ANNAMALAI UNIVERSITY

(Accredited With 'A' Grade by NAAC)

Faculty of Engineering and Technology
Department of Chemical Engineering

M.Tech., Industrial Safety Engineering
(Choice Based Credit System)

HAND BOOK
REGULATIONS AND SYLLABUS
2019 - 2020
(onwards)

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

PROGRAMME *(CBCS)*

REGULATIONS -2019

1. **Conditions for Admission**

   Candidates for admission to the first year of the four-semester **M.E / M.Tech Degree programme in Engineering** shall be required to have passed B.E / B.Tech degree of Annamalai University or any other authority accepted by the syndicate of this University as equivalent thereto. They shall satisfy the conditions regarding qualifying marks and physical fitness as may be prescribed by the Syndicate of the AnnamalaiUniversity from time to time. The admission for M.E Part Time programme is 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 I

3. **Courses of study**

   The courses of study along with the respective syllabi and the scheme of Examinations for each of the M.E / M. Tech programmes offered by the different Departments of study in the Faculty of Engineering and Technology are given separately.

4. **Choice Based Credit System (CBCS)**

   The curriculum includes three components namely Program Core, Program Electives and Open Electives, Mandatory Learning Courses and Audit Courses in addition to Thesis. Each semester curriculum shall normally have a blend of theory and practical courses.

5. **Assignment of Credits for Courses**

   Each course is normally assigned one credit per hour of lecture / tutorial per week and 0.5 credit for one hour of laboratory or project or industrial training or seminar per week. The total credits for the programme will be **68**.

6. **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.

7. **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 Phase-II shall be done at the appropriate semesters.

8. **Electives**

   8.1 Program Electives

   The student has to select two electives in first semester, another two electives in the second semester and one more in the third semester from the list of Program Electives.

   8.2 Open Electives

   The student has to select two electives in third semester from the list of Open Electives offered by the Department and / or other departments in the Faculty of Engineering and Technology.

8.3 MOOC (SWAYAM) Courses

Further, the student can be permitted to earn credits by studying the Massive Open Online Courses offered through the SWAYAM Portal of UGC with the approval of the Head of the Department concerned. These courses will be considered as equivalent to open elective courses. Thus the credit earned through MOOC courses can be transferred and considered for awarding Degree to the student concerned.

8.4 Value added courses (Inter Faculty Electives)

Of the two open elective courses, a student must study one value added course that is offered by other Faculties in our University either in second or third semester of the M.E programme.

9. Industrial Project

A student may be allowed to take up the one program elective and two open elective courses of third semester (Full Time program) in the first and second semester, to enable him/her to carry out Project Phase-I and Phase-II in an industry during the entire second year of study. The condition is that the student must register those courses in the first semester itself. Such students should meet the teachers offering those elective courses themselves for clarifications. No specific slots will be allotted in the time table for such courses.

10. Assessment

10.1 Theory Courses

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

10.2 Practical Courses

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

10.3 Thesis work

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.

10.4 Seminar / Industrial Training

The continuous assessment marks for the seminar / industrial training will be 40 and to be assessed by a seminar committee consisting of the Seminar Coordinator and a minimum of two members nominated by the Head of the Department. The continuous assessment marks will be awarded at the end of the seminar session. 60 marks are allotted for the seminar / industrial training and viva voce examination conducted based on the seminar / industrial training report at the end of the semester.

11. Student Counselors (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 counselor

(mentor) for those students throughout their period of study. Such student counselors shall advise the students in selecting open elective courses from, give preliminary approval for the courses to be taken by the students during each semester, and obtain the final approval of the Head of the Department monitor their progress in SWAYAM courses / open elective courses.

12. Class Committee

For each of the semesters of M.E / M.Tech programmes, separate class committees will be constituted by the respective Head of the Departments. The composition of the class committees from first to fourth semesters for 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 courses / 40 marks for practical courses, for Industrial Training and for Thesis work (Phase-I and Phase-II) 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 Full time / 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 and declaration 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 68 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 68 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 68 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.Tech degree 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.Tech could 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	**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
2	**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, Agricutural and irrigation Engg, Geo informatics, Energy and Environmental Engg.
3	**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.	
4	**Computer Science & Engineering**	i.	Computer Science & Engineering	B.E. / B.Tech - Computer Science and Engineering, Information Technology, Electronics and Communication Engg, Software Engineering
5	**Electrical Engineering**	i.	Embedded Systems	B.E. / B.Tech – Electrical and Electronics Engg, 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	
6	**Electronics & Communication Engineering**	i.	Communication Systems	B.E. / B.Tech -Electronics and Communication Engg, Electronics Engg.

