Regulation 2023

Program Structure

1122 Diploma in Fire Technology and Safety

Program Outcomes (POs)

POs are statements that describe what students are expected to know and be able to do upon graduating from the program. These relate to the skills, knowledge, analytical ability, attitude, and behavior that students acquire through the program.

The POs essentially indicate what the students can do from subject-wise knowledge acquired by them during the program. As such, POs define the professional profile of an engineering diploma graduate.

NBA has defined the following seven POs for an Engineering diploma graduate:

PO1: Basic and Discipline-specific knowledge: Apply knowledge of basic mathematics, science and engineering fundamentals and an engineering specialization to solve the engineering problems.

PO2: Problem analysis: Identify and analyse well-defined engineering problems using codified standard methods.

PO3: Design/ development of solutions: Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs.

PO4: Engineering Tools, Experimentation, and Testing: Apply modern engineering tools and appropriate technique to conduct standard tests and measurements.

PO5: Engineering practices for society, sustainability and environment: Apply appropriate technology in the context of society, sustainability, environment and ethical practices.

PO6: Project Management: Use engineering management principles individually, as a team member or as a leader to manage projects and effectively communicate about well-defined engineering activities.

PO7: Life-long learning: Ability to analyse individual needs and engage in updating in the context of technological changes.

GOVERNMENT OF TAMIL NADU

DEPARTMENT OF TECHNICAL EDUCATION

DIPLOMA IN ENGINEERING AND TECHNOLOGY - REGULATION 2023

1122 DIPLOMA IN FIRE TECHNOLOGY AND SAFETY (FT)

Credit Distribution

Semester	No of Courses	Periods	Credits
Semester I	8	640	20
Semester II	9	640	20
Semester III	8	625	22
Semester IV	8	610	19
Semester V	8	605	21
Semester VI	3	660	18
		Total	**120**

GOVERNMENT OF TAMIL NADU
DEPARTMENT OF TECHNICAL EDUCATION
DIPLOMA IN ENGINEERING AND TECHNOLOGY - REGULATION 2023
1122 DIPLOMA IN FIRE TECHNOLOGY AND SAFETY (FT)
SEMESTER III

#	Course Category	Course Type	Course Code	Course Title	L-T-P	Period	Credit	End Exam
1	Program Core	Theory	1122233110	Fire Engineering	3-0-0	45	3	Theory
2	Program Core	Theory	1122233210	Industrial Safety Engineering	4-0-0	60	4	Theory
3	Program Core	Practicum	1122233340	Chemical Safety	1-0-4	75	3	Practical
4	Program Core	Practicum	1122233440	Safety Engineering	1-0-4	75	3	Practical
5	Program Core	Practicum	1122233540	Basic First AID	1-0-4	75	3	Practical
6	Program Core	Practicum	1122233640	Personal Protective Equipment	1-0-4	75	3	Practical
7	Open Elective	Advanced Skill Certification	1122233760	Advanced Skills Certification - 3	1-0-2	60	2	NA
8	Humanities & Social Science	Integrated Learning Experience	1122233880	Growth Lab	-	30	0	NA
9	Audit Course	Integrated Learning Experience	1122233881	Induction Program - II	-	16	0	-
10	Audit Course	Integrated Learning Experience	1122233882	I&E/ Club Activity/ Community Initiatives	-	16	0	-
11	Audit Course	Integrated Learning Experience	1122233883	Shop floor Immersion	-	8	0	-
12	Audit Course	Integrated Learning Experience	1122233884	Student-Led Initiative	-	22	0	-
13	Audit Course	Integrated Learning Experience	1122233885	Emerging Technology Seminars	-	8	0	-
14	Audit Course	Integrated Learning Experience	1122233886	Health & Wellness	0-0-2	30	1	-
				Total		**580**	**22**	**-**

Note: *Test & Revisions – 30 Periods, Library – 15 Periods*

GOVERNMENT OF TAMIL NADU
DEPARTMENT OF TECHNICAL EDUCATION
DIPLOMA IN ENGINEERING AND TECHNOLOGY - REGULATION 2023
1122 DIPLOMA IN FIRE TECHNOLOGY AND SAFETY (FT)
SEMESTER IV

	Course Category	Course Type	Course Code	Course Title	L-T-P	Period	Credit	End Exam
1	Program Core	Theory	1122234110	Fire Control Technology	3-0-0	45	3	Theory
2	Program Core	Theory	1122234210	Occupational Health and Safety	3-0-0	45	3	Theory
3	Program Core	Practical	1122234320	Environmental hazard Assessment	0-0-4	60	2	Practical
4	Program Core	Practicum	1122234440	Electrical Safety	1-0-4	75	3	Practical
5	Program Core	Practicum	1122234540	Fire Safety and Fighting	1-0-4	75	3	Practical
6	Program Core	Practicum	1122234640	Industrial Hygiene	1-0-4	75	3	Practical
7	Open Elective	Advanced Skill Certification	1122234760	Advanced Skills Certification - 4	1-0-2	60	2	NA
8	Audit Course	Integrated Learning Experience	1122234882	I&E/ Club Activity/ Community Initiatives	-	30	0	-
9	Audit Course	Integrated Learning Experience	1122234883	Shop floor Immersion	-	8	0	-
10	Audit Course	Integrated Learning Experience	1122234884	Student-Led Initiative	-	24	0	-
11	Audit Course	Integrated Learning Experience	1122234885	Emerging Technology Seminars	-	8	0	-
12	Audit Course	Integrated Learning Experience	1122234886	Health & Wellness	-	30	0	-
13	Audit Course	Integrated Learning Experience	1122234887	Special Interest Groups *(Placement Training)*	-	30	0	-
				Total		**565**	**19**	

Note: Test & Revisions – 30 Periods, Library – 15 Periods

GOVERNMENT OF TAMIL NADU
DEPARTMENT OF TECHNICAL EDUCATION
DIPLOMA IN ENGINEERING AND TECHNOLOGY - REGULATION 2023
1122 DIPLOMA IN FIRE TECHNOLOGY AND SAFETY (FT)
SEMESTER V

#	Course Category	Course Type	Course Code	Course Title	L-T-P	Period	Credit	End Exam
1	Program Core	Theory	1122235110	Environmental Safety	3-0-0	45	3	Theory
2	Program Elective	Theory	*	Elective-1	3-0-0	45	3	Theory
3	Program Core	Practicum	1122235340	Hazard Identification and Risk Management	1-0-4	75	3	Practical
4	Program Core	Practicum	1122235440	Manufacturing Safety	1-0-4	75	3	Practical
5	Program Elective	Practicum	**	Elective-2	1-0-4	75	3	Practical
6	Humanities & Social Science	Practicum	1122235654	Innovation & Startup	1-0-2	45	2	Project
7	Project/Internship	Project/Internship	1122235773	Industrial Training* [Summer Vacation - 90 Hours]	-	-	2	Project
8	Open Elective	Advanced Skill Certification	1122235860	Advanced Skills Certification - 5	1-0-2	60	2	NA
9	Audit Course	Integrated Learning Experience	1122235881	Induction program III	-	40	0	-
10	Audit Course	Integrated Learning Experience	1122235884	Student-Led Initiative	-	30	0	-
11	Audit Course	Integrated Learning Experience	1122235886	Health & Wellness	-	30	0	-
12	Audit Course	Integrated Learning Experience	1122235887	Special Interest Groups (Placement Training)	-	40	0	-
				Total		**560**	**21**	

Note: Test & Revisions – 30 Periods, Library – 15 Periods

GOVERNMENT OF TAMIL NADU
DEPARTMENT OF TECHNICAL EDUCATION
DIPLOMA IN ENGINEERING AND TECHNOLOGY - REGULATION 2023
1122 DIPLOMA IN FIRE TECHNOLOGY AND SAFETY (FT)
SEMESTER VI

#	Course Category	Course Type	Course Code	Course Title	L-T-P	Period	Credit	End Semester Exam
1	Open Elective	Theory	***	Electives-3 (Pathway)	3-0-0	45	3	Theory
2	Open Elective	Practicum	****	Elective-4 (Specialization)	1-0-4	75	3	Practical
3	Project	Project	1122236351/ 1122236353/ 1122236374	Internship / Fellowship / In-house Project**	-	540	12	Project
				Total		**660**	**18**	

Note: ** Every student should select any one from the In-House Project or Internship or Fellowship. The guidelines given have to be followed.

Elective 1*

#	Course Category	Course Type	Course Code	Course Title
1	Program Elective	Theory	1122235211	Safety in Engineering Industries
2	Program Elective	Theory	1122235212	Safety in Process Industries and Powder Handling
3	Program Elective	Theory	1122235213	Safety in Oil and Gas Industries

Elective 2**

#	Course Category	Course Type	Course Code	Course Title
1	Program Elective	Practicum	1122235541	Computer Aided Risk Analysis
2	Program Elective	Practicum	1122235542	Safety and Regulations Audit
3	Program Elective	Practicum	1122235543	Explosion Theory and Control

Elective 3 (Pathway) ***

#	Course Category	Course Type	Course Code	Course Title
1	Open Elective	Theory	1122236111	Regulations for Safety, Health and Environment
2	Open Elective	Theory	1122236112	Disaster Management
3	Open Elective	Theory	1122236113	Safety in Material Handling

Elective 4 (Specialization) ****

#	Course Category	Course Type	Course Code	Course Title
1	Open Elective	Practicum	1122236241	Emergency Preparedness
2	Open Elective	Practicum	1122236242	Transport and Road Safety
3	Open Elective	Practicum	1122236243	Construction and Material Handling

1122233110	Fire Engineering	L	T	P	C
Theory		3	0	0	3

Introduction:

All students must possess a basic understanding of fire engineering before going into complex applications, they have to completely understand the components of the fire engineering includes anatomy of fire and case studies, basic physics and chemistry related to fire, fire prevention and protection, industrial fire protection systems and common and special hazards. A thorough understanding of the concepts is an essential one to excel in this course.

Course Objectives:

The objective of this course is to enable the student to

- To explain about the basics of physics and chemistry of fire.
- To understand properties of physics and chemistry of fire.
- To describe the Fire prevention and protection.
- To learn about the Industrial fire protection systems.
- To understand about the fire hazards systems.

Course Outcomes:

On successful completion of this course, the student will be able to

CO1: Explain about the basics of physics and chemistry of fire.

CO2: Understand properties of physics and chemistry of fire.

CO3: Describe the Fire prevention and protection.

CO4: Learn about the Industrial fire protection systems.

CO5: Understand about the fire hazards systems.

Pre-requisites:

Knowledge of basic Science

CO/PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7

CO1	3	1	1	-	2	-	-
CO2	3	1	1	-	2	-	-
CO3	3	1	1	-	2	-	-
CO4	3	1	1	-	2	-	-
CO5	3	1	1	-	2	-	-

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- **Engage and Motivate:** Instructors should actively engage students to boost their learning confidence.
- **Real-World Relevance:** Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- **Interactive Learning:** Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- **Application-Based Learning:** Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- **Simulation and Real-World Practice:** Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- **Encourage Critical Analysis:** Foster an environment where students can honestly assess experiment outcomes and analyse potential sources of error in case of discrepancies

Assessment Methodology:

	Continuous Assessment (40 marks)				**End Semester Examination (60 marks)**
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Written test (Two units)	Written test (Another Two units)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 Hour	3 Hours	3 Hours
Exam Marks	50	50	60	100	100

Converted to	15	15	5	20	60
Marks	15		5	20	60
Tentative Schedule	6th Week	12th Week	13-14th Week	16th Week	

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 15 Marks. Best of one will be considered for the internal assessment of 15 Marks.

CA1and CA2, Assessment test should be conducted for two units as below.

PART A: (5 X 10 Marks = 50 Marks).

Eight questions will be asked; students should write Five questions. Each unit Four questions can be asked. Each question may have subdivisions. Maximum two subdivisions shall be permitted.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The marks scored should be converted to 5 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 20 marks for the internal assessment.

Question Pattern:

Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

1122233110	**Fire Engineering**	**L**	**T**	**P**	**C**
Theory		**3**	**0**	**0**	**3**
UNIT 1	**ANATOMY OF FIRE AND CASE STUDIES**				
Anatomy of Fire : Fire properties of solid, liquid and gases - fire spread - toxicity of products of combustion - theory of combustion and explosion – vapour clouds – flash fire – jet fires – pool fires – unconfined vapour cloud explosion, shock waves - auto-ignition – boiling liquid expanding vapour explosion **Case Studies :** Flixborough, Mexico disaster, Pasedena Texas, Piper Alpha,					9

Peterborough and Bombay Victoria dockship Explosions.		
UNIT 2	**BASIC CHEMISTRY AND PHYSICS OF FIRE**	
Atomic structure - Elements, compounds - Pure substance and mixture - Physical and chemical changes - Condition for the changes - Energy changes - Effects of heat on matter – Combustion – Temperature - Specific heat capacity – Catalyst – Neutralization – Sublimation - Heat of decomposing - Chemical reaction - Exothermic reaction and endothermic reaction - Transmission of heat - Flash and fire point - Ignition temperature.		9
UNIT 3	**FIRE PREVENTION AND PROTECTION**	
Fire Source : Sources of ignition – fire triangle – principles of fire extinguishing – active and passive fire protection systems – various classes of fires – A, B, C, D, E. **Protection :** Types of fire extinguishers – fire stoppers – hydrant pipes – hoses – monitors – fire watchers – layout of stand pipes – fire station- fire alarms and sirens – maintenance of fire trucks – foam generators – Escape from fire rescue operations – fire drills – notice-first aid for burns.		9
UNIT 4	**INDUSTRIAL FIRE PROTECTION SYSTEMS**	
Protection systems : Sprinkler-hydrants-stand pipes – special fire suppression systems like deluge and emulsifier, selection criteria of the above installations, reliability, maintenance, evaluation and standards - alarm and detection systems. Other suppression systems – CO_2 system, foam system, dry chemical powder (DCP) system, halon system – need for halon replacement – smoke venting. Portable extinguishers – flammable liquids – tank farms – indices of inflammability - fire fighting systems. **Building fire safety :** Objectives of fire safe building design, Fire load, fire resistant material and fire testing – structural fire protection – structural integrity – concept of egress design - exist – width calculations – fire Certificates – fire safety requirements for high rise buildings –snookers.		9
UNIT 5	**COMMON AND SPECIAL HAZARDS**	
Electricity as an Ignition Source – Hazardous Locations and National Electric Code – Safe Design of Electrical Equipment – National Testing Laboratory – Flammable Liquids and Combustible Liquids – Upper and Lower Explosive Limits – Flammable and Combustible Liquid Storage – Containers and Portable Tanks Transfer of Flammable and Combustible Liquids – Storage Cabinets – Storage Tanks – Above		9

Ground Tanks – Under Ground Tanks – Tanker Loading and Unloading – Hydrogen – Acetylene – Oxygen – LPG.	
Total Hours	**45**

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based on the course.
- Periodic class quizzes conducted on a weekly/fortnightly based on the course.
- Mini project that shall be an extension of any practical lab exercise to real-world application.

Text Books:

1. Das, A.K., 2020. Principles of Fire Safety Engineering: Understanding Fire and Fire Protection. PHI Learning Pvt. Ltd..

2. Drysdale, D., 2011. An introduction to fire dynamics. John wiley & sons.

3. K. Ehteshami, 2023. Handbook of Fire Protection Engineering. Khanna Publishing.

4. Ali S. Rangwala and V. Raghavan, Mechanism of Fires: Chemistry and Physical Aspects, ANE Publishers, 2021 and Springer, 2022.

5. Gregory E. Gorbett, James L. Pharr, and Scott Rockwell, Fire Dynamics, Pearson, 2017

Web-based/Online Resources:

1. Prof. V. Raghavan. Theory of Fire Propagation (Fire Dynamics), IIT Madras, https://onlinecourses.nptel.ac.in/noc23_me142/preview

END SEMESTER QUESTION PATTERN - THEORY EXAM

Duration: 3 Hrs. **Max. Marks: 100**

Note: Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Instruction to the Question Setters

Four questions will be asked from every unit, students should write any two questions

for 10 marks. The question may have two subdivisions only.

