origin of petroleum
- To identify the hazards and risks in the drilling operation
- To know the safety procedures involved in the operation and maintenance of oil field

Petroleum and Petroleum products – Fuels- Petroleum solvents – Lubricating oils – Petroleum wax, greases – Miscellaneous product

On and off shore oil operation – Construction of Installation – Pipe line Construction – Maintenance and repair activities – Safety and associated hazards

Drilling oil – Technique and equipment- Work position –Working condition – safety and associated hazards- lighting and its effects

Petroleum Extraction and transport by sea – Oil field products – Operation – Transport of crude by sea – Crude oil hazards.

Petroleum product storage and transport –Storage equipment –Precaution –Tank cleaning

REFERENCES:

1. Offshore Safety Management, Ian Suton, Elsevier, 2nd edition, 2013
2. Petroleum Refining Engineering, Nelson W. L., Mc Graw Hill,4th edition, 1985
3. Encyclopedia of Occupational Health and Safety, Vol. II, International LabourOrganisation, Geneva, 1985 & I.

COURSE OUTCOMES:

After learning the course, the students should be able to

1. Understand the fundamentals of drilling techniques
2. Develop safe operating procedures required for a oil field
3. Identify the hazards and take preventive measures in the oil field

Mapping with Programme Outcomes							
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	√		√	√	√		√
CO2	√	√	√	√		√	
CO3	√		√		√		

ISE XXX	SAFETY IN ENGINEERING INDUSTRY	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To understand the safe practice of wood working machines
- To know about the principle of machine guarding
- To know about welding, gas cutting, cold farming and hot working of metals

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.

Principles of machine guarding
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-shearingpresses-forge hammer-flywheels-shafts-couplings-gears-sprockets wheels and chain spulleys and belts-authorized entry to hazardous installations-benefits of good guarding systems.

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

REFERENCES:

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

COURSE OUTCOMES:

After learning the course the students shall be able to

1. Understand the safety principles of machine guarding
2. Know about the working of wood, welding, gas cutting, cold farming and hot working of metals

Mapping with Programme Outcomes							
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	√		√	√			√
CO2	√	√		√		√	

ISE XXX	**SAFETY IN MINES**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES:

- To know the hazards of mines and the common causes of accidents in mines
- To learn the safe operations in tunneling and carry out risk assessments

Open Cast Mines

Causesandprevention ofaccidentfrom:Heavymachinery,beltand bucket conveyors, drilling, hand tools-pneumatic systems, pumping, water, dust, electricalsystems,fire prevention. Garagesafety–accidentreporting system- workingcondition-safe transportation–handling ofexplosives.

Underground Mines

Fallofroofandsides-effectofgases-fire andexplosions-water flooding-warning sensors-gasdetectors-occupational hazards-workingconditions-windingand transportation.

Tunnelling

Hazards from:groundcollapse,inundationandcollapseoftunnel face,fallsfrom platforms and danger from falling bodies. Atmospheric pollution (gases and dusts)–trapping–transport-noise-electrical hazards-noiseandvibrationfrom: pneumatictools andother machines–ventilationandlighting–personal protective equipment.

Riskassessment

Basic concepts of risk-reliability and hazard potential-elements of risk assessment–statisticalmethods–control charts-appraisal ofadvanced techniques-faulttreeanalysis-failure mode andeffect analysis–quantitative structure-activityrelationshipanalysis-fuzzymodelfor risk assessment.

Accidentanalysisandmanagement

Accidents classification and analysis-fatal, serious, minor and reportable accidents–safety audits-recent developmentofsafety engineering approaches formines-frequency rates-accident occurrence-investigation-measures for improvingsafety inmines-costofaccident-emergency preparedness–disaster management

REFERENCES:

1. Mine Health &SafetyManagement, Michael Karmis ed., SME, Littleton,Co., 2001.
2. Kejiriwal, B.K.SafetyinMines,GyanPrakashan,Dhanbad,2001.

COURSE OUTCOMES:

1. The Students will know the hazards in the mines and control of those hazards
2. Students learn how to overcome the issues such as ground collapse, atmospheric pollution, etc., occurs in the mines

Mapping with Programme Outcomes							
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	√		√	√	√		√
CO2	√		√	√	√		

ISEE XXX	**SAFETY IN TEXTILE INDUSTRY**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES:

- To understand the textile industrial process
- To identify the hazards and risks associated to textile industry
- To develop health and safety measures

Introduction

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

Textile hazards I

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.