S.No.	Department		Programme (Full Time & Part time)	Eligible B.E./B.TechProgramme
7	**Electronics & Instrumentation**	i.	Process Control & Instrumentation	B.E. / B.Tech – Electronics and Instrumentation Engg, Electrical and Electornics Engg, Control

	Engineering			and Instrumentation Engg, Instrumentation Engg, , Electronics and Communication Engg,
		ii.	Rehabilitative Instrumentation	B.E. / B.Tech – Electronics and Instrumentation Engg, Electrical and Electornics Engg, 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
8	**Information Technology**	i	Information Technology	B.E. / B.Tech - Computer Science and Engineering, Information Technology, Electronics and Communication Engg, Software Engineering
9	**Mechanical Engineering**	iv.	Thermal Power	B.E. / B.Tech – Mechanical Engg, Automobile Engg, Mechanical Engg (Manufacturing).
		v.	Energy Engineering & Management	B.E. / B.Tech – Mechanical Engg, Automobile Engg, Mechanical (Manufacturing) Engg, Chemical Engg
10	**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 and 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

ANNAMALAI UNIVERSITY
DEPARTMENT OF CHEMICAL ENGINEERING
M.Tech. Industrial Safety 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

PROGRAMME OUTCOME (PO s):

After the completion of the programme, students will be able to fulfill 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, analyses 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
8. Understand the impact of health safety and environment solution on productivity.

9. Understanding of the social, legal, cultural issues and the consequent responsibly relevant to occupational health safety practices.
10. Effective communication in occupational health safety among the employees.
11. Provide practical solution to safety problem
12. Establishment, implement and improvement on safety management to improve safety culture.

Mapping with Programme Outcomes												
PEO s/PO s	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
PEO1	√	√	√	√			√	√				
PEO2	√	√		√		√	√					
PEO3	√	√			√				√			
PEO4			√		√		√					√
PEO5	√	√			√	√	√			√	√	

COURSES OF STUDY AND SCHEME OF EXAMINATIONS

Full-Time

FACULTY OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF CHEMICAL ENGINEERING

Program :M.Tech, **Specialization: Industrial Safety Engineering**

CURRICULUM - 2019

SEMESTER I									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
CHISPC11	**PC**	Safety Management	3	-	-	25	75	100	3
CHISPC12	**PC**	Occupational Health and Hygiene	3	-	-	25	75	100	3
CHISPE13	**PE**	Program Elective-I	3	-	-	25	75	100	3
CHISPE14	**PE**	Program Elective-II	3	-	-	25	75	100	3
CHISMC15	**MC**	Research Methodology and IPR	2	-	-	25	75	100	2
CHISCP16	**CP**	Environmental Hazard Analysis Laboratory	-	-	3	40	60	100	2
CHISCP17	**CP**	Air Pollutants Analysis Laboratory	-	-	3	40	60	100	2
CHISAC18	**AC**	Audit Course-I	2	-	-	-	-	-	0
							Total		**18**

SEMESTER II									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
CHISPC21	**PC**	Computer Aided Risk Analysis	3	-	-	25	75	100	3
CHISPC22	**PC**	Fire Engineering and Explosion Control	3	-	-	25	75	100	3
CHISPE23	**PE**	Program Elective-III	3	-	-	25	75	100	3
CHISPE24	**PE**	Program Elective-IV	3	-	-	25	75	100	3
CHISCP25	**OE**	Open Elective (Inter Faculty)	3	-	1	25	75	100	3
CHISOE26	**CP**	Fire Control, PPE & QRA Studies Laboratory	-	-	3	40	60	100	2
CHISTS27	**TS**	Industrial Training and Seminar / Mini project		Tr 2	S 2	40	60	100	2
CHISAC28	**AC**	Audit Course-II	2	-	-	-	-	-	0
							Total		**19**

DEPARTMENT OF CHEMICAL ENGINEERING

Program : M.Tech. **Specialization: Industrial Safety Engineering**

CURRICULUM - 2019

SEMESTER III									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
CHISPE31	**PE**	Program Elective-V	3	-	-	25	75	100	3
CHISOE32	**OE**	Open Elective (inter faculty)	3	-	-	25	75	100	3
CHISPV33	**PV-I**	Project work & Viva-voce Phase-I	-	Pr 16	S 4	40	60	100	10
							Total		**16**

SEMESTER IV									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
CHISPV41	**PV-II**	Project work & Viva-voce Phase-II	-	Pr 24	S 6	40	60	100	15
							Total		**15**

LIST OF PROGRAM ELECTIVES

1. Safety in Chemical Industries
2. Environmental Pollution Control
3. Safety in On and Off shore Drilling
4. Safety in Material Handling
5. Safety in Engineering Industry
6. Safety in Mines
7. Regulations for Health, Safety and Environment
8. Nuclear Engineering and Safety
9. Dock Safety
10. Safety in Construction
11. Environmental Impact Assessment
12. Occupational Health Safety Management System ISO 45001:2018
13. Human Factors Engineering
14. Safety in Textile Industry
15. Air Pollution Control

AUDIT COURSES

1. English for Research Paper Writing
2. Disaster Management
3. Sanskrit for Technical Knowledge
4. Value Education
5. Constitution of India
6. Pedagogy Studies
7. Stress Management by Yoga
8. Personality Development through Life Enlightenment Skills.