1122233210	Industrial Safety Engineering	L	T	P	C
Theory		4	0	0	4

Introduction:

All students must possess a basic understanding of industrial safety engineering before going into complex applications, they have to completely understand the components of the industrial safety engineering includes safety in engineering industry, plant location & layout, working conditions, personal protection and factories act-1948. A thorough understanding of the concepts is an essential one to excel in this course.

Course Objectives:

The objective of this course is to enable the student to

- To explain about the general safety rules and principles.
- To explain the construction of plant layouts.
- To describe the industry working conditions.
- To understand the personal protection details.
- To know the factories acts.

Course Outcomes:

On successful completion of this course, the student will be able to

CO1: Explain about the general safety rules and principles.

CO2: Explain the construction of plant layouts.

CO3: Describe the industry working conditions.

CO4: Understand the personal protection details.

CO5: Know the factories acts.

Pre-requisites:

Knowledge of basic Science

CO/PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7

CO1	3	1	1	-	3	-	-
CO2	3	1	1	-	3	-	-
CO3	3	1	1	-	3	-	-
CO4	3	1	1	-	3	-	-
CO5	3	1	1	-	3	-	-

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- **Engage and Motivate:** Instructors should actively engage students to boost their learning confidence.
- **Real-World Relevance:** Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- **Interactive Learning:** Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- **Application-Based Learning:** Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- **Simulation and Real-World Practice:** Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- **Encourage Critical Analysis:** Foster an environment where students can honestly assess experiment outcomes and analyse potential sources of error in case of discrepancies

Assessment Methodology:

	Continuous Assessment (40 marks)				**End Semester Examination (60 marks)**
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Written test (Two units)	Written test (Another Two units)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 Hour	3 Hours	3 Hours
Exam Marks	50	50	60	100	100

Converted to	15	15	5	20	60
Marks	15		5	20	60
Tentative Schedule	6th Week	12th Week	13-14th Week	16th Week	

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 15 Marks. Best of one will be considered for the internal assessment of 15 Marks.

CA1and CA2, Assessment test should be conducted for two units as below.

PART A: (5 X 10 Marks = 50 Marks).

Eight questions will be asked; students should write Five questions. Each unit Four questions can be asked. Each question may have subdivisions. Maximum two subdivisions shall be permitted.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The marks scored should be converted to 5 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 20 marks for the internal assessment.

Question Pattern:

Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

1122233210	**Industrial Safety Engineering**	**L**	**T**	**P**	**C**
Theory		**4**	**0**	**0**	**4**
UNIT 1	**SAFETY IN ENGINEERING INDUSTRY**				
General safety : Rules - Principles – inspections of turning machine, boring machines, milling machine, planning machine and grinding machines, CNC machines. **Welding :** Gas welding and oxygen cutting, resistances welding, arc welding and cutting, common hazards, personal protective equipment.					12

Foundry : Hot working safety in forging, hot rolling mill operation, safety in gas furnace operations, cupola, Crucibles, ovens, foundry health hazards.		
UNIT 2	**PLANT LOCATION & LAYOUT**	
Plant Location : Selection of plant locations- territorial parameters, considers of land, water, electricity- location for waste treatment and disposal, further, expansions. **Safe Layout :** Equipment layout- safety system- fire hydrant locations- fire service rooms- facilities for safe effluent disposal and treatment tank, site considerations, approach roads, Plant railway lines, security towers.		12
UNIT 3	**WORKING CONDITIONS**	
Ventilation : Principles of good ventilation- purpose- physiological and comfort level types, local and exhaust ventilation, hood and duct design, air conditioning- application- purpose of lighting- and advantages of good illumination- glare and effect. **Work Standard :** Requirement for Various work, standards, housekeeping, principles of 5"S".		12
UNIT 4	**PERSONAL PROTECTION**	
Personal Protective Equipments : Concepts of personal protective equipment- types- selection of PPE- invisible protective barriers- procurement, storage, **Inspection & Standards :** Inspection and testing- quality- standards- ergonomic considerations in personal Protective equipment design.		12
UNIT 5	**FACTORIES ACT - 1948**	
Statutory authorities – Inspecting staff health - safety, provisions relating to hazardous processes, welfare, working hours, employment of young person's - special provisions - penalties and procedures - Tamilnadu Factories Rules 1950 under safety and health chapters of Factories Act 1948 - schedules of factories Act.		12
Total Hours		**60**

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based on the course.
- Periodic class quizzes conducted on a weekly/fortnightly based on the course.
- Mini project that shall be an extension of any practical lab exercise to real-world application.

Text Books:

1. The Factories Act 1948, Madras Book Agency, Chennai, 2000.

2. Srinivasan S, “The Tamil Nadu Safety Officers Rules 2005” Madras Book Agency, Chennai, 28th Edition, 2017.

3. Danuta Koradecka, Hand book of "Occupational Safety and Health", CRC Press, 2010.

Web-based/Online Resources:

1. Prof. Jhareswar Maiti. Industrial Safety Engineering, IIT Kharagpur, https://onlinecourses.nptel.ac.in/noc20_mg43/preview

END SEMESTER QUESTION PATTERN - THEORY EXAM

Duration: 3 Hrs. **Max. Marks: 100**

Note: Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Instruction to the Question Setters

Four questions will be asked from every unit, students should write any two questions

for 10 marks. The question may have two subdivisions only.

1122233340	Chemical Safety	L	T	P	C
Practicum		1	0	4	3

Introduction:

All students must possess a basic understanding of chemical safety before going into complex applications, they have to completely understand the components of chemical safety includes identifying the different types of chemical substances, prepare material safety datasheet, preparation of handling and storage of various metals, toxic gases and industrial chemicals, identifying the routes of entry of chemical into human body and preparing the products and industrial utilizing toxic chemicals. A thorough understanding and practice are an essential one to excel in this course.

Course Objectives:

The objective of this course is to enable the student to

- To identify the different types of chemical substances
- To prepare Material safety data sheet
- To prepare the handling and storage of various metals, toxic gases and industrial chemicals
- To identify the routes of entry of chemical into human body
- To prepare the products and industrial utilizing toxic chemicals

Course Outcomes:

On successful completion of this course, the student will be able to

CO1: Identify the different types of chemical substances.

CO2: Prepare Material safety datasheet.

CO3: Prepare the handling and storage of various metals, toxic gases and industrial chemicals

CO4: Identify the routes of entry of chemical into human body.

CO5: Prepare the products and industrial utilizing toxic chemicals.

Pre-requisites:

Knowledge of basic Science

CO/PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7

CO1	3	1	1	3	3	-	-
CO2	3	1	1	3	3	-	-
CO3	3	1	1	3	3	-	-
CO4	3	1	1	3	3	-	-
CO5	3	1	1	3	3	-	-

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- **Engage and Motivate:** Instructors should actively engage students to boost their learning confidence.
- **Real-World Relevance:** Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- **Interactive Learning:** Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- **Application-Based Learning:** Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- **Simulation and Real-World Practice:** Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- **Encourage Critical Analysis:** Foster an environment where students can honestly assess experiment outcomes and analyse potential sources of error in case of discrepancies

Assessment Methodology:

	Continuous Assessment (40 marks)				**End Semester Examination (60 marks)**
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Cycle I Exercises 50% Exercises	Cycle II Exercises	All Units	All Exercises	All Exercises
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 hours
Exam Marks	60	60	100	100	100
Converted	10	10	15	15	60

to Marks					
Marks	10		15	15	60
Internal Marks	40				
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

Note:

- **CA1 and CA2:** All the exercises/experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

The details of the documents to be prepared as per the instruction below.

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	5
B	Procedure/Material preparation/ Arrangements	15
C	Demonstration/ Flow chart/Data analysis	20
D	Output / Result	10
TOTAL		50
E	Practical Documents (As per the portions)	10
		60

- **CA 3:** Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

Question pattern – Written Test Theory

Description		Marks	
Part – A	30 MCQ Questions.	30 X 1 Mark	30 Marks
Part – B	7 Questions to be answered out of 10 Questions.	7 X 10 Marks	70 Marks
TOTAL			100 Marks

- **CA 4:** All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

SCHEME OF EVALUATION

Model Practical Examination and End Semester Examination - Practical Exam

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	5
B	Procedure/Material preparation/ Arrangements	20
C	Demonstration/ Flow chart/Data analysis	25
D	Output / Result	10
E	Written Test (Theory Portions)	30
F	Viva voce	10
	TOTAL	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

1122233340	Chemical Safety	L	T	P	C
Practicum		1	0	4	3
UNIT 1	**SAFE HANDLING OF HAZARDOUS CHEMICAL**				
Common rules that relate to almost every laboratory, Safety policies, First aid, Use of fire safety, Use of laboratory hood. Introduction of hazardous chemicals, Rules for handling chemicals, Essential practices for handling hazardous chemicals, Laboratory waste management.					8
UNIT 2	**STORING, LABELING, HANDLING AND PERSONAL HYGIENE**				
Storage and labeling of chemicals, Storage of Explosive and reactive hazardous chemicals, Transportation of hazardous chemicals, Minimizing Hazard, Chemical Hygiene Plan (CHP), Standard Operating Procedures (SOP), Personal Protective Equipment (PPE).					7
Ex.No	**Name of the Experiment**				
1	Study on the types of chemical substances (Harmful, irritant, Corrosive, Toxic, and Carcinogenic).				6
2	Reading and Interpretation of Material safety datasheet.				6
3	Demonstration on the Hierarchy of Control Measures.				6
4	Safety in handling and storage of heavy metals.				6
5	Safety in handling and storage of toxic gases.				6
6	Safety in handling and storage of industrial chemicals.				6
7	Study on the Exposure limits of toxic chemicals.				6
8	Study on the routes of entry of chemical into human body.				6
9	Study on the products and industrial utilizing toxic chemicals.				6
10	Personal protective equipments for chemical safety.				6
Total Hours					**75**

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based on the course.
- Periodic class quizzes conducted on a weekly/fortnightly based on the course.

- Mini project that shall be an extension of any practical lab exercise to real-world application.

References:

1. Crowl, D.A. and Louvar, J.F., 2001. Chemical process safety: fundamentals with applications. Pearson Education.

2. Richardson, M. ed., 2008. Chemical safety: international reference manual. John Wiley & Sons.

Web-based/Online Resources:

1 Dr. Shishir Sinha. Chemical Process Safety, IIT Roorkee, https://nptel.ac.in/courses/103107156

Equipment / Facilities required to conduct the Practical Course. (Batch Strength: 30 Students)

- Material safety data sheet, hazardous chemicals handbook
- Material safety data sheet
- Posters and real-world examples (like measures taken for COVID-19)
- Material safety data sheet, hazardous chemicals handbook
- Industrial visits, Industrial product data
- Equipment for respiratory protection, hand skin protection, eye protection, protective clothing.
- Multi Gas Detector
- Chemical Safety and Eye wash shower
- Eye wash Cup
- Friction Sensitiveness Tester.

END SEMESTER EXAMINATION – PRACTICAL EXAM

Note: All the exercises should be given in the question paper and students are allowed to select by a lot or the question paper allotted from the DOTE shall be used.

Practical document should be submitted for the examination with a bonafide certificate.

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	5
B	Procedure/Material preparation/ Arrangements	20
C	Demonstration/ Flow chart/Data analysis	25
D	Output / Result	10
E	Written Test (Theory Portions)	30
F	Viva voce	10
	TOTAL	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

1122233440	Safety Engineering	L	T	P	C
Practicum		1	0	4	3

Introduction:

All students must possess a basic understanding of safety engineering before going into complex applications, they have to completely understand the components of safety engineering includes identifying the equipment used in safety engineering, preparation of flow charts for reporting of accidents, performing job safety analysis, identifying the industrial accidents and understand the job safety analysis for a work/task. A thorough understanding and practice are an essential one to excel in this course.

Course Objectives:

The objective of this course is to enable the student to

- To identify the equipment used in safety engineering.
- To prepare the flow charts for reporting of accidents.
- To perform the job safety analysis.
- To identify the industrial accidents.
- To understand the Job safety Analysis for a Work/Task.

Course Outcomes:

On successful completion of this course, the student will be able to

CO1: Identify the equipment used in safety engineering.

CO2: Prepare the flow charts for reporting of accidents.

CO3: To perform the job safety analysis.

CO4: To identify the industrial accidents.

CO5: To understand the Job safety Analysis for a Work/Task.

Pre-requisites:

Knowledge of basic Science

CO/PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	2	3	2	-	-

CO2	3	-	2	3	2	-	-
CO3	3	-	2	3	2	-	-
CO4	3	-	2	3	2	-	-
CO5	3	-	2	3	2	-	-

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- **Engage and Motivate:** Instructors should actively engage students to boost their learning confidence.
- **Real-World Relevance:** Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- **Interactive Learning:** Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- **Application-Based Learning:** Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- **Simulation and Real-World Practice:** Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- **Encourage Critical Analysis:** Foster an environment where students can honestly assess experiment outcomes and analyse potential sources of error in case of discrepancies

Assessment Methodology:

	Continuous Assessment (40 marks)				**End Semester Examination (60 marks)**
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Cycle I Exercises 50% Exercises	Cycle II Exercises	All Units	All Exercises	All Exercises
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 hours
Exam Marks	60	60	100	100	100
Converted to Marks	10	10	15	15	60

Marks	10		15	15	60
Internal Marks	40				
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

Note:

- **CA1 and CA2:** All the exercises/experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

The details of the documents to be prepared as per the instruction below.

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	5
B	Procedure/Material preparation/ Arrangements	15
C	Demonstration/ Flow chart/Data analysis	20
D	Output / Result	10
TOTAL		50
E	Practical Documents (As per the portions)	10
		60

- **CA 3:** Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

Question pattern – Written Test Theory

Description		Marks	
Part – A	30 MCQ Questions.	30 X 1 Mark	30 Marks
Part – B	7 Questions to be answered out of 10 Questions.	7 X 10 Marks	70 Marks
TOTAL			100 Marks

- **CA 4:** All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

SCHEME OF EVALUATION

Model Practical Examination and End Semester Examination - Practical Exam

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	5
B	Procedure/Material preparation/ Arrangements	20
C	Demonstration/ Flow chart/Data analysis	25
D	Output / Result	10
E	Written Test (Theory Portions)	30
F	Viva voce	10
	TOTAL	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

1122233440	Safety Engineering	L	T	P	C
Practicum		1	0	4	3
UNIT 1	**SAFETY INTRODUCTION**				
Common rules that relate to almost every laboratory, Safety policies, First aid, Use of fire safety, Use of laboratory hood. Introduction, key concepts, terminologies, and safety quantification, safety by design, Hazard identification techniques (e.g., HAZOP, FMEA, etc.).					8
UNIT 2	**PERSONAL PROTECTION IN WORK ENVIRONMENT**				
Personal protection in the work environment, Types of PPEs, Personal protective equipment respiratory and non-respiratory equipment. Standards related to PPEs. Monitoring Safety Performance: Frequency rate, severity rate, incidence rate, activity rate. Housekeeping: Responsibility of management and employees. Advantages of good housekeeping. 5 s of housekeeping. Work permit system- objectives, hot work and cold work permits. Typical industrial models and methodology. Entry into confined spaces.					7
Ex.No	**Name of the Experiment**				
1	Study of Personal Protective Equipments.				6
2	Design of safety training posters.				6
3	Identification of unsafe Acts, Unsafe condition.				6
4	Developing the Flowchart for reporting of accidents according to its severity.				6
5	Analysis of Data on Industrial Accidents.				6
6	Determination of accident rate and severity rate of an accident.				6
7	Determination of Cost and Man-hour Losses in an accident.				6
8	Performing evidence- based Accident Investigation for a mock accident.				6
9	Performing incident recall technique for an event.				6
10	Performing why-Why Analysis for a work/Task.				6
Total Hours					**75**

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based on the course.
- Periodic class quizzes conducted on a weekly/fortnightly based on the course.
- Mini project that shall be an extension of any practical lab exercise to real-world application.