Textile hazards II

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

Health and welfare

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.

Safety status

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

REFERENCES:

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

6. Little, A.H.,"Water supplies and the treatment and disposal of effluent"

COURSE OUTCOMES:
After learning the course the students shall be able to

3. Identify the hazards and risks and suggest safety procedures for textile indusries
4. Develop health and safety measures.
5. Use Special precautions for specific hazardous work environments.
6. Advise statutory norms to be followed for a textile industry

Mapping with Programme Outcomes							
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	√		√	√	√		
CO2		√	√	√			
CO3						√	√
CO4						√	√

ISEE XXX	**DOCK SAFETY**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES:

- To know the statues associated with the dock safety
- To know the hazards in the dock
- To learn the safe operation of handling cargo equipment and emergency action plans in the dock

History of Safety Legislation

History of dock safety statues in India-background of present dock safety statues-dockworkers(safety,healthandwelfare)act 1986andtherules and regulations framedthereunder, otherstatues likemarking ofheavypackagesact 1951andtherulesframedthereunder- manufacture,storageandimportof hazardouschemicals.Rules1989framedunderthe environment(protection) act,1989–fewcases laws tointerprettheterms usedinthedock safetystatues. Responsibilityof different agenciesfor safety, health andwelfare involvedin dock work –responsibilitiesofport authorities–docklabourboard–owner ofship master, agent of ship – owner of lifting appliances and loose gear etc. – employersofdockworkerslikestevedores–clearing and forwarding agents–competentpersonsanddockworker.Forumsforpromotingsafety andhealthin ports–SafeCommitteesandAdvisoryCommittees. Their functions,trainingof dock workers.

Working on Board the Ship

Typesofcargoships–workingonboardships–Safetyinhandling ofhatch beams–hatchcoversincludingitsmarking,Mechanicaloperatedhatchcovers ofdifferent typesanditssafety features–safety inchipping and painting operations onboardships–safe meansofaccesses–safety in storageetc.– illuminationofdecksandinholds–hazardsinworking insidetheholdoftheship and on decks – safety precautions needed – safety in use of transport equipment- internalcombustibleengineslikefort-lifttrucks-payloadersetc. Workingwithelectricityandelectrical management–Storage–types,hazardous cargo.

Lifting Appliances

Different typesoflifting appliances–construction, maintenance and use, various methods ofrigging ofderricks,safety intheuseofcontainerhandling/lifting appliances like portainers,

transtainer, top lift trucks and other containers – testing andexaminationoflifting appliances–portainers–transtainers–toplift trucks–derricks in differentriggingetc.
Useandcareofsyntheticandnatural fiber ropes–wireropechains,different types ofslings andloosegears.

Transport Equipment
Thedifferenttypesofequipment fortransportingcontainersand safety intheir use-safetyintheuseofselfloadingcontainervehicles,containersidelifter,fork lifttruck,dock railways,conveyors andcranes.
Safe use ofspecial lift trucks inside containers–Testing, examination and inspectionofcontainers–carriageofdangerousgoodsincontainers and maintenanceandcertification ofcontainersfor safeoperation
Handling ofdifferenttypesofcargo–stacking andunstacking both onboardthe shipandashore–loading andunloading ofcargoidentificationof berths/walking fortransfer operationofspecificchemical fromshiptoshore andviceversa– restrictionofloading andunloadingoperations.

Emergency Action Plan and Dock Workers Regulations
EmergencyactionPlansforfireandexplosions-collapseofliftingappliances andbuildings,sheds etc.,-gasleakagesandprecautionsconcerningspillageof dangerousgoodsetc.,- Preparationofon-siteemergencyplanandsafetyreport. Dockworkers(SHW) rulesandregulations1990-relatedtoliftingappliances, Container handling,loading& unloading,handling ofhatchcoverings and beams, Cargo handling,conveyors, dock railways,forklift.