LIST OF OPEN ELECTIVES

1. Maintainability Engineering
2. Electrical Safety
3. Work Study and Ergonomics
4. Transport Safety

DEPARTMENT OF CHEMICAL ENGINEERING

M.E. (Industrial safety Engineering) PART TIME - DEGREE PROGRAMME
REGULATION - 2019
Courses of Study and Scheme of Examination

Sl. No.	Course Code	Category	Course	L	T	P	CA	FE	Total	Credits	Equivalent Course Code in M.E. Full Time
S E M E S T E R – I											
1	PXXYYPC11	**PC**	Safety Management	3	-	-	25	75	100	3	PCHISPC11
2	PXXYYPC12	**PC**	Occupational Health and Hygiene	3	-	-	25	75	100	3	PCHISPC12
3	PXXYYMC13	**MC**	Research Methodology and IPR	2	-	-	25	75	100	2	PCHISMC15
4	PXXYYCP14	**CP**	Environmental Hazard Analysis Laboratory	-	-	3	40	60	100	2	PCHISCP16
	Total						**115**	**285**	**400**	**10**	

Sl. No.	Course Code	Category	Course	L	T	P	CA	FE	Total	Credits	Equivalent Course Code in M.E. Full Time
S E M E S T E R – II											
1	PXXYYPC21	**PC**	Computer Aided Risk Analysis	3	-	-	25	75	100	3	PCHISPC21
2	PXXYYPC22	**PC**	Fire Engineering and Explosion Control	3	-	-	25	75	100	3	PCHISPC22
3	PXXYYOE23	**OE**	Open Elective - I (**From the Dept**)	3	-	-	25	75	100	3	PCHISOE25
4	PXXYYCP24	**CP**	Fire Control, PPE & QRA Studies Laboratory	-	-	3	40	60	100	2	PCHISCP26
	Total						**115**	**285**	**400**	**11**	

Sl. No.	Course Code	Category	Course	L	T	P	CA	FE	Total	Credits	Equivalent Course Code in M.E. Full Time
S E M E S T E R – III											
1	PXXYYPE31	**PE**	Program Elective-I	3	-	-	25	75	100	3	PCHISPE13
2	PXXYYPE32	**PE**	Program Elective-II	3	-	-	25	75	100	3	PCHISPE14
3	PXXYYCP33	**CP**	Air Pollutants Analysis Laboratory	-	-	3	40	60	100	2	PCHISCP17
	Total						**90**	**210**	**300**	**8**	

Sl. No.	Course Code	Category	Course	L	T	P	CA	FE	Total	Credits	Equivalent Course Code in M.E. Full Time
S E M E S T E R – IV											
1	PXXYYPE41	PE	Program Elective-III	3	-	-	25	75	100	3	PCHISPE23
2	PXXYYPE42	PE	Program Elective-IV	3	-	-	25	75	100	3	PCHISPE24
3	PXXYYTS43	TS	Industrial Training and Seminar / Mini project		Tr 2	S 2	40	60	100	2	PCHISTS27
	Total						**90**	**210**	**300**	**8**	

Sl. No.	Course Code	Category	Course	L	T	P	CA	FE	Total	Credits	Equivalent Course Code in M.E. Full Time
S E M E S T E R –V											
1	PXXYYPE51	**PE**	Program Elective-V	3	-	-	25	75	100	3	PCHISPE31
2	PXXYYOE52	**OE**	Open Elective - II (From the Dept)	3	-	-	25	75	100	3	PCHISOE32
3	PXXYYPV53	**PV-I**	Project work & Viva-voce Phase-I	-	Pr 16	S 4	40	60	100	10	PCHISPV33
	Total						**90**	**210**	**300**	**16**	

Sl. No.	Course Code	Category	Course	L	T	P	CA	FE	Total	Credits	Equivalent Course Code in M.E. Full Time
S E M E S T E R –VI											
1	PXXYYPV61	**PV-II**	Project work & Viva-voce Phase-II	-	Pr 24	S 6	40	60	100	15	PCHISPV41
	Total						**40**	**60**	**100**	**15**	

SEMESTER – I

CHISPC11	SAFETY MANAGEMENT	L	T	P	C
		3	0	0	3

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

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. 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 will 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 Programme Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	√	√	√	√			√	√				
CO2	√	√		√		√	√					
CO3	√	√			√				√			
CO4			√		√		√					√
CO5	√	√			√	√	√			√	√	

CHISPC12	OCCUPATIONAL HEALTH AND HYGIENE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To know the importance of health and hygiene at work place
- To understand the concept of Physical, 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- non-ionizing radiations, effects, types, radar hazards,
microwaves and radio waves, lasers, TLV- cold environments, hypothermia, wind chill index, control measures hot environments, thermal comfort, heat stress indices, acclimatization, estimation and control

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 Vapor 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 pain disorders 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 completing the course, the students will be able to

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
4. Understand the functions and activities of Occupational health services
5. Identifying noticeable occupational diseases arising out of occupation and suggestion for preventing methods

Mapping with Programme Outcomes												
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	√		√	√	√		√	√			√	√
CO2	√	√	√	√	√	√	√				√	√
CO3	√		√	√			√					
CO4		√	√		√		√		√	√		
CO5	√			√	√		√			√	√	

CHCEMC15	**RESEARCH METHODOLOGY AND IPR**	**L**	**T**	**P**	**C**
		2	**0**	**0**	**2**

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

Effective literature studies approaches, analysis Plagiarism, Research ethics,

Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

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

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

REFERENCES:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2nd Edition , "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
5. Mayall , "Industrial Design", McGraw Hill, 1992.
6. Niebel , "Product Design", McGraw Hill, 1974.
7. Asimov , "Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.
9. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