References:

1. R.K Jain (2000) Industrial Safety, Health and Environment management systems, Khanna Publications.

2. Paul S V (2000), Safety management System and Documentation training Programme handbook, CBS Publication.

3. Krishnan, N.V. (1997). Safety management in Industry. Jaico Publishing House, New Delhi.

Web-based/Online Resources:

1 Prof. Jhareswar Maiti. Industrial Safety Engineering, IIT Kharagpur, https://nptel.ac.in/courses/110105094

Equipment / Facilities required to conduct the Practical Course. (Batch Strength: 30 Students)

- Engineering drawing equipment and Instruments
- Real world scenarios
- Reliable Accident data from Director of Industrial safety and health
- Mock Accident Data
- Mock Accident details and Scenarios
- Mock Accident details and an eye-witness
- Personal Protective Equipment
- IS 3786: 1983 document copy

END SEMESTER EXAMINATION – PRACTICAL EXAM

Note: All the exercises should be given in the question paper and students are allowed to select by a lot or the question paper allotted from the DOTE shall be used.

Practical document should be submitted for the examination with a bonafide certificate.

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	5
B	Procedure/Material preparation/ Arrangements	20
C	Demonstration/ Flow chart/Data analysis	25
D	Output / Result	10
E	Written Test (Theory Portions)	30
F	Viva voce	10
	TOTAL	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

1122233540	Basic First Aid	L	T	P	C
Practicum		1	0	4	3

Introduction:

All students must possess a basic understanding of basic first aid before going into complex applications, they have to completely understand the components of basic first aid includes identifying the first aid kit used in fire safety, perform evacuations techniques, preparation of first aid burns, electric shock, and injuries and perform and discuss basic cardio pulmonary resuscitation. A thorough understanding and practice are an essential one to excel in this course.

Course Objectives:

The objective of this course is to enable the student to

- To identify the first aid kit used in fire safety.
- To understand the First Aid for bleeding Wounds.
- To perform the evacuations techniques.
- To prepare the first aid burns, electric shock, and injuries.
- To perform and discuss about the Basic Cardio Pulmonary resuscitation.

Course Outcomes:

On successful completion of this course, the student will be able to

CO1: Identify the first aid kit used in fire safety.

CO2: Understand the First Aid for bleeding Wounds.

CO3: Perform the evacuations techniques.

CO4: Prepare the first aid burns, electric shock, and injuries.

CO5: Perform and discuss about the Basic Cardio Pulmonary resuscitation.

Pre-requisites:

Knowledge of basic Science

CO/PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7

CO1	3	-	2	3	1	-	1
CO2	3	-	2	3	1	-	1
CO3	3	-	2	3	1	-	1
CO4	3	-	2	3	1	-	1
CO5	3	-	2	3	1	-	1

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- **Engage and Motivate:** Instructors should actively engage students to boost their learning confidence.
- **Real-World Relevance:** Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- **Interactive Learning:** Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- **Application-Based Learning:** Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- **Simulation and Real-World Practice:** Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- **Encourage Critical Analysis:** Foster an environment where students can honestly assess experiment outcomes and analyse potential sources of error in case of discrepancies

Assessment Methodology:

	Continuous Assessment (40 marks)				**End Semester Examination (60 marks)**
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Cycle I Exercises 50% Exercises	Cycle II Exercises	All Units	All Exercises	All Exercises
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 hours
Exam Marks	60	60	100	100	100
Converted	10	10	15	15	60

to Marks					
Marks	10		15	15	60
Internal Marks	40				
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

Note:

- **CA1 and CA2:** All the exercises/experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

The details of the documents to be prepared as per the instruction below.

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	5
B	Procedure/Material preparation/ Arrangements	15
C	Demonstration/ Flow chart/Data analysis	20
D	Output / Result	10
TOTAL		50
E	Practical Documents (As per the portions)	10
		60

- **CA 3:** Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

Question pattern – Written Test Theory

Description		Marks	
Part – A	30 MCQ Questions.	30 X 1 Mark	30 Marks
Part – B	7 Questions to be answered out of 10 Questions.	7 X 10 Marks	70 Marks
TOTAL			100 Marks

- **CA 4:** All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

SCHEME OF EVALUATION

Model Practical Examination and End Semester Examination - Practical Exam

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	5
B	Procedure/Material preparation/ Arrangements	20
C	Demonstration/ Flow chart/Data analysis	25
D	Output / Result	10
E	Written Test (Theory Portions)	30
F	Viva voce	10
	TOTAL	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

1122233540	Basic First AID	L	T	P	C
Practicum		1	0	4	3

UNIT 1	BECOMING A FIRST AIDER	
	Common rules that relate to almost every laboratory, Safety policies, Use of fire safety, Use of laboratory hood. First aider, preparing yourself for first aid, Protection from infection, dealing with a casualty, requesting help. The use of medication, remember your own needs, action at an emergency, traffic accidents, fires, electrical incidents, water incidents, major incident / Mass Casualties-Assessing the sick or injured, mechanisms of injury, primary survey, secondary survey, head-to-toe examination, monitoring vital signs- breathing and circulation, life-saving priorities, unconscious adult, unconscious child, unconscious infant, how to use an AED.	8

UNIT 2	MEDICAL CONDITIONS, TECHNIQUES AND EQUIPMENT	
	Angina, heart attack, stroke, diabetes mellitus, hyperglycemia, hypoglycemia, seizures in adults, seizures in children, fever meningitis, fainting, allergy, anaphylactic shock, headache, migraine, sore throat, earache and toothache, abdominal pain, vomiting and diarrhea, childbirth, emergency childbirth, removing clothing, removing headgear, casualty handling, first aid materials, dressings, cold compresses, principles of bandaging, roller bandages, tubular gauze bandages, square knots, hand and foot cover, arm sling, elevation sling and improvised slings.	7

Ex.No	Name of the Experiment	
1	Demonstration of First Aid Kit (Small, Medium and Large First Aid box.)	6
2	First Aid for bleeding Wounds.	6
3	First Aid for Burns (Chemical, Electrical, Thermal Burns).	6
4	First Aid for Electrical shock.	6
5	First Aid for fits	6
6	First Aid for Injuries.	6
7	Performing evacuations exercises. (Single Helper Technique: Shoulder Pull, Cradle, Human Crutch, Fireman's lift)	6
8	Performing evacuations exercises.	6

	(Multiple Helper Technique: Human Crutch, hand Seat, and aft method, Kitchen- Chair Carry, three person carry).	
9	Performing evacuations exercises. (Multiple Helper Technique: Stretcher. Blanker, Emergency Lifts)	6
10	Performing Basic Cardio Pulmonary resuscitation (CPR).	6
Total Hours		**75**

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based on the course.
- Periodic class quizzes conducted on a weekly/fortnightly based on the course.
- Mini project that shall be an extension of any practical lab exercise to real-world application.

References:

1. Thygerson, S.M. and Thygerson, A.L., 2012. First Aid, CPR, and AED Essentials. Jones & Bartlett Publishers.

2. Flegel, M.J., 2013. Sport first aid. Human Kinetics.

3. Le, T., Bhushan, V., Sochat, M., Kallianos, K., Chavda, Y., Zureick, A.H. and Kalani, M., 2018. First Aid for the USMLE step 1 2018 (p. 800). McGraw-Hill Medical.

Web-based/Online Resources:

- https://www.redcross.org/take-a-class/first-aid/first-aid-training/first-aid-online
- https://www.firstaidforfree.com/

Equipment / Facilities required to conduct the Practical Course. (Batch Strength: 30 Students)

- Small first Aid Box – 5 Nos
- Medium first Aid Box – 5 Nos
- Large first Aid Box – 5 Nos
- A Volunteer as the victim or Dummy Human Body Dressing – 1 No

- A Volunteer as the victim or Dummy Human Body bandages, Slings – 1 No
- A Volunteer as the victim or Dummy Human Body, chair blanket – 1 No
- A Volunteer as the victim or Dummy Human Body, chair blanket – 1 No
- CPR Dummy – 1 No
- First aid leaflet issued by Government of India
- Chemical eye wash shower – 5 Nos
- Eye wash cup – 5 Nos

END SEMESTER EXAMINATION – PRACTICAL EXAM

Note: All the exercises should be given in the question paper and students are allowed to select by a lot or the question paper allotted from the DOTE shall be used.

Practical document should be submitted for the examination with a bonafide certificate.

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	5
B	Procedure/Material preparation/ Arrangements	20
C	Demonstration/ Flow chart/Data analysis	25
D	Output / Result	10
E	Written Test (Theory Portions)	30
F	Viva voce	10
	TOTAL	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

1122233640	Personal Protective Equipment	L	T	P	C
Practicum		1	0	4	3

Introduction:

All students must possess a basic understanding of personal protective equipment before going into complex applications, they have to completely understand the components of personal protective equipment includes identifying the tools used in respiratory, non-respiratory PPE, preparation of inspection methods for the personal protective equipment- head protection-industrial safety helmet, preparation of industrial safety equipment, study and prepare safety protective equipment for professional use and study of maintenance of respiratory protective devices. A thorough understanding and practice are an essential one to excel in this course.

Course Objectives:

The objective of this course is to enable the student to

- To identify the tools used in respiratory, non-respiratory PPE.
- To prepare the inspection methods for the personal protective equipment- head protection-industrial safety helmet.
- To prepare the industrial safety equipment.
- To study and prepare the safety protective equipment for professional use.
- To study the maintenance of respiratory protective devices.

Course Outcomes:

On successful completion of this course, the student will be able to

CO1: Identify the tools used in respiratory, non-respiratory PPE.

CO2: Prepare the inspection methods for the personal protective equipment- head protection-industrial safety helmet.

CO3: To prepare the industrial safety equipment.

CO4: To study and prepare the safety protective equipment for professional use.

CO5: To study the maintenance of respiratory protective devices.

Pre-requisites:

Knowledge of basic Science

CO/PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	2	2	1	-	1
CO2	3	-	2	2	1	-	1
CO3	3	-	2	2	1	-	1
CO4	3	-	2	2	1	-	1
CO5	3	-	2	2	1	-	1

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- **Engage and Motivate:** Instructors should actively engage students to boost their learning confidence.
- **Real-World Relevance:** Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- **Interactive Learning:** Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- **Application-Based Learning:** Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- **Simulation and Real-World Practice:** Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- **Encourage Critical Analysis:** Foster an environment where students can honestly assess experiment outcomes and analyse potential sources of error in case of discrepancies

Assessment Methodology:

	Continuous Assessment (40 marks)				**End Semester Examination (60 marks)**
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Cycle I Exercises 50% Exercises	Cycle II Exercises	All Units	All Exercises	All Exercises

Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 hours
Exam Marks	60	60	100	100	100
Converted to Marks	10	10	15	15	60
Marks	10		15	15	60
Internal Marks	40				
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

Note:

- **CA1 and CA2:** All the exercises/experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

The details of the documents to be prepared as per the instruction below.

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	5
B	Procedure/Material preparation/ Arrangements	15
C	Demonstration/ Flow chart/Data analysis	20
D	Output / Result	10
TOTAL		50

E	Practical Documents (As per the portions)	10
		60

- **CA 3:** Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

Question pattern – Written Test Theory

Description		**Marks**	
Part – A	30 MCQ Questions.	30 X 1 Mark	30 Marks
Part – B	7 Questions to be answered out of 10 Questions.	7 X 10 Marks	70 Marks
TOTAL			100 Marks

- **CA 4:** All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

SCHEME OF EVALUATION

Model Practical Examination and End Semester Examination - Practical Exam

PART	**DESCRIPTION**	**MARKS**
A	Aim & Apparatus Required	5
B	Procedure/Material preparation/ Arrangements	20
C	Demonstration/ Flow chart/Data analysis	25
D	Output / Result	10
E	Written Test (Theory Portions)	30
F	Viva voce	10
	TOTAL	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

1122233640	Personal Protective Equipment	L	T	P	C
Practicum		1	0	4	3
UNIT 1	**INTRODUCTION**				
Introduction and requirements and assessment of PPE, type of PPE. Non respiratory personal protective devices: head protection, ear protection, face and eye protection, hand protection, feet protection, body protection. Supply, use, care and maintenance of personal protective equipment. Requirements under Factories Acts and Rules.					8
UNIT 2	**RESPIRATORY PERSONAL PROTECTIVE DEVICES**				
Respiratory personal protective devices. Classification of hazards, classification of respiratory personal protective devices, selection of respirators, instructions and hints in the use of breathing apparatus, supply, use, care and maintenance of breathing apparatus, training in the use of breathing apparatus.					7
Ex.No	**Name of the Experiment**				
1	Demonstration on the specification and inspection methods for the personal protective equipment- head protection- industrial safety helmet.				6
2	Demonstration on the specification and inspection methods for the protective equipment – Body protection. Aprons and protective leather clothing.				6
3	Demonstration on code or practice for care and maintenance of industrial safety clothing.				6
4	Demonstration on guide for selection of industrial safety equipment for eye, face and ear protection.				6
5	Demonstrations on code of practice for maintenance and care of industrial safety equipment for face and ear protection.				6
6	Demonstration on specification for safety footwear safety protective equipment footwear for professional use.				6
7	Demonstration on specification for safety gloves - leather and cotton gloves.				6
8	Demonstration on guide for selection of industrial safety equipment for the protections of arms and hands.				6

9	Demonstration on recommendations for selection use and maintenance of respiratory protective devices.	6
10	Demonstration on specification for breathing apparatus.	6
Total Hours		**75**

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based on the course.
- Periodic class quizzes conducted on a weekly/fortnightly based on the course.
- Mini project that shall be an extension of any practical lab exercise to real-world application.

References:

1. Dickson, E.F.G., 2012. Personal protective equipment for chemical, biological, and radiological hazards: Design, evaluation, and selection. John Wiley & Sons.

2. Majchrzycka, K., 2020. Head, Eye, and Face Personal Protective Equipment: New Trends, Practice and Applications. CRC Press.

Web-based/Online Resources:

1. Dr. Shishir Sinha, Unit 12 - Chemical Process Safety, IIT Roorkee. https://nptel.ac.in/courses/103107156

Equipment / Facilities required to conduct the Practical Course. (Batch Strength: 30 Students)

- Non respiratory PPE Safety helmet – 5 Nos.
- Face shield – 5 Nos.
- Safety Goggles –5 Nos.
- Welding shield –5 Nos.
- Ear Muff, Ear Plug – 5 Nos.
- Apron, Gloves, Gum boots – 5 Nos.
- Safety shoes, Safety harness – 5 Nos.
- Respiratory PPE, Cotton Mask, Canister mask, Cartridge mask, Surgical mask – 5 Nos.

- SCBA – Self-contained breathing apparatus – 2 Nos.
- Safety harness – 4 Nos.

END SEMESTER EXAMINATION – PRACTICAL EXAM

Note: All the exercises should be given in the question paper and students are allowed to select by a lot or the question paper allotted from the DOTE shall be used.

Practical document should be submitted for the examination with a bonafide certificate.

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	5
B	Procedure/Material preparation/ Arrangements	20
C	Demonstration/ Flow chart/Data analysis	25
D	Output / Result	10
E	Written Test (Theory Portions)	30
F	Viva voce	10
	TOTAL	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

1122234110	Fire Control Technology	L	T	P	C
Theory		3	0	0	3

Introduction:

All students must possess a basic understanding of Fire Control Technology before going into complex applications, they have to completely understand the components of the Fire Control Technology includes Hose, Rope, Lines, knots and ladders, SCBA and foam making equipment, Pumps, primers, tenders and water relays and Fire alarm. A thorough understanding of the concepts is an essential one to excel in this course.

Course Objectives:

The objective of this course is to enable the student to

- To explain about the hose types and details.
- To explain about the rope lines, knots and ladders.
- To describe about the BA sets and making equipment.
- To explain about the pump, primers and water relays.
- To know the fire alarm and maintenance.

Course Outcomes:

On successful completion of this course, the student will be able to

CO1: Explain about the hose types and details.

CO2: Explain about the rope lines, knots and ladders.

CO3: Describe about the BA sets and making equipment.

CO4: Explain about the pump, primers and water relays.

CO5: Know the fire alarm and maintenance.