REFERENCES:

1. SafetyandHealthinDock work,IIndEdition,ILO,1992.
2. DockSafety, ThaneBelapurIndustriesAssociation,Mumbai.
3. Taylor D.A.,IntroductiontoMarine Engineering
4. Srinivasan,Harbour, Dock andTunnelEngineering
5. BindraSR,CourseinDock&HarbourEngineering

COURSE OUTCOMES:
1. The Students will know the statues relating to dock activities
2. Students can identify the various hazards in different dock activities and take measures to eradicate them.
3. Students shall be able to manage emergency situations in the dock due to fire/explosion

Mapping with Programme outcomes							
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1			√		√		
CO2	√		√	√	√		
CO3		√				√	√

ISEE XXX	NUCLEAR ENGINEERING AND SAFETY	L	T	P
		4	0	0

COURSE OBJECTIVES:
- To impart knowledge and skills in the safety of Nuclear Engineering

- Know the various design considerations required for a nuclear reactor
- To provide knowledge on the radiation hazards and its prevention techniques

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

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

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

Safety of nuclear reactors
Safety design principles – engineered safety features – site related factors – safety related systems –heat transport systems – reactor control and protection system – fire protection system – qualityassurance in plant components – operational safety – safety regulation process – public awarenessand emergency preparedness. Accident Case studies- Three Mile island and Chernobyl accident.

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

REFERENCES:

1. M.M.E.L.Wakil, “Nuclear Power Engineering”, International Text Book Co.
2. StermanU.S.’”Thermal and Nuclear Power Stations”, MIR Publications, Moscow, 1986.
3. “Loss prevention in the process Industries” Frank P.Lees Butterworth-Hein-UK, 1990.
4. M.M.E.L.Wakil, “Nuclear Energy Conversion”, International Text Book Co.
5. R.L.Murray, “Introduction to Nuclear Engineering”, Prentice Hall.
6. Sri Ram K, “Basic Nuclear Engineering” Wiley Eastern Ltd., New Delhi, 1990.
7. Loffness, R.L., “Nuclear Power Plant” Van Nostrand Publications, 1979. USA

COURSE OUTCOMES:
After learning the course the students should be able to
1. Understand the concepts of safety of Nuclear reactors.
2. Design the safety relief systems required for nuclear reactors
3. Manage emergency situations
4. Control radiation hazards and advise on disposal techniques, etc.,

Mapping with Programme Outcomes							
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	√		√	√	√		
CO2	√		√	√	√		
CO3						√	√
CO4	√	√	√		√	√	

ISEE XXX	**DISASTER MANAGEMENT**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES:

- To provide knowledge on disaster mitigation
- To know the usage of software at different disaster scenarios
- To know the on and offsite emergency preparedness plans

Philosophy ofDisastermanagement-IntroductiontoDisastermitigation- Hydrological,Coastal andMarineDisasters-Atmospheric disasters-Geological, meteorological phenomena-Mass Movement and Land Disasters-Forest related disasters-Wind and water related disasters-deforestation-Use of space technologyforcontrol ofgeological disasters

Technological Disasters-Case studies of Technologydisasters with statistical details-Emergencies andcontrolmeasures-APELL-Onsite andOffsite emergencies-Crisismanagementgroups-Emergencycentersandtheir functions throughoutthecountry-Softwaresonemergency controls-Monitoring devices for detection ofgases intheatmosphere-Righttoknowact

IntroductiontoSustainableDevelopment-BioDiversity-Atmospheric pollution-Globalwarming and OzoneDepletion-ODS banking and phasing out-Sealevel rise-El Nino andclimatechanges-Ecofriendlyproducts-Greenmovements-Green philosophy-Environmental Policies-Environmental ImpactAssessment-case studies-Lifecycle

Offshoreandonshore drilling-controloffires-Casestudies-Marinepollutionand control-Toxic,hazardous&Nuclearwastes-stateofIndia's andGlobal environmentalissues-carcinogens-complex emergencies-Earthquakedisasters- thenature-extremeeventanalysis-theimmunesystem-proof andlimits-

Environmentaleducation-Populationandcommunity ecology-Naturalresources conservation-Environmental protection andlaw- Risk assessment process, assessmentfor differentdisaster types- Assessment data use,destructivecapacity-riskadjustment-choice-loss acceptance-disasteraid-publicliability insurance-stock takingandvulnerability analysis-disaster profileofthecountry-national policies-objectives andstandards-physicaleventmodification-preparedness, forecasting andwarning,landuse planning

REFERENCES:

1. IntroductiontoInternational Disaster Management, Damon Coppola, Elsevier, 2015
2. Disaster Management Handbook, Jack Pinkowski, CRC Press, 2008