COURSE OUTCOMES:

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

1. Understand research problem formulation.
2. Analyze research related information
3. Follow research ethics
4. Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
5. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
6. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

CHISCP16	ENVIRONMENTAL HAZARD ANALYSIS LABORATORY	L	T	P	C
				3	2

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) Estimation of COD
5) Estimation of BOD

COURSE OUTCOMES:

After completing the course, the students will be able to

1. Carryout field investigations such as measurement of noise, illumination and humidity
2. Carry out field investigation on illumination level
3. Carry out field investigation on humidity level
4. Compare the measured level with standards
5. Suggestion measures for minimizing abnormalities

Mapping with Programme Outcomes												
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	√		√	√	√		√		√	√		
CO2	√		√	√		√	√					
CO3	√		√		√	√	√			√		
CO4	√		√	√	√			√	√			
CO5	√		√	√	√			√	√		√	√

CHISCP17	**AIR POLLUTANTS ANALYSIS LABORATORY**	**L**	**T**	**P**	**C**
				3	**2**

COURSE OBJECTIVES:

- To learn procedures 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 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) Determination of particulate matter in air

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.,
5. Compare the measured level with standards

Mapping with Programme Outcomes												
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	√		√	√	√	√	√					√
CO2	√		√		√	√	√		√		√	√
CO3	√	√	√	√	√	√			√		√	√
CO4	√	√	√	√	√	√			√	√	√	√
CO5	√	√			√	√	√			√	√	√

SEMESTER – II

CHISPC21	**COMPUTER AIDED RISK ANALYSIS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

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/jet fire/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, preliminary hazard analysis (PHA), hazard operability studies (HAZOP)

Applications of Advanced Equipments and Instruments, Thermo Calorimetry, Differential Scanning Calorimeter (DSC), Thermo Gravimetric Analyzer (TGA), Accelerated Rate Calorimeter (ARC), Principles of operations, Controlling parameters, Applications, advantages. Explosive testing, Deflagration Test, Detonation Test, Ignition Test, Minimum ignition energy Test, Sensitiveness Test, Impact Sensitiveness Test(BAM) and Friction Sensitiveness Test (BAM), Shock Sensitiveness Test, Card Gap Test.

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

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

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 will be able to

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

Mapping with Programme Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	√		√	√	√	√	√					√
CO2		√	√	√		√				√		√
CO3			√	√			√	√				√
CO4	√		√	√		√					√	√
CO5		√		√		√			√	√		√

CHISPC22	**FIRE ENGINEERING AND EXPLOSION CONTROL**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

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:

After learning the course, the students will 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
4. Know the different source of ignition and their prevention techniques
5. Understand the causes and prevention of explosion

Mapping with Programme Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	√	√	√	√	√	√						
CO2	√		√	√	√	√	√					
CO3	√		√	√	√							
CO4	√		√	√	√	√		√			√	√
CO5	√	√	√	√	√							√

CHISCP26	**FIRE CONTROL, PPE & QRA STUDIES LABORATORY**	**L**	**T**	**P**	**C**
				3	**2**

COURSE OBJECTIVES:

- To learn procedures 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. Study of Fire Alarms
2. QRA study using ALOHA
3. A study on Fire Fighting Equipment
4. A study on Personal Protective Equipment

COURSE OUTCOMES:

After learning the course, the students will be able to

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

Mapping with Programme Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1			√	√	√	√	√			√		
CO2	√		√		√	√	√				√	
CO3		√		√	√	√		√				√
CO4		√		√	√	√						√
CO5	√	√	√	√	√	√	√	√		√	√	√

CHISTS27	INDUSTRIAL TRAINING AND SEMINAR / MINI PROJECT	Tr	T	P	C
		2	0	2	2

COURSE OBJECTIVES:

- To train the students in the field work related to industrial safety engineering and to have a practical knowledge in carrying out work at industrial safety engineering
- 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 chemical engineering during the summer vacation (at the end of second semester for full-time/ IV 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 third semester for full time/fifth semester for part time. The student will be evaluated by a team of staff members nominated by head of the department through a viva voce examination

COURSE OUTCOME:

1. The student can face the challenges and practice with confidence
2. The student will be benefitted by the training with managing the situation arises during the execution of work related to chemical process industries.

SEMESTER – III

CHCEPV 33	PROJECT WORK VIVAVOCE PHASE – I	L	P	S	C
		0	16	4	10

CHCEPV 41	PROJECT WORK VIVA VOCE PHASE – II	L	P	S	C
		0	24	6	15

Dissertation Phase – I and Phase – II

Teaching Scheme Lab work: 20 and 30 hrs/week for phase I and II respectively

COURSE OBJECTIVES:

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

- Ability to synthesize knowledge and skills previously gained and applied to an in-depth study and execution of new technical problem.
- Capable to select from different methodologies, methods and forms of analysis to produce a suitable research design, and justify their design.
- Ability to present the findings of their technical solution in a written report.
- Presenting the work in International/ National conference or reputed journals.