Pre-requisites:

Knowledge of basic Science

CO/PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7

CO1	3	1	2	-	1	-	1
CO2	3	1	2	-	1	-	1
CO3	3	1	2	-	1	-	1
CO4	3	1	2	-	1	-	1
CO5	3	1	2	-	1	-	1

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- **Engage and Motivate:** Instructors should actively engage students to boost their learning confidence.
- **Real-World Relevance:** Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- **Interactive Learning:** Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- **Application-Based Learning:** Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- **Simulation and Real-World Practice:** Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- **Encourage Critical Analysis:** Foster an environment where students can honestly assess experiment outcomes and analyse potential sources of error in case of discrepancies

Assessment Methodology:

	Continuous Assessment (40 marks)				**End Semester Examination (60 marks)**
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Written test (Two units)	Written test (Another Two units)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 Hour	3 Hours	3 Hours
Exam Marks	50	50	60	100	100

Converted to	15	15	5	20	60
Marks	15		5	20	60
Tentative Schedule	6th Week	12th Week	13-14th Week	16th Week	

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 15 Marks. Best of one will be considered for the internal assessment of 15 Marks.

CA1and CA2, Assessment test should be conducted for two units as below.

PART A: (5 X 10 Marks = 50 Marks).

Eight questions will be asked; students should write Five questions. Each unit Four questions can be asked. Each question may have subdivisions. Maximum two subdivisions shall be permitted.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The marks scored should be converted to 5 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 20 marks for the internal assessment.

Question Pattern:

Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

1122234110	**Fire Control Technology**	**L**	**T**	**P**	**C**
Theory		**3**	**0**	**0**	**3**
UNIT 1	**HOSE**				
Types of hose- characteristics- frictional lose- material used, cause and prevention of mildew, causes and prevention of shock- causes and prevention of rubber acid- care and maintenance. Types of hose fittings, couplings, component parts of inter locking couplings- suction coupling wrenches, branches, nozzles and branch holders- foam making branches, nozzles- collecting head and suction hose fittings- breechings,					9

adapters- maintenance of Hose fittings.		
UNIT 2	**ROPE, LINES, KNOTS AND LADDERS**	
Ropes and Lines : Introduction- manufacturing materials- types of ropes and size- cordage, causes of deterioration of ropes and lines- different type of lines. **Knots and Ladders :** Different type of knots- purpose of knots- Ladder introduction- hook ladders, escape ladder, turn table and Extension ladder- hook ladder belts.		9
UNIT 3	**SCBA AND FOAM MAKING EQUIPMENTS**	
SCBA (Self Contained Breathing Apparatus) : Introduction – physiology of respiration - effects of respiration - essential fetchers of BA set - description and technical details -Care and maintenance of various BA sets- advantages and disadvantages of various BA set. **Foam And Foam Making Equipments :** Foam and foam making equipments - different types of foam concentrate – storage – characteristics - foam branch and its type - Mechanical foam generator.		9
UNIT 4	**PUMPS, PRIMERS, TENDERS AND WATER RELAYS**	
Pumps and Primers : Introduction- definition, pumps- different types, primers-types- working principle of various pump primers- maintenance and troubleshooting- testing of pumps- Advantages and disadvantages. **Tenders and Water Relays :** Water relay system- open circuit system- closed circuit system. Tenders – types - fire alarm system- operation and maintenance of Various tenders- water, foam, CO2- DCP and emergency tenders.		9
UNIT 5	**FIRE ALARM**	
Introduction of electronics and electricity - semiconductor physics - circuit control and protective devices – transistors - principles of fire detectors - parts of fire alarm unit - control panel - type of detectors - automatic fire detection - classification of detector - control and indicating equipment - trouble shooting and maintenance - Intruder Alarms.		9
Total Hours		**45**

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based on the course.
- Periodic class quizzes conducted on a weekly/fortnightly based on the course.

- Mini project that shall be an extension of any practical lab exercise to real-world application.

Text Books:

1. B.M.Sen, Fire Fighting Vol-1, Paperback, Techno World, 2021,
2. Sesha, Prekash, Manual of Fire Safety, CBS, 2017
3. Principles of fire safety engineering: Akilkumar Das, Educreation Publishing. 2012.

Web-based/Online Resources:

1. Prof. B Bhattacharjee. Fire Protection Services and Maintenance Management of Building, IIT Delhi, https://onlinecourses.nptel.ac.in/noc20_ce09/preview

END SEMESTER QUESTION PATTERN - THEORY EXAM

Duration: 3 Hrs. **Max. Marks: 100**

Note: Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Instruction to the Question Setters

Four questions will be asked from every unit, students should write any two questions for 10 marks. The question may have two subdivisions only.

1122234210	Occupational Health and Safety	L	T	P	C
Theory		3	0	0	3

Introduction:

All students must possess a basic understanding of occupational health and safety before going into complex applications, they have to completely understand the components of the occupational health and safety includes physical hazards, chemical hazards, biological and ergonomical hazards, occupational health and toxicology and occupational physiology. A thorough understanding of the concepts is an essential one to excel in this course.

Course Objectives:

The objective of this course is to enable the student to

- To have knowledge about types of hazards arising out of physical agents.
- To explain about types of hazards arising out of chemical agents.
- To enable students to understand about the biological and ergonomical hazards.
- To enable the students to learn the function and activity of occupational health services.
- To understand the basic knowledge on occupational physiology parameters.

Course Outcomes:

On successful completion of this course, the student will be able to

CO1: Have knowledge about types of hazards arising out of physical agents.

CO2: Explain about types of hazards arising out of chemical agents.

CO3: Enable students to understand about the biological and ergonomical hazards.

CO4: Enable the students to learn the function and activity of occupational health services.

CO5: Understand the basic knowledge on occupational physiology parameters.

Pre-requisites:

Knowledge of basic Science

CO/PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	2	-	2	-	1

CO2	3	1	2	-	2	-	1
CO3	3	1	2	-	2	-	1
CO4	3	1	2	-	2	-	1
CO5	3	1	2	-	2	-	1

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- **Engage and Motivate:** Instructors should actively engage students to boost their learning confidence.
- **Real-World Relevance:** Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- **Interactive Learning:** Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- **Application-Based Learning:** Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- **Simulation and Real-World Practice:** Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- **Encourage Critical Analysis:** Foster an environment where students can honestly assess experiment outcomes and analyse potential sources of error in case of discrepancies

Assessment Methodology:

	Continuous Assessment (40 marks)				**End Semester Examination (60 marks)**
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Written test (Two units)	Written test (Another Two units)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 Hour	3 Hours	3 Hours
Exam Marks	50	50	60	100	100
Converted to	15	15	5	20	60

Marks	15		5	20	60
Tentative Schedule	6th Week	12th Week	13-14th Week	16th Week	

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 15 Marks. Best of one will be considered for the internal assessment of 15 Marks.

CA1and CA2, Assessment test should be conducted for two units as below.

PART A: (5 X 10 Marks = 50 Marks).

Eight questions will be asked; students should write Five questions. Each unit Four questions can be asked. Each question may have subdivisions. Maximum two subdivisions shall be permitted.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The marks scored should be converted to 5 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 20 marks for the internal assessment.

Question Pattern:

Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

1122234210	Occupational Health and Safety	L	T	P	C
Theory		3	0	0	3
UNIT 1	PHYSICAL HAZARDS				
Noise - noise exposure regulation - properties of sound - occupational damage - risk factors - sound measuring instruments - octave band analyzer - noise networks, noise surveys noise, control program - industrial audiometric - 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					9

environments, hypothermia, wind chill index, control measures- hot environments, thermal comfort, heat stress indices, acclimatization- estimation and control.		
UNIT 2	**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 OSHA standard. Air sampling instruments – types - measurement procedures - instruments procedures - gas and vapour monitors - dust sample collection devices - personal sampling methods of control - engineering control, design maintenance considerations - design specifications - general control methods - training and education.		9
UNIT 3	**BIOLOGICAL AND ERGONOMICAL HAZARDS**	
Classification of Biohazardous agents – examples, bacterial agents, rickettsial and chlamydial agents, viral agents, fungal, parasitic agents, infectious diseases - Biohazard control program - employee health program - laboratory safety program - animal care and handling - biological safety cabinets - building design. Work Related Musculoskeletal Disorders – carpal tunnel syndrome CTS - Tendon pain - disorders of the neck - back injuries.		9
UNIT 4	**OCCUPATIONAL HEALTH AND TOXICOLOGY**	
Concept and spectrum of health - functional units and activities of occupational health services - pre- employment and post-employment medical examinations - occupational related diseases, levels of prevention of diseases - notifiable occupational diseases such as silicosis, asbestosis, pneumoconiosis, siderosis, anthracosis, aluminosis and anthrax - lead-nickel, chromium and manganese toxicity - gas poisoning (such as CO, ammonia, coal and dust etc) - 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.		9
UNIT 5	**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		9

heaviness – work organization – stress – strain – fatigue – Rest pauses – shift work – personal hygiene.	
Total Hours	**45**

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based on the course.
- Periodic class quizzes conducted on a weekly/fortnightly based on the course.
- Mini project that shall be an extension of any practical lab exercise to real-world application.

Text Books:

1. Danuta Koradecka, Handbook of Occupational Health and Safety, CRC, 2010.

2. S.K. Haldar, Industrial and Occupational Health, CBS Publishers and Distributors Pvt. Ltd; Second edition, 14 March 2023.

3. SK. Haldar, Occupational Health and Hygiene in Industry, CBS Publishers and Distributors Pvt. Ltd, 7 June 2022.

Web-based/Online Resources:

1 Prof. Jhareswar Maiti. MODULE 11 - Industrial Safety Engineering, IIT Kharagpur, https://nptel.ac.in/courses/110105094

END SEMESTER QUESTION PATTERN - THEORY EXAM

Duration: 3 Hrs. **Max. Marks: 100**

Note: Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Instruction to the Question Setters

Four questions will be asked from every unit, students should write any two questions for 10 marks. The question may have two subdivisions only.

1122234320	Environmental hazard Assessment	L	T	P	C
Practical		0	0	4	2

Introduction:

All students must possess a basic understanding of environmental hazard assessment before going into complex applications, they have to completely understand the components of environmental hazard assessment includes preparation of the air quality index chart, identifying the total Dissolved solid (TDS) in water and water hardness, studying about the biological oxygen demand and chemical oxygen demand of water, identifying the dust particles in a working environment and exploring the Environment Impact assessment (EIA) of a process. A thorough understanding and practice are an essential one to excel in this course.

Course Objectives:

The objective of this course is to enable the student to

- To prepare the air quality index chart
- To identify the total Dissolved solid (TDS) in water and water hardness
- To study about the biological oxygen demand and chemical oxygen demand of water
- To identify the dust particles in a working environment
- To explore the Environment Impact assessment (EIA) of a Process

Course Outcomes:

On successful completion of this course, the student will be able to

CO1: Prepare the air quality index chart

CO2: Identify the total Dissolved solid (TDS) in water and water hardness

CO3: Study about the biological oxygen demand and chemical oxygen demand of water

CO4: Identify the dust particles in a working environment

CO5: Explore the Environment Impact assessment (EIA) of a Process

Pre-requisites:

Knowledge of basic Science

CO/PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7

CO1	2	-	2	3	1	-	1
CO2	2	-	2	3	1	-	1
CO3	2	-	2	3	1	-	1
CO4	2	-	2	3	1	-	1
CO5	2	-	2	3	1	-	1

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- **Engage and Motivate:** Instructors should actively engage students to boost their learning confidence.
- **Real-World Relevance:** Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- **Interactive Learning:** Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- **Application-Based Learning:** Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- **Simulation and Real-World Practice:** Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- **Encourage Critical Analysis:** Foster an environment where students can honestly assess experiment outcomes and analyse potential sources of error in case of discrepancies

Assessment Methodology:

	Continuous Assessment (40 marks)				**End Semester Examination (60 marks)**
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Practical Test	Practical Test	Practical Document	Practical Test	Practical Examination
Portion	First Cycle / 50 % Exercises	Second Cycle / Another 50 % Exercises	All Exercises	All Exercises	All Exercises
Duration	2 Periods	2 Periods	Regularly	3 Hours	3 Hours

Exam Marks	50	50	Each Practical 10 Marks	100	100
Converted to	10	10	10	20	60
Marks	10		10	20	60
Internal Marks	40				60
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

Note:

- **CA1 and CA2:** All the exercises/experiments as per the portions mentioned above should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded will be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	10
B	Procedure/Material preparation/ Arrangements	15
C	Demonstration/ Flow chart/Data analysis	15
D	Output / Result	10
TOTAL		50

- **CA 3:** Practical document should be maintained for every exercise / experiment immediately after completion of the practice. The same should be evaluated for 10 Marks. The total marks awarded should be converted to 10 Marks for the internal assessment. The practical document should be submitted for the Practical Test and End Semester Examination with a bonafide certificate

- **CA 4:** All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded should be converted to 20 Marks for the internal assessment.

SCHEME OF EVALUATION

Model Practical Examination and End Semester Examination- Practical Exam

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	10
B	Procedure	20
C	Material preparation/Demonstration	20
D	Flow chart / Data analysis	20
E	Output / Result	20
F	Viva Voce	10
	TOTAL	100

1122234320	**Environmental hazard Assessment**	**L**	**T**	**P**	**C**
Practical		**0**	**0**	**4**	**2**
BASIC CONCEPTS					
Basics of air quality index, biological oxygen demand (BOD) of water, chemical oxygen demand (COD) of water, total dissolved solid (TDS) in water, water hardness, particulate substance in welding fumes, dust particles in a working environment, Electrostatic precipitator, municipal solid wastes.					10
Ex.No	**Name of the Experiment**				
1	Measurement for air quality index (AQ1) of an environment.				40
2	Demonstration of biological oxygen demand (BOD) of water				

3	Demonstration of chemical oxygen demand (COD) of water	
4	Measurement of total dissolved solid (TDS) in water	
5	Measurement of water hardness	
6	Measurement of particulate substance in welding fumes.	
7	Measurement of dust particles in a working environment.	
8	Study on the working of Electrostatic precipitator.	
9	Identification of municipal solid wastes.	
10	Environment Impact assessment (EIA) of a process.	
Test and Revision		**10**
Total Hours		**60**

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based on the course.
- Periodic class quizzes conducted on a weekly/fortnightly based on the course.
- Mini project that shall be an extension of any practical lab exercise to real-world application.

References:

1. Kiran Bisht Nidhi Gauba Dhawan, Environmental Studies Challenge & Solutions, Dreamtech Press (1 January 2020)

2. Araneo, R. and Mitolo, M., 2021. Electrical Safety Engineering of Renewable Energy Systems. John Wiley & Sons.

Web-based/Online Resources:

1. Prof. Harshit Sosan Lakra, Environmental Impact Assessment
https://onlinecourses.nptel.ac.in/noc22_ar07/preview

Equipment / Facilities required to conduct the Practical Course. (Batch Strength: 30 Students)

- Particulate matter sensor, Air Quality Measurement Kit
- BOD apparatus, pipette, Burette, Conical flask
- COD apparatus, pipette, Burette, Conical flask

- TDS meter, Water samples from various sources
- Water hardness meter, water samples from various sources
- Fume filters, sensitive weighing balance
- Dust collector, sensitive weighing balance
- BIS Standard on Electrostatic precipitator (IS9254, IS10919)
- Industrial Visit, Site Visit, Visual Media
- Standard forms related to Environmental impact assessment

END SEMESTER EXAMINATION – PRACTICAL EXAM

Note: All the exercises should be given in the question paper and students are allowed to select by a lot or the question paper allotted from the DOTE shall be used.

Practical document should be submitted for the examination with a bonafide certificate.

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	10
B	Procedure	20
C	Material preparation/Demonstration	20
D	Flow chart / Data analysis	20
E	Output / Result	20
F	Viva Voce	10
	TOTAL	100

1122234440	Electrical Safety	L	T	P	C
Practicum		1	0	4	3

Introduction:

All students must possess a basic understanding of electrical safety before going into complex applications, they have to completely understand the components of electrical safety includes identify and select controlling elements, study about the earthing, resistance for motors and cables, preparation of personal protective equipment, explore the performance of single-phase circuit and preparation of relays, conductors, push buttons and limit switch. A thorough understanding and practice are an essential one to excel in this course.