COURSE OUTCOMES:

After learning the course the students should be able to

1. Mitigate the various types of disasters
2. Implement the emergency preparedness plans
3. Apply software and take decisions accordingly to minimize the consequences

Mapping with Programme Outcomes							
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	√		√		√	√	
CO2			√	√	√	√	√
CO3		√					

ISEE XXX	**OHSAS 18001 AND ISO 14001:2015**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES:

- To have familiarities with OHSAS standards and its policy and implementation procedures
- To provide an idea to the ISO 14001 guidelines

OHSAS standard

Introduction – Development of OHSAS standard – Structure and features of OSHAS 18001 – Benefits of certification-certification procedure – OH & S management system element, specification and scope - correspondence between OHSAS 18001, ISO 14001:1996 and ISO 9001:1994 – Guidelines (18002:2000) for implementing OHSAS 18001.

OHSAS 18001 policy & planning

Developing OH & S policy– Guidelines – Developments - procedure - Content of OH & S policy – General principle, strategy and planning, specific goals, compliance – methodology. Planning – Guidelines, methodology steps developing action plan – Analysis and identify the priorities, objective & Targets, short term action plan, benefits and cost of each option, Development of action plan.

Implementation and operation, checking and review

Guidelines for structure and Responsibilities, Top Management, middle level management, co-ordinator and employees - Developing procedures, identifying training needs, providing training, documentation of training, Training methodology consultation and communications. Checking & Review; performance measurement and monitoring, Proactive and Reactive monitoring, measurement techniques, inspections, measuring equipment - Accidents reports, Process & procedures, recording, investigation corrective action and follow up - records and records management. Handling documentation, information, records.

ISO 14001:2015

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

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

REFERENCES:

1. K.C. Arora, *ISO 9000 to OHSAS 18001,* S.K. Kataria& Sons, New Delhi
2. R.K. Jain & Sunil S Rao, (2006) *Industrial Safety, Health and Environment Management Systems,* 1st Ed. Khanna Publishers, New Delhi.

COURSE OUTCOMES:

1. The Students will know the current standards of OHSAS 18001 and implementing procedure
2. Students understand the guidelines of ISO 14001 and its necessity and the principles of environmental audits

Mapping with Programme Outcomes							
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	√		√	√			√
CO2		√			√	√	√

OPEN ELECTIVES

ISEE XXX	SAFETY IN CONSTRUCTION	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To know the factors associated with contract document and safety
- To know the hazards in excavation, foundation, cordoning, demolition and other construction activities
- To learn preventive measures such as Lockout/Tagout systems

General Safety Consideration – Analyzing construction jobs for Safety – Contract Document Hazards in Excavation – Working at Height – Foundation and utilities – Cordoning –

Demolition – Dismantling – Clearing Debris

Types of Foundations – Footings

Safety in Erection – Construction Materials – Specifications – Suitability – Limitations

Steel structures – Concrete structures – Safety in the Construction of Dams – Bridges – Water Tanks – Retaining Walls – Critical factors for failure – Inspection and Monitoring

Maintenance – Training – Scheduling – Preventive Maintenance – Lockout of Mechanical and Electrical systems – Ground maintenance – Hand tools – Gasoline operating equipment.

REFERENCES:

1. Fulman, J. B., Construction Safety, Security and Loss Prevention, John Wiley & Sons, 1979.
2. Hudson, R. Construction Hazard and Safety Handbook, Butterworth Heinemann, 1985.

COURSE OUTCOMES:

1. The Students will be able to understand the importance of contracts and agreements in the construction with respect to workers safety and health.
2. Students can identify the various hazards in different construction activities and take measures to eradicate them.
3. The students will get knowledge on the critical factors that can cause damages in the dams, bridges, water tanks and retaining walls which would help them in the design to prevent accidents.

Mapping with Programme Outcomes							
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1			√	√	√		√
CO2	√		√	√	√	√	
CO3	√		√	√	√	√	

ISEE XXX	ELECTRICAL SAFETY	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To explain how electrical current adversely affects the human body.
- Applicable Statutory requirements on safety standards regarding electrical works, equipment and installations
- To educate workers on safety tips in an electrical environment
- To identify and access the electrical hazard

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).