Syllabus Contents:

The dissertation / project topic should be selected / chosen to ensure the satisfaction of the urgent

need to establish a direct link between education, national development and productivity and thus
reduce the gap between the world of work and the world of study. The dissertation should have the following
• Relevance to social needs of society
• Relevance to value addition to existing facilities in the institute
• Relevance to industry need
• Problems of national importance
• Research and development in various domain

The student should complete the following:
• Literature survey
  Problem Definition
• Motivation for study and Objectives
• Preliminary design / feasibility / modular approaches
• Implementation and Verification
• Report and presentation

The dissertation stage II is based on a report prepared by the students on dissertation allotted to them.
It may be based on:
• Experimental verification / Proof of concept.
• Design, fabrication, testing of Communication System.
• The viva-voce examination will be based on the above report and work.

Guidelines for Dissertation Phase – I and II
• As per the AICTE directives, the dissertation is a yearlong activity, to be carried out and evaluated in two phases i.e. Phase – I: July to December and Phase – II: January to June.
• The dissertation may be carried out preferably in-house i.e. department's laboratories and centers OR in industry allotted through department's T & P coordinator.
• After multiple interactions with guide and based on comprehensive literature survey, the student shall identify the domain and define dissertation objectives. The referred literature should preferably include Springer/Science Direct. In case of Industry sponsored projects, the relevant application notes, while papers, product catalogues should be referred and reported.

• Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and phase wise work distribution, and submit the proposal within a month from the date of registration.
• Phase – I deliverables: A document report comprising of summary of literature survey, detailed objectives, project specifications, paper and/or computer aided design, proof of concept/functionality, part results, A record of continuous progress.
• Phase – I evaluation: A committee comprising of guides of respective specialization shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend repeating the phase-I work.
• During phase – II, student is expected to exert on design, development and testing of the proposed work as per the schedule. Accomplished results/contributions/innovations should be published in terms of research papers in reputed journals and reviewed focused conferences OR IP/Patents.
• Phase – II deliverables: A dissertation report as per the specified format, developed system in the form of hardware and/or software, A record of continuous progress.

• Phase – II evaluation: Guide along with appointed external examiner shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend for extension or repeating the work

COURSE OUTCOMES:

After learning the course, the students will 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
4. Present the findings of the technical solution in a written report
5. Publishing the novelty of the work in conferences of journals

Mapping with Programme Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	√		√	√	√				√	√		√
CO2		√	√	√	√							
CO3	√	√	√	√	√	√		√	√		√	
CO4			√	√	√		√			√		
CO5				√	√					√		

PROGRAM ELECTIVE

CHISPEXX	**SAFETY IN CHEMICAL INDUSTRIES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

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, handling, 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 students will 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
4. Able to prepare the emergency planning for chemical industry problem
5. Able to create safe storage system

Mapping with Programme Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1		√	√	√				√			√	√
CO2	√	√			√		√				√	√
CO3		√	√			√	√	√		√		
CO4	√			√	√	√					√	√
CO5	√		√	√	√						√	√

CHISPEXX	**ENVIRONMENTAL POLLUTION CONTROL**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

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 behaviour -Control of gaseous pollutants, sulphurdioxides, nitrogen oxides, Carbon monoxide and Hydrocarbons. Air pollution laws and Standards.

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 and petrochemical.

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
4. Understand the standards that are published by the professional bodies
5. Explain the environmental health issues problem arises due to air and water pollution
6.

Mapping with Programme Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	√	√	√	√		√					√	√
CO2	√	√	√	√	√		√					
CO3			√	√	√		√					
CO4			√	√	√		√				√	√
CO5	√	√	√	√		√	√				√	

CHISPEXX	**SAFETY IN ON AND OFFSHORE DRILLING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

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 will 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
4. Know the necessary personal protective equipments required for drilling operations
5. Understanding the need of safe storage and transportation of petroleum products

Mapping with Programme Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	√		√	√	√		√		√			√
CO2	√	√	√	√		√		√	√		√	√

CO3	√		√		√				√		√	√
CO4	√		√	√	√	√					√	√
CO5	√	√		√	√	√					√	√

CHISPEXX	**SAFETY IN MATERIAL HANDLING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

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 will be able to

1. Understand the Basic principles of safety in Material handling
2. Know the safe operation and maintenance of Trucks and cranes
3. Understanding the difficulties during the application of ergonomics in work environment
4. Identifying the proper equipment requirement for a specific process to avoid accidents
5. Know the effective material handling system

Mapping with Programme Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**

CO1	√			√	√	√					√	√
CO2	√					√	√		√	√	√	√
CO3	√	√	√	√		√					√	√
CO4	√	√		√	√			√			√	√
CO5	√		√	√	√						√	√

CHISPEXX	**SAFETY IN ENGINEERING INDUSTRY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

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 by N.V. Krishnan JaicoPublishery House, 1996
2. Safety Management by John V. Grimaldi and Rollin H. Simonds, All India Travelers Book seller, 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 will 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
3. Understand the safety rules standards in varies mechanical engineering process
4. Knowledge in testing and inspecting as per rules of boiler, heat treatment operation etc.
5. Clear about the preventive measures in health and wefare of workers aspects in industries.