Course Objectives:

The objective of this course is to enable the student to

- To identify and select controlling elements.
- To study about the earthing, resistance for motors and cables.
- To prepare the personal protective equipment.
- To explore the performance of single-phase circuit.
- To prepare the relays, conductors, push buttons and limit switch.

Course Outcomes:

On successful completion of this course, the student will be able to

CO1: Identify and select controlling elements.

CO2: Study about the earthing, resistance for motors and cables.

CO3: Prepare the personal protective equipment.

CO4: Explore the performance of single-phase circuit.

CO5: Prepare the relays, conductors, push buttons and limit switch.

Pre-requisites:

Knowledge of basic Science

CO/PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	-	2	3	1	-	1
CO2	2	-	2	3	1	-	1
CO3	2	-	2	3	1	-	1
CO4	2	-	2	3	1	-	1
CO5	2	-	2	3	1	-	1

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- **Engage and Motivate:** Instructors should actively engage students to boost their learning confidence.
- **Real-World Relevance:** Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- **Interactive Learning:** Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- **Application-Based Learning:** Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- **Simulation and Real-World Practice:** Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- **Encourage Critical Analysis:** Foster an environment where students can honestly assess experiment outcomes and analyse potential sources of error in case of discrepancies

Assessment Methodology:

	Continuous Assessment (40 marks)				**End Semester Examination (60 marks)**
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Cycle I Exercises 50% Exercises	Cycle II Exercises	All Units	All Exercises	All Exercises
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 hours

Exam Marks	60	60	100	100	100
Converted to Marks	10	10	15	15	60
Marks	10		15	15	60
Internal Marks	40				
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

Note:

- **CA1 and CA2:** All the exercises/experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

The details of the documents to be prepared as per the instruction below.

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	5
B	Procedure/Material preparation/ Arrangements	15
C	Demonstration/ Flow chart/Data analysis	20
D	Output / Result	10
TOTAL		50
E	Practical Documents (As per the portions)	10

	60

- **CA 3:** Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

Question pattern – Written Test Theory

Description		**Marks**	
Part – A	30 MCQ Questions.	30 X 1 Mark	30 Marks
Part – B	7 Questions to be answered out of 10 Questions.	7 X 10 Marks	70 Marks
TOTAL			100 Marks

- **CA 4:** All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

SCHEME OF EVALUATION

Model Practical Examination and End Semester Examination - Practical Exam

PART	**DESCRIPTION**	**MARKS**
A	Aim & Apparatus Required	5
B	Procedure/Material preparation/ Arrangements	20
C	Demonstration/ Flow chart/Data analysis	25
D	Output / Result	10
E	Written Test (Theory Portions)	30
F	Viva voce	10
	TOTAL	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

1122234440	Electrical Safety	L	T	P	C
Practicum		1	0	4	3
UNIT 1	**BASIC CONCEPTS OF ELECTRICAL SYSTEM**				
Basic knowledge of electrical circuit element and parameters, measurement methods and measuring instruments used for electrical parameters, ohms law , current, voltage, power in DC circuits, active power , reactive power, energy, frequency ,power factor in single and three phase AC circuits.					8
UNIT 2	**PROTECTION SYSTEMS**				
Fuse, circuit breakers and overload relays, protection against over voltage and under voltage, safe limits of amperage, voltage, safe distance from lines-capacity and protection of conductor, joints-and connections, overload and short circuit protection, no load protection, earth fault protection. FRLS insulation-insulation and continuity test, system grounding-equipment grounding-earth leakage circuit breaker (ELCB), cable wires maintenance of ground-ground fault circuit interrupter-use of low voltage, electrical guards.					7
Ex.No	**Name of the Experiment**				
1	Energy Measurement in Single Phase Circuit Using Lamp Load.				6
2	Power Measurement in single Phase Circuit.				6
3	Testing of relays, conductors, Push buttons and limit switch.				6
4	Test the working of single-phase preventer.				6
5	To Prepare a wiring circuit to check the availability of R/Y/B Phases using one lamp only by operating Individual switches for each phase and test it.				6
6	Measuring the Insulation Resistance for motors and cables.				6
7	Estimation of earth Resistance.				6
8	Earth continuity test.				6
9	Sensitivity test for ELCB, MCB, RCCB, MCCB.				6
10	Measurement of Lux level using lux Meter				6
Total Hours					**75**

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based on the course.
- Periodic class quizzes conducted on a weekly/fortnightly based on the course.
- Mini project that shall be an extension of any practical lab exercise to real-world application.

References:

1. Fordham-Cooper, W., 1998. Electrical safety engineering. Elsevier.

2. Araneo, R. and Mitolo, M., 2021. Electrical Safety Engineering of Renewable Energy Systems. John Wiley & Sons.

Web-based/Online Resources:

1. Dr. Rakhi Sharma, Electricity & Safety Measures, https://onlinecourses.swayam2.ac.in/nou20_cs08/preview

Equipment / Facilities required to conduct the Practical Course. (Batch Strength: 30 Students)

S.NO	NAME OF THE EQUIPMENTS	RANGE	REQUIRED
1.	DC Regulated power supply	(0-30V), 1A	1
2.	DC Voltmeter (Analog/ Digital)	Different Range	6
3.	DC Ammeter (Analog/ Digital)	Different Range	6
4.	Wattmeter	300V/10A	3
5.	Energy Meter	Single Phase	1
6.	Lamb load	-	1
7.	Resistive load	Single phase	1
8.	Relay	1-2/ 5A	1
9.	Contactor	Air Break, 20A, 220V	1
10.	Push Button ON and OFF	2A, 220V	Each 5
11.	Limit Switch	20A, 220V	1

12.	Single Phase Preventer kit	-	1
13.	3 Phase Motor	-	1
14.	Personal protective equipment: safety helmet, Google, safety, Gloves, Nose mask, ear plug, safety belt	-	Each 2
15.	Ohm meter, Megger & Insulation tester	-	Each 2
16.	Earth Megger kit with Necessary connecting Leads and Rods	-	1
17.	Earth Continuity Tester kit	-	1
18.	ELCB, MCB, RCCB, MCCB	2 pole, 20A & 4 pole, 20A	Each 1
19.	LUX Meter	-	1
20.	Lockout / Tag out Kit and Device	-	1
21.	Multi meter	Digital	2

END SEMESTER EXAMINATION – PRACTICAL EXAM

Note: All the exercises should be given in the question paper and students are allowed to select by a lot or the question paper allotted from the DOTE shall be used.

Practical document should be submitted for the examination with a bonafide certificate.

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	5
B	Procedure/Material preparation/ Arrangements	20
C	Demonstration/ Flow chart/Data analysis	25
D	Output / Result	10

E	Written Test (Theory Portions)	30
F	Viva voce	10
	TOTAL	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

1122234540	Fire Safety and Fighting	L	T	P	C
Practicum		1	0	4	3

Introduction:

All students must possess a basic understanding of fire safety and fighting before going into complex applications, they have to completely understand the components of fire safety and fighting includes successfully extinguish fires with the use of a fire extinguisher, apply the theory of the fire triangle in preventing fires at work sites, understand and use the principles of personal protective equipment, understand the behaviour of fire during its propagation, installation of fire detection and warning systems and communication with employees and others on the premises. A thorough understanding and practice are an essential one to excel in this course.

Course Objectives:

The objective of this course is to enable the student to

- Successfully extinguish fires with the use of a fire extinguisher.
- Apply the theory of the fire triangle in preventing fires at work sites.
- Understand the behaviour of fire during its propagation.
- Installation of Fire detection and warning systems
- Communication with employees and others on the premises

Course Outcomes:

On successful completion of this course, the student will be able to

CO1: Identify and select controlling elements.

CO2: Study about the earthing, resistance for motors and cables.

CO3: Prepare the personal protective equipment.

CO4: Explore the performance of single-phase circuit.

CO5: Prepare the relays, conductors, push buttons and limit switch.

Pre-requisites:

Knowledge of basic Science

CO/PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1	-	2	3	1	-	1
CO2	1	-	2	3	1	-	1
CO3	1	-	2	3	1	-	1
CO4	1	-	2	3	1	-	1
CO5	1	-	2	3	1	-	1

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- **Engage and Motivate:** Instructors should actively engage students to boost their learning confidence.
- **Real-World Relevance:** Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- **Interactive Learning:** Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- **Application-Based Learning:** Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- **Simulation and Real-World Practice:** Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- **Encourage Critical Analysis:** Foster an environment where students can honestly assess experiment outcomes and analyse potential sources of error in case of discrepancies

Assessment Methodology:

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Cycle I Exercises 50% Exercises	Cycle II Exercises	All Units	All Exercises	All Exercises
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 hours
Exam Marks	60	60	100	100	100

Converted to Marks	10	10	15	15	60
Marks	10		15	15	60
Internal Marks	40				
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

Note:

- **CA1 and CA2:** All the exercises/experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

The details of the documents to be prepared as per the instruction below.

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	5
B	Procedure/Material preparation/ Arrangements	15
C	Demonstration/ Flow chart/Data analysis	20
D	Output / Result	10
TOTAL		50
E	Practical Documents (As per the portions)	10
		60

- **CA 3:** Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

Question pattern – Written Test Theory

Description		Marks	
Part – A	30 MCQ Questions.	30 X 1 Mark	30 Marks
Part – B	7 Questions to be answered out of 10 Questions.	7 X 10 Marks	70 Marks
TOTAL			100 Marks

- **CA 4:** All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

SCHEME OF EVALUATION

Model Practical Examination and End Semester Examination - Practical Exam

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	5
B	Procedure/Material preparation/ Arrangements	20
C	Demonstration/ Flow chart/Data analysis	25
D	Output / Result	10
E	Written Test (Theory Portions)	30
F	Viva voce	10
	TOTAL	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

1122234540	Fire Safety and Fighting	L	T	P	C
Practicum		1	0	4	3
UNIT 1	**INTRODUCTION**				
Chemistry of fire, Fire Tetrahedran Spreading methods of fire, Types of flammable fuels & their symbols, Methods of fire Extinguishing, type of fire Extinguishers & their uses, Details about Water Tender, Water Pumps, Ladders, Nozzels, Ropes, Hoses, Risers, Fire Suits, Fire Couplings.					8
UNIT 2	**EMERGENCY PLAN**				
Manual Call-Point, Fire Alarm, Automatic Fire Alarm, Gas Flooding System, Sensors & Detectors, Philosophy of accident, Causes of accidents & Safety Measures, Do's & Don'ts while major fire & gas leaks. On - site & Off - site Emergency Plan, Plant Layout, Handling & Storage of materials, Safe methods of handling LPG cylinder, Do's & Don'ts in case of LPG Leaks, Personal Protective Equipment & their uses.					7
Ex.No	**Name of the Experiment**				
1	Determination of calorific value of substance.				6
2	Determination of Fire Load in a Building /facility.				6
3	Determination of fire Triangle and Principle of fire extinction.				6
4	Basic fire Fighting using portable Dry Chemical Power fire extinguishers.				6
5	Basic Firefighting using portable CO_2 fire extinguishers.				6
6	Refilling different type’s extinguisher.				6
7	Reading and Demonstration Fire excavation plan.				6
8	Demonstration on the working of smoke, Beam and Flame detectors.				6
9	Demonstration of fire hydrant system and dry riser system in a building.				6
10	Demonstration of personal Protective Equipment used for firefighting.				6
Total Hours					**75**

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based on the course.
- Periodic class quizzes conducted on a weekly/fortnightly based on the course.
- Mini project that shall be an extension of any practical lab exercise to real-world application.

References:

1. Ramachandran, G., 2002. The economics of fire protection. Routledge.

2. Muckett, M. and Furness, A., 2007. Introduction to fire safety management. Routledge.

Web-based/Online Resources:

1. Dr. B. Bhattacharjee, Fire Protection, Services and Maintenance Management of Building, https://nptel.ac.in/courses/105102176

Equipment / Facilities required to conduct the Practical Course. (Batch Strength: 30 Students)

- Cleveland Open cup Apparatus: Pensky-Martens Closed Cup Apparatus – 2 Nos
- Bomb Calorimeter – 2 Nos
- Standard data Book containing Calorific value of Various Substance – 2 Nos
- Fuel and Ignition Source
- Pool of fire and dry chemical Power fire Extinguisher – 3 Nos
- Pool of Fire and CO2 fire extinguisher – 3 Nos
- Fire excavation Plan of any facility
- Smoke, Heat, Beam and Flame detectors – each 2 Nos
- Dummy fire Hydrant and Fire riser System – 2 Nos
- Firefighter Gloves: Firefighter Structural Firefighting Boots: Firefighter, Garments, Firefighter Eye and ear Protection, fire fighter Head Protection.

END SEMESTER EXAMINATION – PRACTICAL EXAM

Note: All the exercises should be given in the question paper and students are allowed to select by a lot or the question paper allotted from the DOTE shall be used.

Practical document should be submitted for the examination with a bonafide certificate.

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	5
B	Procedure/Material preparation/ Arrangements	20
C	Demonstration/ Flow chart/Data analysis	25
D	Output / Result	10
E	Written Test (Theory Portions)	30
F	Viva voce	10
	TOTAL	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

1122234640	Industrial Hygiene	L	T	P	C
Practicum		1	0	4	3

Introduction:

All students must possess a basic understanding of industrial hygiene before going into complex applications, they have to completely understand the components of industrial hygiene includes preparation of workers role in occupational health safety and hygiene service programs, discuss the scope of occupational health and safety, identify the elements of a work environment, discuss the common interactions in the workplace, discuss the environmental impact, and understand the need to integrate occupational hygiene practice with environmental protection and understand the total lung capacity of human body. A thorough understanding and practice are an essential one to excel in this course.

Course Objectives:

The objective of this course is to enable the student to

- To prepare the workers role in occupational health safety and hygiene service programs.
- To discuss the scope of occupational health and safety.
- To identify the elements of a work environment.
- To discuss the environmental impact, and understand the need to integrate occupational hygiene practice with environmental protection.
- To understand the total lung capacity of human body.

Course Outcomes:

On successful completion of this course, the student will be able to

CO1: Prepare the workers role in occupational health safety and hygiene service programs.

CO2: Discuss the scope of occupational health and safety.

CO3: Identify the elements of a work environment.

CO4: Discuss the environmental impact, and understand the need to integrate occupational hygiene practice with environmental protection.

CO5: Understand the total lung capacity of human body.

Pre-requisites:

Knowledge of basic Science

CO/PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1	-	2	3	2	-	1
CO2	1	-	2	3	2	-	1
CO3	1	-	2	3	2	-	1
CO4	1	-	2	3	2	-	1
CO5	1	-	2	3	2	-	1

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- **Engage and Motivate:** Instructors should actively engage students to boost their learning confidence.
- **Real-World Relevance:** Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- **Interactive Learning:** Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- **Application-Based Learning:** Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- **Simulation and Real-World Practice:** Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- **Encourage Critical Analysis:** Foster an environment where students can honestly assess experiment outcomes and analyse potential sources of error in case of discrepancies

Assessment Methodology:

	Continuous Assessment (40 marks)				**End Semester Examination (60 marks)**
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Cycle I Exercises 50% Exercises	Cycle II Exercises	All Units	All Exercises	All Exercises

Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 hours
Exam Marks	60	60	100	100	100
Converted to Marks	10	10	15	15	60
Marks	10		15	15	60
Internal Marks	40				
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

Note:

- **CA1 and CA2:** All the exercises/experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

The details of the documents to be prepared as per the instruction below.