Electrical Hazards: Primary and secondary hazards– Energy leakage – Clearance and insulation – Excess energy – Current surges – Electrical causes of fire and explosion - ionization, spark and arc-ignition energy – National electrical Safety code - 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

Protection systems - fuse, circuit breakers, FRLS insulations, and Personal protective equipment – safety in handling hand held electrical appliances tools and medical equipments. Lightning, hazards, lightning arrestor, installation – earthing, specifications, earth resistance, earth pit maintenance.

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.

Hazardous zones: Classification of hazardous zones -intrinsically safe and explosion proof electrical apparatus (IS, API and OSHA standard) -increase safe equipment-their selection for different zones- temperature classification-grouping of gases-use of barriers and isolators-equipment certifying agencies.

REFERENCES:

1. Fordham Cooper, W., “Electrical Safety Engineering” Butterworth and Company, London, 1986.
2. Accident prevention manual for industrial operations”, N.S.C.,Chicago, 1982.
3. Indian Electricity Act and Rules, Government of India.
4. Power Engineers – Handbook of TNEB, Chennai, 1989.

COURSE OUTCOMES:

After the completion of the course, the Students will be able to

1. understand the types of electrical hazards
2. develop safe operating procedures to various electrical installations
3. classify the various hazardous zones as per the Standards

Mapping with Programme Outcomes							
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	√		√	√	√	√	
CO2	√		√	√	√	√	
CO3							√

ISEE XXX	**ENVIRONMENTAL IMPACT ASSESSMENT**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES:

- To understand the concept of EIA
- To study about types of EIA
- To study about the methodologies of EIA
- To know about various Prediction tools of EIA
- To know about Environmental Clearance Procedures

Evolution of EIA - Concepts - Methodologies - Screening - Scoping - Mitigation - Matrices - Checklist

Rapid and Comprehensive EIA- Legislative and Environmental Clearance Procedure in India - Prediction tools for EIA

Assessment of Impact - Air - Water- Soil - Noise - Biological - Socio cultural Environment – Public Participation - Resettlement and Rehabilitation

Documentation of EIA - Environmental Management Plan - Post Project Monitoring

Environmental Audit - Life Cycle Assessment - EMS - Case Studies in EIA

REFERENCES:

1. Canter, R.L., “Environmental Impact Assessment”, McGraw Hill Inc., New Delhi, 1996.
2. Shukla, S.K. and Srivastava, P.R., “Concepts in Environmental Impact Analysis”, Common Wealth Publishers, New Delhi, 1992.
3. John G. Rau and David C Hooten “Environmental Impact Analysis Handbook”, McGraw Hill Book Company, 1990.
4. “Environmental Assessment Source book”, Vol. I, II & III. The World Bank, Washington, D.C., 1991.
5. Judith Petts, “Handbook of Environmental Impact Assessment Vol. I & II”, Blackwell Science, 1999.

COURSE OUTCOMES:

The students completing the course will have ability to

1. Carry out scoping and screening of developmental projects for environmental and social assessments
2. Explain different methodologies for environmental impact prediction and assessment
3. Plan environmental impact assessments and environmental management plans
4. Evaluate environmental impact assessment reports

Mapping with Programme Outcomes							
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1							√
CO2			√	√			√
CO3							√
CO4							√

ISEE XXX	WORK STUDY AND ERGONOMICS	L	T	P
		4	0	0

COURSE OBJECTIVES:

- To study about workplace hazards
- To understand the concept of ergonomics
- To know the importance of personal protective equipment
- To learn process and equipment design and man machine systems

Work study:

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

Ergonomics

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

Personal protection

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

Process and equipment design

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

Man machine systems

Job and personal risk factors –standards - selection and training - body size and posture - body dimension (static/dynamic) – adjustment range – penalties – guide lines for safe design and postures – evaluation and methods of reducing posture strain. Man - machine interface – controls - types of control - identification and selection - types of displays - compatibility and stereotypes of important operations - fatigue and vigilance - measurement characteristics and strategies for enhanced performance.

REFERENCES:

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

COURSE OUTCOMES:

After learning the course, the students should be able to

1. Understand the fundamentals of ergonomics.
2. Know about workplace hazards.
3. Use personal protective equipments for specific hazardous work environments.

Mapping with Programme Outcomes							
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	√		√	√	√		
CO2	√		√	√	√		
CO3			√	√	√	√	√