Mapping with Programme Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	√		√	√			√	√			√	√
CO2	√	√		√		√		√	√		√	
CO3	√		√				√				√	√
CO4	√			√	√						√	
CO5	√	√	√	√	√	√			√	√		√

CHISPEXX	**SAFETY IN MINES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

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

Causes and prevention of accident from: Heavy machinery, belt and bucket conveyors, drilling, hand tools-pneumatic systems, pumping, water, dust, electrical

systems, fire prevention. Garage safety–accident reporting system- working condition-safe transportation–handling of explosives.

Underground Mines

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

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.

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.

Accident analysis and management

Accidents classification and analysis-fatal, serious, minor and reportable accidents–safety audits-recent developmentofsafetyengineering approaches formines-frequency rates-accident occurrence-investigation-measures for improvingsafetyinmines-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:

After learning the course, the students will be able to

1. Know the hazards in the mines and control of those hazards
2. Learn how to overcome the issues such as ground collapse, atmospheric pollution, etc., occurs in the mines
3. Understand the mining activities of open case, underground and tunneling mining
4. Able to implement disaster management, emergency preparedness and risk assessment
5. Effectively employ the knowledge on prevention of accident

Mapping with Programme Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	√		√	√	√		√		√		√	√
CO2	√		√	√	√				√			√
CO3	√			√	√	√	√	√			√	√
CO4	√	√			√	√						√
CO5	√			√	√	√			√		√	√

CHISPEXX	**REGULATIONS FOR HEALTH, SAFETY AND ENVIRONMENT**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

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

Factories Act and Rules - Employee's Compensation Act 1923 - Building and Other Construction Workers Act 1996
Indian Explosive Act - Gas Cylinder Rules - SMPV Act - Indian Boiler Act 1923 - Indian Petroleum Act - Indian Electricity Act.

Environment Act (Protection) 1986 - Air Act1981 - Water Act 1974 - The Noise Pollution (Regulation and control) Rules, 2000 - National Green Tribunal Act 2010

Manufacture, Storage and Import of Hazardous Chemical rules 1989 - Hazardous Wastes (Management and Handling) Rules 1989 - Biomedical Waste (Management and Handling) Rules 1998 - Municipal Solid Wastes (Management and Handling) Rules 2000

Overview of ISO Series - ISO 45001- ISO 14001

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. The Indian boilers act 1923, Commercial Law Publishers (India) Pvt. Ltd., Allahabad.

COURSE OUTCOMES:

After learning the course, the students will 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
5. Understanding the benefits of following regulations for health safety and environment

Mapping with Programme Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	√	√						√	√		√	√
CO2			√	√				√	√	√		
CO3			√	√			√	√				√
CO4						√	√		√			√
CO5			√	√	√	√	√		√	√		√

CHISPEXX	**NUCLEAR ENGINEERING AND**	**L**	**T**	**P**	**C**

	SAFETY	3	0	0	3

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 will 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.,
5. Explain the safety design principles and regulation process

Mapping with Programme Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	√		√	√	√			√		√	√	

CO2	√		√	√	√					√	√	√
CO3						√	√		√		√	
CO4	√	√	√		√	√					√	√
CO5	√		√	√	√	√				√	√	

CHISPEXX	**DOCK SAFETY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

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, health and welfare) act 1986andtherules and regulations framed there under, other statues like marking of heavy packages act 1951 and the rules framed there under-manufacture, storage and import of hazardouschemicals.Rules1989framedunderthe environment (protection) act,1989–fewcases laws to interpret the terms used in the dock safety statues. Responsibility of different agencies for safety, health and welfare involved in dock work –responsibilities of port authorities–dock labourboard–owner of ship master, agent of ship – owner of lifting appliances and loose gear etc. – employers of dock workers like stevedores–clearing and forwarding agents– competent persons and dockworker. Forums for promoting safety and health in ports–Safe Committees and Advisory Committees. Their functions, training of dock workers.

Working on Board the Ship

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

Lifting Appliances

Different types of lifting appliances–construction, maintenance and use, various methods of rigging of derricks, safety in the use of container handling/lifting appliances like portainers, transtainer, top lift trucks and other containers – testing and examination of lifting appliances–portainers–transtainers–toplift trucks–derricks in different rigging etc.
Use and care of synthetic and natural fiber ropes–wirer open chains, different types of slings and loose gears.

Transport Equipment

The different types of equipment for transporting containers and safety in their use-safety in the use of self loading container vehicles, container side lifter, fork lift truck, dock railways, conveyors and cranes. Safe use of special lift trucks inside containers–Testing, examination and in section of containers–carriage of dangerous goods in containers and maintenance and certification of containers for safe operation Handling of different types of cargo–stacking and unstacking both on board the ship and ashore–loading and unloading of

cargo identification of berths/walking for transfer operation of specific chemical from ship to shore and vice versa– restriction of loading and unloading operations.

Emergency Action Plan and Dock Workers Regulations

Emergency action Plans for fire and explosions – collapse of lifting appliances and buildings, sheds etc.,-gas leakages and precautions concerning spillage of dangerous goods etc.,- Preparation of on–site emergency plan and safety report. Dock workers(SHW) rules and regulations1990-related to lifting appliances, Container handling, loading & unloading, handling of hatch coverings 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:

After learning the course, the students will be able to

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.
4. Understand the operation of various types of material handling equipments
5. Students, recognize various problems associated with the use of lifting equipments in storage yard.