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	5
B	Procedure/Material preparation/ Arrangements	15
C	Demonstration/ Flow chart/Data analysis	20
D	Output / Result	10
TOTAL		50

E	Practical Documents (As per the portions)	10
		60

- **CA 3:** Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

Question pattern – Written Test Theory

Description		**Marks**	
Part – A	30 MCQ Questions.	30 X 1 Mark	30 Marks
Part – B	7 Questions to be answered out of 10 Questions.	7 X 10 Marks	70 Marks
TOTAL			100 Marks

- **CA 4:** All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

SCHEME OF EVALUATION

Model Practical Examination and End Semester Examination - Practical Exam

PART	**DESCRIPTION**	**MARKS**
A	Aim & Apparatus Required	5
B	Procedure/Material preparation/ Arrangements	20
C	Demonstration/ Flow chart/Data analysis	25
D	Output / Result	10
E	Written Test (Theory Portions)	30
F	Viva voce	10
	TOTAL	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

1122234640	Industrial Hygiene	L	T	P	C
Practicum		1	0	4	3
UNIT 1	**INTRODUCTION**				
Concept, definition and importance of hygiene in industry. Difference between domestic hygiene and industrial hygiene. Physical hazards – heat stress and its control, ventilation, noise, vibration, illumination, thermal radiation, X rays, ultra violet radiation, ionizing and non-ionizing radiations, permissible exposure limits, effects of exposure, preventive and control measures. Air sampling, the concept of threshold limits, acute and chronic exposure effect, personal monitoring, biological monitoring and control measures, risk management at work places, emergency control measures, awareness for ensuring ideal hygiene.					8
UNIT 2	**INDUSTRIAL HYGIENE PARAMETERS**				
Noise and vibration, the effect of noise on man, measurement and evaluation of noise, vibration damping, noise isolation, noise absorption, silencers, practical aspects of control of noise, case studies on impact of noise from compressors and generators. Vibration effects, measurement and control. Industrial physiology, classification of workload, work capacity and man-job alignment, fatigue and rest allowances, physiological list in occupational health assessment, ergonomics, man-machine differences, man-machine interface, fitting the man to the job, prevention work related limb disorders and repetitive strain injury (RSI).					7
Ex.No	**Name of the Experiment**				
1	Measuring lighter in a working environment and inferring with the standard values.				6
2	Measuring Noise level in a working environment and inferring with the standard values.				6
3	Measuring Vibration in a working environment and inferring with the standard values.				6

4	Measuring human Body vibration in a working environment and inferring with the standard values.	6
5	Measuring Heat in a working environment and inferring with the standard values.	6
6	Measuring humidity level in a working environment and inferring with the standard values.	6
7	Measuring total Lung capacity (TLC) of a human through Spirometer.	6
8	Measuring total lung capacity (TLC) of a human through pulmonary function Test.	6
9	Study experiment on Radiation Safety.	6
10	Demonstration of personal protective equipment for Noise, Heat and respiration.	6
Total Hours		**75**

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based on the course.
- Periodic class quizzes conducted on a weekly/fortnightly based on the course.
- Mini project that shall be an extension of any practical lab exercise to real-world application.

References:

1. Nims, D., 1999. Basics of industrial hygiene (Vol. 1). John Wiley & Sons.

2. Popendorf, W., 2019. Industrial hygiene control of airborne chemical hazards. CRC Press.

Web-based/Online Resources:

1. Dr. Shishir Sinha, Unit 2 & 3 - Chemical Process Safety, IIT Roorkee. https://nptel.ac.in/courses/103107156

Equipment / Facilities required to conduct the Practical Course. (Batch Strength: 30 Students)

- Light Meter – 2 Nos
- Sound-level meter – 2 Nos
- Vibro meter or Accelerometer – 2 Nos
- Human vibration Meter – 2 Nos
- Calorimeter – 2 Nos
- Hygrometer – 3 Nos
- Spiro meter – 3 Nos
- Pulmonary function Test device – 2 Nos
- Posters, Visual aids to learn Radiation Safety
- Ear Muffs, ear Plugs, Thermal protective Clothing Respirators – each 3 Nos

END SEMESTER EXAMINATION – PRACTICAL EXAM

Note: All the exercises should be given in the question paper and students are allowed to select by a lot or the question paper allotted from the DOTE shall be used.

Practical document should be submitted for the examination with a bonafide certificate.

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	5
B	Procedure/Material preparation/ Arrangements	20
C	Demonstration/ Flow chart/Data analysis	25
D	Output / Result	10
E	Written Test (Theory Portions)	30
F	Viva voce	10
	TOTAL	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

1122235110	Environmental Safety	L	T	P	C
Theory		3	0	0	3

Introduction:

All students must possess a basic understanding of occupational health and safety before going into complex applications, they have to completely understand the components of the occupational health and safety includes air pollution, water pollution, hazardous waste management, environmental measurement and control and pollution control in process industries. A thorough understanding of the concepts is an essential one to excel in this course.

Course Objectives:

The objective of this course is to enable the student to

- To explain about the air pollution sources and causes.
- To describe the water pollution and water treatment.
- To explain about the Hazardous waste management.
- To understand to handle the environmental measuring instruments.
- To know about the pollution control processes in industries.

Course Outcomes:

On successful completion of this course, the student will be able to

CO1: Explain about the air pollution sources and causes.

CO2: Describe the water pollution and water treatment.

CO3: Explain about the Hazardous waste management.

CO4: Understand to handle the environmental measuring instruments.

CO5: Know about the pollution control processes in industries.

Pre-requisites:

Knowledge of basic Science

CO/PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	2	-	2	-	1

CO2	3	-	2	-	2	-	1
CO3	3	-	2	-	2	-	1
CO4	3	-	2	-	2	-	1
CO5	3	-	2	-	2	-	1

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- **Engage and Motivate:** Instructors should actively engage students to boost their learning confidence.
- **Real-World Relevance:** Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- **Interactive Learning:** Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- **Application-Based Learning:** Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- **Simulation and Real-World Practice:** Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- **Encourage Critical Analysis:** Foster an environment where students can honestly assess experiment outcomes and analyse potential sources of error in case of discrepancies

Assessment Methodology:

	Continuous Assessment (40 marks)				**End Semester Examination (60 marks)**
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Written test (Two units)	Written test (Another Two units)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 Hour	3 Hours	3 Hours
Exam Marks	50	50	60	100	100
Converted to	15	15	5	20	60

Marks	15		5	20	60
Tentative Schedule	6th Week	12th Week	13-14th Week	16th Week	

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 15 Marks. Best of one will be considered for the internal assessment of 15 Marks.

CA1and CA2, Assessment test should be conducted for two units as below.

PART A: (5 X 10 Marks = 50 Marks).

Eight questions will be asked; students should write Five questions. Each unit Four questions can be asked. Each question may have subdivisions. Maximum two subdivisions shall be permitted.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The marks scored should be converted to 5 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 20 marks for the internal assessment.

Question Pattern:

Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

1122235110	Environmental Safety	L	T	P	C
Theory		3	0	0	3
UNIT 1	AIR POLLUTION				
Classification and properties of air pollutants – pollution sources – effects of air pollutants on human beings, animals, plants and materials - automobile pollution- hazards of air pollution-concept of clean coal combustion technology - ultra violet radiation, infrared radiation, radiation hazards from sun due to depletion of ozone – deforestation -automobile exhausts- chemical factory stack emissions - CFC.					9
UNIT 2	WATER POLLUTION				

Classification of water pollutants-health hazards-sampling and analysis of water-water treatment - different industrial effluents and their treatment and disposal - advanced wastewater treatment - effluent quality standards and laws- chemical industries, tannery, textile effluents - common treatment.		9
UNIT 3	**HAZARDOUS WASTE MANAGEMENT**	
Hazardous waste management in India-waste identification, characterization and classification- technological optionsfor collection, treatment and disposal of hazardous waste-selection charts for the treatment of different hazardous wastes-methods of collection and disposal of solid wastes-health hazards-toxic and radioactive wastes-incineration and verification - hazards due to bio-process- dilution-standards and restrictions – recycling and reuse.		9
UNIT 4	**ENVIRONMENTAL MEASUREMENT AND CONTROL**	
Sampling and analysis – dust monitor – gas analyzer- particle size analyzer – lux meter-pH meter – gas chromatograph – atomic absorption spectrometer. Gravitational settling chambers - cyclone separators – scrubbers - electrostatic precipitator - bag filter – maintenance - control of gaseous emission by adsorption, absorption and combustion methods - pollution control board - laws.		9
UNIT 5	**POLLUTION CONTROL IN PROCESS INDUSTRIES**	
Pollution control in process industries like cement, paper, petroleum - petroleum products – textile – tanneries - thermal power plants – dying and pigment industries - eco-friendly energy.		9
Total Hours		**45**

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based on the course.
- Periodic class quizzes conducted on a weekly/fortnightly based on the course.
- Mini project that shall be an extension of any practical lab exercise to real-world application.

Text Books:

1. ISO14001:2004, Environmental Management Systems Requirements with Guidance for Use” , ISO 2004.

2. Rao, CS, “Environmental pollution engineering”, Wiley Eastern Limited, New Delhi, 1st January 2018.
3. S. P. Mahajan, “Pollution control in process industries”, Tata McGraw Hill Publishing Company, New Delhi, 2006.
4. S.C.Sharma and Vinit Kumar, Safety, Occupational Health and Environmental Management in Construction, Khanna Publishers, 1 January 2013.

Web-based/Online Resources:

1. Dr. Srinivasan Chandrasekaran. Health, Safety and Environmental Management in Offshore and Petroleum Engineering, IIT Madras, https://nptel.ac.in/courses/114106039

END SEMESTER QUESTION PATTERN - Theory Exam

Duration: 3 Hrs. **Max. Marks: 100**

Note: Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Instruction to the Question Setters

Four questions will be asked from every unit, students should write any two questions for 10 marks. The question may have two subdivisions only.

1122235340	Hazard Identification and Risk Management	L	T	P	C
Practicum		1	0	4	3

Introduction:

All students must possess a basic understanding of hazard identification and risk management before going into complex applications, they have to completely understand the components of hazard identification and risk management includes preparing the different types of hazard in a working environment, identifying the existing safeguards available to control the risks due to the hazards, suggesting the additional control measures to reduce the risk to acceptable level, preparing a risk register that will help in continuously monitoring these risks and detect any changes and ensure the controls are effective. A thorough understanding and practice are an essential one to excel in this course.

Course Objectives:

The objective of this course is to enable the student to

- To prepare the different types of hazards in a working environment.
- To identify the existing safeguards available to control the risks due to the hazards.
- To suggest additional control measures to reduce the risk to acceptable level.
- To prepare a Risk register that will help in continuously monitoring these risks.
- To detect any changes and ensure the controls are effective.

Course Outcomes:

On successful completion of this course, the student will be able to

CO1: Prepare the different types of hazards in a working environment.

CO2: Identify the existing safeguards available to control the risks due to the hazards.

CO3: Suggest additional control measures to reduce the risk to acceptable level.

CO4: Prepare a Risk register that will help in continuously monitoring these risks.

CO5: Detect any changes and ensure the controls are effective.

Pre-requisites:

Knowledge of basic Science

CO/PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	-	2	3	1	-	1
CO2	2	-	2	3	1	-	1
CO3	2	-	2	3	1	-	1
CO4	2	-	2	3	1	-	1
CO5	2	-	2	3	1	-	1

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- **Engage and Motivate:** Instructors should actively engage students to boost their learning confidence.
- **Real-World Relevance:** Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- **Interactive Learning:** Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- **Application-Based Learning:** Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- **Simulation and Real-World Practice:** Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- **Encourage Critical Analysis:** Foster an environment where students can honestly assess experiment outcomes and analyse potential sources of error in case of discrepancies

Assessment Methodology:

	Continuous Assessment (40 marks)				**End Semester Examination (60 marks)**
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Cycle I Exercises 50% Exercises	Cycle II Exercises	All Units	All Exercises	All Exercises
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 hours

Exam Marks	60	60	100	100	100
Converted to Marks	10	10	15	15	60
Marks	10		15	15	60
Internal Marks	40				
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

Note:

- **CA1 and CA2:** All the exercises/experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

The details of the documents to be prepared as per the instruction below.

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	5
B	Procedure/Material preparation/ Arrangements	15
C	Demonstration/ Flow chart/Data analysis	20
D	Output / Result	10
TOTAL		50
E	Practical Documents (As per the portions)	10

	60

- **CA 3:** Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

Question pattern – Written Test Theory

Description		**Marks**	
Part – A	30 MCQ Questions.	30 X 1 Mark	30 Marks
Part – B	7 Questions to be answered out of 10 Questions.	7 X 10 Marks	70 Marks
TOTAL			100 Marks

- **CA 4:** All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

SCHEME OF EVALUATION

Model Practical Examination and End Semester Examination - Practical Exam

PART	**DESCRIPTION**	**MARKS**
A	Aim & Apparatus Required	5
B	Procedure/Material preparation/ Arrangements	20
C	Demonstration/ Flow chart/Data analysis	25
D	Output / Result	10
E	Written Test (Theory Portions)	30
F	Viva voce	10
	TOTAL	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

1122235340	Hazard Identification and Risk Management	L	T	P	C
Practicum		1	0	4	3
UNIT 1	**BASICS OF HAZARD, RISK AND RISK RANKING**				
Introduction, hazard and risk, risk register, risk matrix and risk, Ranking, consequence, PHA & ALARP, fault tolerance and plant ageing, safety instrumentation, functional safety.					8
UNIT 2	**EVALUATION OF HAZARD AND RISK ANALYSIS**				
Plant hazard analysis preliminaries, evaluation of plant hazard, selection techniques, comparison of various PHA methods, hazard identification (HAZID) and risk estimation, risk assessment and management.					7
Ex.No	**Name of the Experiment**				
1	Identification of mechanical Hazard in a Working environment				6
2	Identification of Physical Hazard in a Working environment.				6
3	Identification of Chemical Hazard in a Working environment				6
4	Identification of Electrical Hazard in a Working environment				6
5	Identification of Fire Hazard in a Working environment				6
6	Identification of manual Material handling Hazard in a Working environment.				6
7	Identification of Mechanical material handling Hazard in a Working environment				6
8	Identification of Hazard in a Movement of people and vehicles in a working environment.				6
9	Identification of Biological Hazard in a Working environment.				6
10	Identification of psychological hazard in a Working environment.				6
Total Hours					**75**

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based on the course.

- Periodic class quizzes conducted on a weekly/fortnightly based on the course.
- Mini project that shall be an extension of any practical lab exercise to real-world application.

References:

1. Ostrom, L.T. and Wilhelmsen, C.A., 2019. Risk assessment: tools, techniques, and their applications. John Wiley & Sons.

2. Hopkin, P., 2018. Fundamentals of risk management: understanding, evaluating and implementing effective risk management. Kogan Page Publishers.

Web-based/Online Resources:

1. Dr. Shishir Sinha, Unit 8 - Chemical Process Safety, IIT Roorkee. https://nptel.ac.in/courses/103107156

Equipment / Facilities required to conduct the Practical Course. (Batch Strength: 30 Students)

- Forms relevant to Hazard identification and recording
- Appropriate Industrial visits, visual media and
- Relevant equipment / facilities.

END SEMESTER EXAMINATION – PRACTICAL EXAM

Note: All the exercises should be given in the question paper and students are allowed to select by a lot or the question paper allotted from the DOTE shall be used.

Practical document should be submitted for the examination with a bonafide certificate.

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	5
B	Procedure/Material preparation/ Arrangements	20
C	Demonstration/ Flow chart/Data analysis	25

D	Output / Result	10
E	Written Test (Theory Portions)	30
F	Viva voce	10
	TOTAL	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

1122235440	Manufacturing Safety	L	T	P	C
Practicum		1	0	4	3

Introduction:

All students must possess a basic understanding of manufacturing safety before going into complex applications, they have to completely understand the components of the manufacturing safety includes extinguishers, hazard, risk and accident and safety concept. A thorough understanding of the concepts is an essential one to excel in this course.

Course Objectives:

The objective of this course is to enable the student to

- Preparation of hazard prevailing in a Foundry
- Identify the tools used in hazard prevailing in a different areas like metal cutting, welding etc.,
- Prepare safety tools used in Compressed Gas Cylinder in manufacturing Industry.
- Prepare Personal protective equipment relevant to various manufacturing process.
- To have knowledge about sources of information for hazard, risk and accident.
- To familiarize students with evaluation of safety concept.

Course Outcomes:

On successful completion of this course, the student will be able to

CO1: Identify the different types of Mechanical Machinery.

CO2: Prepare Material Storage and safety datasheet.

CO3: Prepare the handling and storage of various metals, hazard gases.

CO4: Identify the routes of material handling for various manufacturing process.

CO5: Prepare the Personal protective equipment relevant to various manufacturing process.

Pre-requisites:

Knowledge of basic Science

CO/PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	1	3	3	-	-
CO2	3	1	1	3	3	-	-
CO3	3	1	1	3	3	-	-
CO4	3	1	1	3	3	-	-
CO5	3	1	1	3	3	-	-

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- **Engage and Motivate:** Instructors should actively engage students to boost their learning confidence.
- **Real-World Relevance:** Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- **Interactive Learning:** Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- **Application-Based Learning:** Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- **Simulation and Real-World Practice:** Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- **Encourage Critical Analysis:** Foster an environment where students can honestly assess experiment outcomes and analyse potential sources of error in case of discrepancies

Assessment Methodology:

	Continuous Assessment (40 marks)				**End Semester Examination (60 marks)**
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Cycle I Exercises 50% Exercises	Cycle II Exercises	All Units	All Exercises	All Exercises

Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 hours
Exam Marks	60	60	100	100	100
Converted to Marks	10	10	15	15	60
Marks	10		15	15	60
Internal Marks	40				
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

Note:

- **CA1 and CA2:** All the exercises/experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

The details of the documents to be prepared as per the instruction below.

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	5
B	Procedure/Material preparation/ Arrangements	15
C	Demonstration/ Flow chart/Data analysis	20
D	Output / Result	10
TOTAL		50

E	Practical Documents (As per the portions)	10
		60

- **CA 3:** Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

Question pattern – Written Test Theory

Description		**Marks**	
Part – A	30 MCQ Questions.	30 X 1 Mark	30 Marks
Part – B	7 Questions to be answered out of 10 Questions.	7 X 10 Marks	70 Marks
TOTAL			100 Marks

- **CA 4:** All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

SCHEME OF EVALUATION

Model Practical Examination and End Semester Examination - Practical Exam

PART	**DESCRIPTION**	**MARKS**
A	Aim & Apparatus Required	5
B	Procedure/Material preparation/ Arrangements	20
C	Demonstration/ Flow chart/Data analysis	25
D	Output / Result	10
E	Written Test (Theory Portions)	30
F	Viva voce	10
	TOTAL	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

1122235440	Manufacturing Safety	L	T	P	C
Practicum		1	0	4	3
UNIT 1	**Machine Guarding and Manufacturing Process**				
General Machine Guarding – Safe Guarding the Point of Operation- Power Presses -Heat Processes – Grinding Machines – Saws – Miscellaneous Machine Guarding – Foundry Processes- Welding Processes – Metal Cutting Processes.					8
UNIT 2	**Material Handling and Personal Protection**				
Material Storage – Industrial Trucks – Passenger – Cranes – Conveyors – Lifts – Protection Need Assessment - Personal Protection Equipment -Hearing Protection – Eye and Face Protection – Respiratory Protection – Head Protection.					7
Ex.No	**Name of the Experiment**				
1	Study on the hazard prevailing in a Foundry				6
2	Demonstration on the hazard prevailing in Metal cutting.				6
3	Illustration on the Hazard prevailing in welding				6
4	Study on the Hazard related to Mechanical machinery.				6
5	Demonstration on fixed guards.				6
6	Demonstration on Adjustable guards.				6
7	Study of the principle of interlocking guards.				6
8	Safety in the use of Compressed Gas Cylinder in manufacturing Industry.				6
9	Demonstration on welding fume extraction system.				6
10	Study on Personal protective equipment relevant to various manufacturing process.				6
	Total Hours				**75**

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based on the course.
- Periodic class quizzes conducted on a weekly/fortnightly based on the course.
- Mini project that shall be an extension of any practical lab exercise to real-world application.

References:

1. C. Ray Asfahl David W. Rieske, University of Arkansas, Industrial Safety and Health Management, Sixth Edition, Prentice Hall.

Web-based/Online Resources:

1 Prof. Jhareswar Maiti. Industrial Safety Engineering, IIT Kharagpur, https://nptel.ac.in/courses/110105094

Equipment / Facilities required to conduct the Practical Course. (Batch Strength: 30 Students)

- Machine Guarding models
- Job Safety analysis worksheet
- Ergonomic analysis - RULA, REBA worksheet
- Inch tape and stop watch (if motion study is done)
- Appropriate industrial visits; Visual media
- Fume extractor, appropriate industrial visits, visual media
- PPE's like Goggles, Safety Shoes, helmet, Gloves, Appropriate industrial visits, Visual media

END SEMESTER EXAMINATION – PRACTICAL EXAM

Note: All the exercises should be given in the question paper and students are allowed to select by a lot or the question paper allotted from the DOTE shall be used.

Practical document should be submitted for the examination with a bonafide certificate.

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	5
B	Procedure/Material preparation/ Arrangements	20

C	Demonstration/ Flow chart/Data analysis	25
D	Output / Result	10
E	Written Test (Theory Portions)	30
F	Viva voce	10
	TOTAL	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

1122235211	Safety in Engineering Industries	L	T	P	C
Theory		3	0	0	3

Introduction:

All students must possess a basic understanding of safety in engineering industries, before going into complex applications, they have to completely understand the components of the safety includes basic of work study and machine guarding related to safety, safety in manufacturing process. A thorough understanding of the concepts is an essential one to excel in this course.

Course Objectives:

The objective of this course is to enable the student to

- To explain about the work study and ergonomics.
- To learn about principles of machine guarding.
- To explain about the safety welding process.
- To describe about the forming process.
- To know about the safety inspection and testing.

Course Outcomes:

On successful completion of this course, the student will be able to

CO1: Understand the basic of work study and ergonomics related to safety.

CO2: Identify the machine guarding.

CO3: Understand the basics of safety in welding process.

CO4: Acquire basic knowledge of forming process.

CO5: Understand the basics of safety concept of inspection and testing.

Pre-requisites:

Knowledge of basic Science

CO/PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7

CO1	3	1	2	1	1	2	2
CO2	3	1	2	1	1	2	2
CO3	3	1	2	1	1	2	2
CO4	3	1	2	1	1	2	2
CO5	3	1	2	1	1	2	2

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- **Engage and Motivate:** Instructors should actively engage students to boost their learning confidence.
- **Real-World Relevance:** Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- **Interactive Learning:** Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- **Application-Based Learning:** Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- **Simulation and Real-World Practice:** Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- **Encourage Critical Analysis:** Foster an environment where students can honestly assess experiment outcomes and analyse potential sources of error in case of discrepancies

Assessment Methodology:

	Continuous Assessment (40 marks)				**End Semester Examination (60 marks)**
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Written test (Two units)	Written test (Another Two units)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 Hour	3 Hours	3 Hours
Exam Marks	50	50	60	100	100

Converted to	15	15	5	20	60
Marks	15		5	20	60
Tentative Schedule	6th Week	12th Week	13-14th Week	16th Week	

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 15 Marks. Best of one will be considered for the internal assessment of 15 Marks.

CA1and CA2, Assessment test should be conducted for two units as below.

PART A: (5 X 10 Marks = 50 Marks).

Eight questions will be asked; students should write Five questions. Each unit Four questions can be asked. Each question may have subdivisions. Maximum two subdivisions shall be permitted.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The marks scored should be converted to 5 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 20 marks for the internal assessment.

Question Pattern:

Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

1122235211	**Safety in Engineering Industries**	**L**	**T**	**P**	**C**
Theory		**3**	**0**	**0**	**3**
UNIT 1	**WORK STUDY AND ERGONOMICS**				
Study of operations – work content – work procedure – breakdown – human factors – safety and method study – methods and movements at the workplace – substitution with latest devices – robotics concepts – applications in hazardous workplaces – productivity, quality and safety (PQS) definition - applications of ergonomic principles in the shopfloor– work benches – seating arrangements.					9

UNIT 2	PRINCIPLES OF MACHINE GUARDING	
Guarding during maintenance, Zero Mechanical State (ZMS), Definition and Policy for ZMS – guarding of hazards - point of operation protective devices, machine guarding, types, fixed guard, interlock guard, automatic guard, trip guard, electron eye, positional control guard, fixed guard fencing- guard construction- guard opening. selection and suitability: lathe-drilling-boring-milling-grinding- shaping-sawing-shearing-presses-forge hammer-flywheels-shafts- couplings- gears-sprockets, wheels and chains-pulleys and belts- authorized entry to hazardous installations-benefits of good guarding systems.		9
UNIT 3	**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.		9
UNIT 4	**SAFETY IN COLD FARMING 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.		9
UNIT 5	**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		9

engineering industry-industrial waste disposal.	
Total Hours	**45**

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based on the course.
- Periodic class quizzes conducted on a weekly/fortnightly based on the course.
- Mini project that shall be an extension of any practical lab exercise to real-world application.

References:

1. B.K.B.Rao, R.K.Jain and Vinit Kumar, Safety In chemical plants /Industry & its Management, Khanna Publishers, 1 January 2010.
2. M.N. Vyas, Safety and Hazards Management in Chemical Industries, Atlantic Publishers & Distributors Pvt Ltd, 2020.
3. Brij Mohan Bansal, Safety in Industry Learn from Experience: Learn from Experience, Woodhead Publishing India Pvt Ltd, 14 May 2022.

Web-based/Online Resources:

1. Prof. Jhareswar Maiti. Industrial Safety Engineering, IIT Kharagpur. https://onlinecourses.nptel.ac.in/noc22_mg97/preview

END SEMESTER QUESTION PATTERN - THEORY EXAM

Duration: 3 Hrs. **Max. Marks: 100**

Note: Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Instruction to the Question Setters

Four questions will be asked from every unit, students should write any two questions for 10 marks. The question may have two subdivisions only.

1122235212	Safety in Process Industries and Powder Handling	L	T	P	C
Theory		3	0	0	3

Introduction:

All students must possess a basic understanding of safety in process industries and powder handling, before going into complex applications, they have to completely understand the components of the safety which is includes basic concept of safety and safety performance, accident investigation, dust explosion of industries. A thorough understanding of the concepts is an essential one to excel in this course.

Course Objectives:

The objective of this course is to enable the student to

- To explain about the basic techniques of process industries.
- To describe about accident investigation and reporting.
- To explain the safety performance monitoring.
- To describe the powder handling and dust explosion.

Course Outcomes:

On successful completion of this course, the student will be able to

CO1: Understand the basic concept of safety.

CO2: Identify the accident investigation and report preparation.

CO3: Understand the basics of safety performance.

CO4: Acquire basic knowledge of power handling.

CO5: Understand the basics of dust Explosion.

Pre-requisites:

Knowledge of basic Science

CO/PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7

CO1	3	1	2	1	1	2	1
CO2	3	1	2	1	1	2	1
CO3	3	1	2	1	1	2	1
CO4	3	1	2	1	1	2	1
CO5	3	1	2	1	1	2	1

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- **Engage and Motivate:** Instructors should actively engage students to boost their learning confidence.
- **Real-World Relevance:** Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- **Interactive Learning:** Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- **Application-Based Learning:** Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- **Simulation and Real-World Practice:** Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- **Encourage Critical Analysis:** Foster an environment where students can honestly assess experiment outcomes and analyse potential sources of error in case of discrepancies

Assessment Methodology:

	Continuous Assessment (40 marks)				**End Semester Examination (60 marks)**
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Written test (Two units)	Written test (Another Two units)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 Hour	3 Hours	3 Hours
Exam Marks	50	50	60	100	100

Converted to	15	15	5	20	60
Marks	15		5	20	60
Tentative Schedule	6th Week	12th Week	13-14th Week	16th Week	

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 15 Marks. Best of one will be considered for the internal assessment of 15 Marks.

CA1and CA2, Assessment test should be conducted for two units as below.

PART A: (5 X 10 Marks = 50 Marks).

Eight questions will be asked; students should write Five questions. Each unit Four questions can be asked. Each question may have subdivisions. Maximum two subdivisions shall be permitted.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The marks scored should be converted to 5 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 20 marks for the internal assessment.

Question Pattern:

Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

1122235212	**Safety in Process Industries and Powder Handling**	**L**	**T**	**P**	**C**
Theory		**3**	**0**	**0**	**3**
UNIT 1	**CONCEPTS OF SAFETY**				
Evolution of modern safety concept- safety policy - safety organization - line and staff functions for safety- safety committee- budgeting for safety. techniques- incident recall technique (IRT), disaster control, job safety analysis (JSA), safety survey, safety inspection, safety sampling, safety audit.					9

UNIT 2	ACCIDENT INVESTIGATION AND REPORTING	
Concept of an accident- reportable and non-reportable accidents- unsafe act and condition – principles of accident prevention- supervisory role- role of safety committee - accident causation models - cost of accident- overall accident investigation process - response to accidents. India reporting requirement- planning document- planning matrix- Investigators kit- functions of investigator- four types of evidences- records of accidents- accident reports- class exercise with case study		9
UNIT 3	**SAFETY PERFORMANCE MONITORING**	
Permanent total disabilities- permanent partial disabilities- temporary total disabilities - calculation of accident indices- frequency rate, severity rate. Frequency severity incidence rate- incident rate- accident rate- safety “t” score- safety activity rate – problems. Importance of training-identification of training needs- training methods – programme, 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.		9
UNIT 4	**POWDER HANDLING**	
Powder classification-physical, chemical and other properties- metal powders- other non- metallic powders-handling methods- manual, mechanical, automatic- charging of powders- charge distribution. Metal powders and characterization atomization, types – milling – electro deposition – spray drying, production of iron powder, aluminum powder, titanium – screening and cleaning of metals – explosively and pyrophoricity – toxicity, particle size and size distribution – measurement, types and significance – particle shape analysis- surface area, density, porosity, flow rate – testing. Metal powders, applications as fuel, solid propellants, explosives and pyrotechnics.		9
UNIT 5	**DUST EXPLOSION**	
Industrial dust- dust explosion accidents – explosibility characteristics - minimum explosive concentration, minimum ignition energy- explosion pressure characteristics- maximum permissible oxygen concentration. Explicability tests. Hartmann vertical tube apparatus- horizontal tube apparatus- inflammatory		9

apparatus- godbert and green ward furnace. Dust explosion prevention – dust explosion protection – dust explosion venting-Dust evaluation and control-methodology- measurements – control approaches and strategies – control of dust sources, dust transmission – role of workers.	
Total Hours	**45**

Suggested List of Students Activity:

1. Presentation/Seminars by students on any recent technological developments based on the course.
2. Periodic class quizzes conducted on a weekly/fortnightly based on the course.
3. Mini project that shall be an extension of any practical lab exercise to real-world application.

References:

1. Das Akhil Kumar, Principles of Fire Safety Engineering, 2nd Edition, PHI Learning Pvt Ltd, 1 January 2020.
2. Prakash N.S, Manual of Fire Safety, CBS, 30 October 2017.

Web-based/Online Resources:

1. Prof. Shishir Sinha. Chemical Process Safety, IIT Roorkee. https://onlinecourses.nptel.ac.in/noc20_ch38/preview

END SEMESTER QUESTION PATTERN - THEORY EXAM

Duration: 3 Hrs. **Max. Marks: 100**

Note: Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Instruction to the Question Setters

Four questions will be asked from every unit, students should write any two questions for 10 marks. The question may have two subdivisions only.

1122235213	Safety in Oil and Gas Industries	L	T	P	C
Theory		3	0	0	3

Introduction:

All students must possess a basic understanding of safety in oil and gas industries, before going into complex applications, they have to completely understand the components of the safety which includes oil and gas handling, safety measures, and factors influencing the accident of oil and gas industries. A thorough understanding of the concepts is an essential one to excel in this course.

Course Objectives:

The objective of this course is to enable the student to

- To explain about the basic oil and gas safety.
- To analyse safety measures in oil and gas safety.
- To analyse safety measures in offshore oil and gas industry
- To describe the factors contributing to accident in oil and gas safety.