Mapping with Programme Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	√		√		√			√	√		√	√
CO2	√		√	√	√				√	√	√	
CO3		√				√	√	√	√		√	
CO4			√	√	√						√	
CO5	√		√	√	√	√					√	

CHISPEXX	**SAFETY IN CONSTRUCTION**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

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:

After learning the course, the students will be able to

1. Able to understand the importance of contracts and agreements in the construction with respect to workers safety and health.
2. Identify the various hazards in different construction activities and take measures to eradicate them.
3. 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.
4. Identifying types and causes of accident and designing aids for safe construction
5. Understanding the safety procedures for work at height.

Mapping with Programme Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1			√	√	√		√	√	√	√		√
CO2	√		√	√	√	√			√		√	
CO3	√		√	√	√	√		√	√		√	
CO4	√		√	√	√						√	
CO5	√			√	√						√	

CHISPEXX	**ENVIRONMENTAL IMPACT ASSESSMENT**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To understand the concept of EIA
- To prepare EIA reports
- To know the components of EIA
- To know about various Prediction tools of EIA
- To know legislation requirement of EIA

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:

After learning the course, the students will be able 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
5. Students able to documentation of environment impact assessment

Mapping with Programme Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1							√	√	√			√
CO2			√	√			√	√			√	√
CO3							√	√			√	√
CO4	√						√	√		√	√	
CO5	√	√	√	√	√		√	√				

CHISPEXX	**OCCUAPATIONAL HEALTH SAFETY MANAGEMENT SYSTEM ISO 45001:2018**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To have familiarities with OHSAS standards and its policy and implementation procedures
- To provide an idea to the ISO 45001

Introduction to ISO 45001 - purpose of developing the standard, major difference between the OHSAS 18001 and ISO 45001, benefits of using and adapt the standard. ISO 45001 related to other standards, terms and definitions, requirements of ISO 45001OH&SMS.

Clause 4: Context of the organization - understanding the organization and its context, input-process-output for contextual issues. Factors affecting the OH&S activities - internal issues, external issues. Plane-Do-Check-Act for gathering the need and expectation of input-process-output for ISO 45001 occupational health and safety. Implementation guidelines.

Clause 5: Leadership OH&S policy, consultation and participation of workers

Clause 6: Planning action to address risk and opportunity-general hazard identification and assessment of risk and opportunity, assessment of OHS risk and other risk, OHS objective and planning, input-process-output for addressing the risk, OH&S legal requirements.
Clause 7: Support input-process-output for clause requirements "people" OH&S competency matrix , implementation guidelines, plane-do-check-act for communication – internal, external communication charts, control of documented information-clause requirement, block diagram, documentation structure.

Clause 8: operational planning and control eliminating hazard and reducing OH&S risk, situation where the operation controls are required, management of change, outsourcing, procurement, emergency preparedness and response (EPR), EPR flow chart, Mock Drill and procedure and carried out for following emergency.
Clause 9: performance evaluation, internal audit - terms and terminologies block diagram, input-process-output, purpose, procedure. Management review.

Clause10: improvement - input-process-output, use of incident, input-process-output for non-conformity and corrective, pareto diagram for causes of accident, occurrence of accidents and its analysis.

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.
3. ISO 45001:2018 occupational health and safety management system, Ramesh lakhe, Krantidharkar
4. The ISO 45001:2018 Implementation Handbook: Guidance on Building an Occupational Health and Safety Management System. Milton P. Dentch

COURSE OUTCOMES:

After learning the course, the students will be able to

1. The Students will know the current standards of OH&S and implementing procedure
2. Students understand the guidelines of ISO 45001 and its necessity and the principles of occupational health audits
3. Students could be able to understand the updating of standards
4. Knowledge on various clauses and preparation of documentation
5. Provide the skill in analyzing the applicability on the nature of organization

Mapping with Programme Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	√		√	√			√	√	√	√		√
CO2		√			√	√	√	√	√	√		√
CO3							√					
CO4	√		√				√					
CO5			√				√				√	

CHISPEXX	**HUMAN FACTORS ENGINEERING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

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:

After learning the course, the students will be able to

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
4. Students able to reduce the accident possibilities by creating the new device.
5. Able to incorporated PPE to reduce the human error.

Mapping with Programme Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	√		√	√	√		√	√	√	√	√	
CO2	√		√	√	√		√		√	√	√	
CO3			√	√	√			√		√	√	√
CO4	√		√	√	√	√		√			√	√
CO5	√			√	√	√					√	√

CHISPEXX	**SAFETY IN TEXTILE INDUSTRY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

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 spinningand 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

1. Identify the hazards and risks and suggest safety procedures for textile industries
2. Develop health and safety measures.
3. Use Special precautions for specific hazardous work environments.
4. Advise statutory norms to be followed for a textile industry.
5. Students, can create the method of various design arrangements to avoid risk.

Mapping with Programme Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	√		√	√	√			√			√	
CO2		√	√	√							√	√
CO3						√	√				√	√
CO4						√	√	√	√		√	
CO5	√			√	√					√	√	

CHISPEXX	**AIR POLLUTION CONTROL**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To impart knowledge on air pollutants and measurement.
- To understand the control of gas and particulate contaminants by using control equipments.
- To develop the knowledge of automobile emissions, indoor air pollution and odour control.
- To analysis the industrial applications and its control measures.

Scope-nature of air pollutants-air pollution measurement- principles underlying the design of pollution control equipment. Pollutant distributions and collection efficiencies: properties and collection of particles-particle distributions-collection offences-multiple collectors

Design of industrial ventilation systems; Control of particulate contaminants: Settling chambers-Intertial separators-Cyclones-Filters-Scrubbers or wet collectors-Electrostatic Precipitators and collection efficiency.

Control of gaseous contaminants: Methods of control and designs- absorption, Adsorption, condensation, Incineration; Design of biological systems-Bio filters, Biotrickling filter, Bio scrubbers; Odours and their control

Types and control of automobile emissions- Exhaust emissions, evaporative emissions, crank-case emissions; Indoor air pollution

Control Measures for Industrial Applications**:** Mineral products – asphaltic concrete, glass manufacturing, asbestos processing; Cement Industry-Thermal Power plants-Petroleum refining and storage plants, Fertilizers, Pharmaceuticals and wood processing industry

REFERENCES:

1. Martin Crawford, Air Pollution Control Theory 2nd Edn.,Tata McGraw-Hill Publications
2. Noel de Nevers, Air Pollution control Engineering, McGraw Hill, New York, 1995.
3. M.N. Rao et al, "Air Pollution" Tata McGraw Hill, 1989.
4. Pollution Prevention and Abatement Handbook, 1998: Toward Cleaner Production,"World Bank group" 1999

COURSE OUTCOMES:

After learning the course, the students will be able to

1. Understand the effect of air pollution and fundamentals.
2. Understand the selection of control measures for air and particulate pollutions.
3. Understand the impact of air pollution on automobile emission, Odours and indoor emission
4. Understand the importance of control measures on industrial Pollutants
5. Able to understand recycling of air pollutants

Mapping with Programme Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1		√				√		√	√		√	
CO2		√	√				√		√		√	√
CO3		√		√		√	√					
CO4		√					√	√	√			
CO5	√	√		√	√			√		√	√	

OPEN ELECTIVE

CHISOEXX	MAINTAINABILITY ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

Maintenance definition – Need for maintenance – Maintenance objectives and challenges – Tero technology – Maintenance costs - Scope of maintenance department.
Proactive/Reactive maintenance – Imperfect maintenance – Maintenance policies – PM versus b/d maintenance – PM schedule and product characteristics – Inspection models- Optimizing profit/downtime – Replacement decisions.
Human factors – Maintenance staffing: Learning curves – Simulation – Maintenance resource requirements: Optimal size of service facility – Optimal repair effort – Maintenance planning and scheduling – Spare parts planning.
Maintenance excellence – Five Zero concept – FMECA – Root cause analysis – System effectiveness – Design for maintainability – reliability Centered Maintenance.
TPM features – Chronic and sporadic losses – Equipment defects – Six major losses – Overall Equipment Effectiveness – TPM pillars – Autonomous maintenance – TPM implementation

REFERENCES:

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

COURSE OUTCOMES:

After learning the course, the students will be able to

1. Understand the various terms and terminologies about the maintenance concept.
2. Understand the various maintenance modes and logistics meant for the execution of various services.
3. Apply their knowledge in areas where the down time, over replacement are existing and could lead to improve the productivity and quality.
4. Understanding the effectiveness of a equipment
5. Students able to know about optimizing profit and replacing decisions

CHISOEXX	ELECTRICAL SAFETY	L	T	P	C
		3	0	0	3

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
4. Understand the operation of various protection systems from electrical hazards
5. Students able to know about the interlock self diagnostic features

CHISOEXX	WORK STUDY AND ERGONOMICS	L	T	P	C
		3	0	0	3

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 will be able to

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

4. Able to incorporate human factors in design of PPE
5. Know the safe design of man-machine systems

CHISOEXX	TRANSPORT SAFETY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

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.

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

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.

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

REFERENCES

1. "Accident Prevention Manual for Industrial Operations", NSC, Chicago, 1982.
2. Babkov, V.F., "Road Conditions and Traffic Safety" MIR Publications, Moscow, 1986.
3. K.W.Ogden, "Safer Roads – A guide to Road Safety Engineering"
4. Kadiyali, "Traffic Engineering and Transport Planning" Khanna Publishers, New Delhi, 1983.
5. Motor Vehicles Act, 1988, Government of India.
6. Pasricha, "Road Safety guide for drivers of heavy vehicle" Nasha Publications, Mumbai, 1999.
7. Popkes, C.A. "Traffic Control and Road Accident Prevention" Chapman and Hall Limited, 1986.

COURSE OUTCOMES:

After learning the course, the students should be able to

1. Recognize various safety activities undertaken in transporting of hazardous goods
2. Understand the various symbols which are specific to the road safety and able to reduce the accidents occurred in the roads.
3. Apply for the safe transportation of hazardous goods, creating TREM card and safe loading and unloading procedure.
4. Able to know about the procedures on accident investing and reporting
5. Know the importance in design of tanker lorries, responsibility of driver, inspection and maintenance of vehicle.