Course Outcomes:

On successful completion of this course, the student will be able to

CO1: Understand the basic concept of oil and gas safety.

CO2: Identify the performance analysis of oil and gas industry.

CO3: Understand the Safety measures in offshore oil and gas industry.

CO4: Acquire basic knowledge of Factors contributing to accidents in oil and gas industry

CO5: Understand the accident data of oil and gas Industry.

Pre-requisites:

Knowledge of basic Science

CO/PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	2	1	1	2	2
CO2	3	1	2	1	1	2	2
CO3	3	1	2	1	1	2	2
CO4	3	1	2	1	1	2	2
CO5	3	1	2	1	1	2	2

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- **Engage and Motivate:** Instructors should actively engage students to boost their learning confidence.
- **Real-World Relevance:** Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- **Interactive Learning:** Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- **Application-Based Learning:** Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- **Simulation and Real-World Practice:** Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- **Encourage Critical Analysis:** Foster an environment where students can honestly assess experiment outcomes and analyse potential sources of error in case of discrepancies

Assessment Methodology:

	Continuous Assessment (40 marks)				**End Semester Examination (60 marks)**
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Written test (Two units)	Written test (Another Two units)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 Hour	3 Hours	3 Hours

Exam Marks	50	50	60	100	100
Converted to	15	15	5	20	60
Marks	15		5	20	60
Tentative Schedule	6th Week	12th Week	13-14th Week	16th Week	

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 15 Marks. Best of one will be considered for the internal assessment of 15 Marks.

CA1and CA2, Assessment test should be conducted for two units as below.

PART A: (5 X 10 Marks = 50 Marks).

Eight questions will be asked; students should write Five questions. Each unit Four questions can be asked. Each question may have subdivisions. Maximum two subdivisions shall be permitted.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The marks scored should be converted to 5 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 20 marks for the internal assessment.

Question Pattern:

Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

1122235213	**Safety in Oil and Gas Industries**	**L**	**T**	**P**	**C**
Theory		**3**	**0**	**0**	**3**
UNIT 1	**INTRODUCTION TO OIL AND GAS SAFETY**				
Introduction-need for safety and safety engineers- safety management principles –					9

product hazard classifications and product safety organization tasks – common causes of work injuries and mechanical injuries- accident causation theories – occupational stress and human error occurrence reasons – consequences of human error and human error classifications – bath tub hazard curve.		
UNIT 2	**METHODS FOR PERFORMING SAFETY AND RELIABILITY ANALYSIS**	
Introduction- root cause analysis – hazards and operability analysis– technique of operations review – interface safety analysis-job safety analysis – preliminary hazard analysis – failure mode and effect analysis- fault tree analysis – markov method		9
UNIT 3	**SAFETY MEASURES IN OFFSHORE OIL AND GAS INDUSTRY**	
Introduction – offshore industrial sector risk picture – offshore worker situation awareness concept, studies and their results – offshore industry accident reporting approach and offshore accident related causes – offshore industry accidents- case studies (Mumbai high north platform , piper alpha accident – bohai 2 oil accident – Alexander l. kieland accident – ocean ranger accident – glomar java sea drillship accident- baker drilling barge accident – Seacrest drillship accident).		9
UNIT 4	**FACTORS CONTRIBUTING TO ACCIDENTS IN OIL AND GAS INDUSTRY**	
Introduction- human factors that affect safety in general – organizational factors – group factors – individual factors – categorization of accident related human factors in the industrial sector – categories of human factors accident causation in the oil and gas industry – oil field fatality analysis – recommendation to reduce fatal oil and gas industry accidents.		9
UNIT 5	**OIL AND GAS INDUSTRY ACCIDENT DATA AND ACCIDENT DATA ANALYSIS**	
Introduction- offshore oil and gas industry accident databases and accident data collection sources – (world wide) offshore accident databank –well control incident database – collision database – hydrocarbon release database - Danish energy agency – performance measurement project – international association of oil and gas producers)- onshore and offshore oil and gas industry accident data and analysis- offshore oil and gas rigs accident analysis – failures and lessons learned from landmark offshore oil and gas accidents and corrective measures (prevention – mitigation– emergency – safety management – preparedness and planning– aftermath / restoration – early warning – lesson learning).		9
Total Hours		**45**

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based on the course.
- Periodic class quizzes conducted on a weekly/fortnightly based on the course.
- Mini project that shall be an extension of any practical lab exercise to real-world application.

References:

1. B.S. Dhillon, Safety and Reliability in the oil and gas industry a practical approach, CRC Press, Taylor and Francis Group 2016.
2. Alireza Bahadori, Personnel Protection and Safety equipment for oil and gas industries, gulf professional publishing of Elsevier group. 2015.
3. Abdul khalique, Basic Offshore Safety, Rutledge. 2016

Web-based/Online Resources:

1. Prof.Srinivasan Chandarsekaran. HSE Practices for Offshore and Petroleum Industries, IIT Madras. https://onlinecourses.nptel.ac.in/noc19_oe02/preview

END SEMESTER QUESTION PATTERN - THEORY EXAM

Duration: 3 Hrs. **Max. Marks: 100**

Note: Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Instruction to the Question Setters

Four questions will be asked from every unit, students should write any two questions for 10 marks. The question may have two subdivisions only.

1122235541	Computer Aided Risk Analysis	L	T	P	C
Practicum		1	0	4	3

Introduction:

All students must possess a basic understanding of computer aided risk analysis before going into complex applications, they have to completely understand the components of computer aided risk analysis includes preparation of even tree analysis, identification of safety risk assessment, preparation of inspection of facility /equipment, identification of cause- and- effect analysis and preparation of Maintenance Management System. A thorough understanding and practice are an essential one to excel in this course.

Course Objectives:

The objective of this course is to enable the student to

- To prepare the even tree analysis
- To identify the safety risk assessment
- To prepare the inspection of facility /equipment
- To identify the cause- and- effect analysis
- To prepare the maintenance management system

Course Outcomes:

On successful completion of this course, the student will be able to

CO1: Prepare the even tree analysis

CO2: Identify the safety risk assessment

CO3: Prepare the inspection of facility /equipment

CO4: Identify the cause- and- effect analysis

CO5: Prepare the maintenance management system

Pre-requisites:

Knowledge of basic Science

CO/PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	2	-	2	1	-
CO2	3	1	2	-	2	1	-
CO3	3	1	2	-	2	1	-
CO4	3	1	2	-	2	1	-
CO5	3	1	2	-	2	1	-

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- **Engage and Motivate:** Instructors should actively engage students to boost their learning confidence.
- **Real-World Relevance:** Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- **Interactive Learning:** Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- **Application-Based Learning:** Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- **Simulation and Real-World Practice:** Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- **Encourage Critical Analysis:** Foster an environment where students can honestly assess experiment outcomes and analyse potential sources of error in case of discrepancies

Assessment Methodology:

	Continuous Assessment (40 marks)				**End Semester Examination (60 marks)**
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Cycle I Exercises 50% Exercises	Cycle II Exercises	All Units	All Exercises	All Exercises
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 hours

Exam Marks	60	60	100	100	100
Converted to Marks	10	10	15	15	60
Marks	10		15	15	60
Internal Marks	40				
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

Note:

- **CA1 and CA2:** All the exercises/experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

The details of the documents to be prepared as per the instruction below.

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	5
B	Procedure / Diagram	15
C	Execution	20
D	Output / Result	10
TOTAL		50
E	Practical Documents (As per the portions)	10

	60

- **CA 3:** Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

Question pattern – Written Test Theory

Description		**Marks**	
Part – A	30 MCQ Questions.	30 X 1 Mark	30 Marks
Part – B	7 Questions to be answered out of 10 Questions.	7 X 10 Marks	70 Marks
TOTAL			100 Marks

- **CA 4:** All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

SCHEME OF EVALUATION

Model Practical Examination and End Semester Examination - Practical Exam

PART	**DESCRIPTION**	**MARKS**
A	Aim & Apparatus Required	5
B	Procedure / Diagram	20
C	Execution	25
D	Output / Result	10
E	Written Test (Theory Portions)	30
F	Viva voce	10
	TOTAL	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

1122235541	Computer Aided Risk Analysis	L	T	P	C
Practicum		1	0	4	3
UNIT 1	**RISK ANALYSIS QUANTIFICATION AND SOFTWARES**				
Fault Tree Analysis and Event Tree Analysis, Logic symbols, methodology, minimal cut set ranking - fire explosion and toxicity index (FETI), various indices - Hazard analysis (HAZAN)- Failure Mode and Effect Analysis (FMEA)- Basic concepts of Reliability- Software on Risk analysis, CISCON, FETI, HAMGARS modules on Heat radiation, Pool fire, Jet, Explosion. Reliability softwares on FMEA for mechanical and electrical systems					8
UNIT 2	**CREDIBILITY OF RISK ASSESSMENT TECHNIQUES**				
Past accident analysis as information sources for Hazard analysis and consequences analysis of chemical accident, Mexico disaster, Flixborough, Bhopal, Seveso, Pasadena, Feyzin disaster(1966), Port Hudson disaster- convey report, hazard assessment of non-nuclear installation- Rijnmond report, risk analysis of size potentially Hazardous Industrial objects- Rasmussen masses report, Reactor safety study of Nuclear power plant.					7
Ex. No	**Name of the Experiment**				
1	Performance of Event tree Analysis (ETA)				6
2	Performance of Fault tree Analysis (FTA)				6
3	Performance of Failure Mode Effect Analysis (FMEA)				6
4	Performance of Air Hazard Modelling				6
5	Performance of Safety Risk Assessment.				6
6	Performance of Cause- and- Effect Analysis.				6
7	Execution of work Permit Management System				6
8	Execution of Incident Reporting				6
9	Execution of Inspection of facility /equipment.				6
10	Execution of Maintenance Management System				6
Total Hours					**75**

Suggested List of Students Activity:

1. Presentation/Seminars by students on any recent technological developments based on the course.
2. Periodic class quizzes conducted on a weekly/fortnightly based on the course.
3. Mini project that shall be an extension of any practical lab exercise to real-world application.

References:

1. Ayyub, B.M., 2003. Risk analysis in engineering and economics. Chapman and Hall/CRC.
2. Afifi, A., May, S. and Clark, V.A., 2003. Computer-aided multivariate analysis. CRC press.

Web-based/Online Resources:

1 Prof. Jhareswar Maiti. Safety and Risk Analytics, IIT Kharagpur, https://onlinecourses.nptel.ac.in/noc22_mg55/preview

Equipment / Facilities required to conduct the Practical Course. (Batch Strength: 30 Students)

- Personal computer – 30 Nos.
- Printer – 1 No.
- Required Software: suitable open-source software packages– Sufficient to the strength.

END SEMESTER EXAMINATION – PRACTICAL EXAM

Note: All the exercises should be given in the question paper and students are allowed to select by a lot or the question paper allotted from the DOTE shall be used.

Practical document should be submitted for the examination with a bonafide certificate.

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	5
B	Procedure / Diagram	20
C	Execution	25
D	Output / Result	10

E	Written Test (Theory Portions)	30
F	Viva voce	10
	TOTAL	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

1122235542	Safety and Regulations Audit	L	T	P	C
Practicum		1	0	4	3

Introduction:

All students must possess a basic understanding of Safety and regulations before going into complex applications, they have to completely understand the components of Safety regulations audit includes identifying the different types of Rules in industrial safety, prepare Material safety, preparation of handling and storage of various metals, toxic gases and industrial chemicals, identifying the routes of audit in safety of human. A thorough understanding and practice are an essential one to excel in this course.

Course Objectives:

The objective of this course is to enable the student to

- To explain about the Factories acts and environment acts.
- To describe the industry working conditions.
- To understand the Manufacture, Storage & Import of Hazardous Chemical Rules.
- To know the international acts and standards.

Course Outcomes:

On successful completion of this course, the student will be able to

CO1: Identify the different types of industry regulation acts.

CO2: Understand the safety in Manufacturing and Hazardous material handling.

CO3: Prepare the material handling and storage of various metals.

CO4: Identify the routes of safety in Toxic gases handling.

CO5: Prepare the products and industrial utilizing toxic chemicals.

Pre-requisites:

Knowledge of basic Science

CO/PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	2	-	2	1	-
CO2	3	1	2	-	2	1	-
CO3	3	1	2	-	2	1	-
CO4	3	1	2	-	2	1	-
CO5	3	1	2	-	2	1	-

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- **Engage and Motivate:** Instructors should actively engage students to boost their learning confidence.
- **Real-World Relevance:** Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- **Interactive Learning:** Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- **Application-Based Learning:** Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- **Simulation and Real-World Practice:** Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- **Encourage Critical Analysis:** Foster an environment where students can honestly assess experiment outcomes and analyse potential sources of error in case of discrepancies

Assessment Methodology:

	Continuous Assessment (40 marks)				**End Semester Examination (60 marks)**
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Cycle I Exercises 50% Exercises	Cycle II Exercises	All Units	All Exercises	All Exercises
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 hours

Exam Marks	60	60	100	100	100
Converted to Marks	10	10	15	15	60
Marks	10		15	15	60
Internal Marks	40				
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

Note:

- **CA1 and CA2:** All the exercises/experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

The details of the documents to be prepared as per the instruction below.

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	5
B	Procedure/Material preparation/ Arrangements	15
C	Demonstration/ Flow chart/Data analysis	20
D	Output / Result	10
TOTAL		50
E	Practical Documents (As per the portions)	10

	60

- **CA 3:** Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

Question pattern – Written Test Theory

Description		Marks	
Part – A	30 MCQ Questions.	30 X 1 Mark	30 Marks
Part – B	7 Questions to be answered out of 10 Questions.	7 X 10 Marks	70 Marks
TOTAL			100 Marks

- **CA 4:** All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

SCHEME OF EVALUATION

Model Practical Examination and End Semester Examination - Practical Exam

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	5
B	Procedure/Material preparation/ Arrangements	20
C	Demonstration/ Flow chart/Data analysis	25
D	Output / Result	10
E	Written Test (Theory Portions)	30
F	Viva voce	10
	TOTAL	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

1122235542	Safety and Regulations Audit	L	T	P	C
Practicum		1	0	4	3
UNIT 1	**FACTORIES ACT – 1948**				
Statutory authorities – inspecting staff, health, safety, provisions relating to hazardous processes- welfare, working hours, employment of young person's – special provisions – penalties and procedures- Tamilnadu factories rules 1950 under safety and health chapters of factories Act 1948.					8
UNIT 2	**MANUFACTURE, STORAGE AND IMPORT OF HAZARDOUS CHEMICAL RULES,1989**				
Definitions – duties of authorities – responsibilities of occupier – notification of major accidents – information to be furnished – preparation of offsite and onsite plans – list of hazardous and toxic chemicals – safety reports – safety data sheets.					7
Ex. No	**Name of the Experiment**				
1	Safety audit of a workplace.				6
2	Audit for the compliance of factories Act.1948 and TN factories Rules.1950				6
3	Audit for the compliance of Indian Electricity rules,1956 and Electricity Act 2003.				6
4	Audit for the compliance of Air (Prevention and Control of Pollution)Act 1981.				6
5	Audit for the compliance of water (Prevention and Control of Pollution) Act 1974.				6
6	Audit for the compliance of Environment protection Act 1986.				6
7	Audit for the compliance of workmen compensation Act 1923.				6
8	Audit for the compliance of ISO 14001-2015 Environmental management system.				6

9	Audit for the compliance of ISO 45001-2008 occupational health and safety management systems.	6
10	Study of Occupational safety, Health and working conditions code-2020	6
Total Hours		**75**

Suggested List of Students Activity:

1. Presentation/Seminars by students on any recent technological developments based on the course.
2. Periodic class quizzes conducted on a weekly/fortnightly based on the course.
3. Mini project that shall be an extension of any practical lab exercise to real-world application.

References:

1. The Factories Act 1948, Madras Book Agency, Chennai, 2000.
2. The manufacture, storage and import of hazardous chemical rules 1989, Madras.

Web-based/Online Resources:

1 Prof. Jhareswar Maiti. Safety and Risk Analytics, IIT Kharagpur, https://onlinecourses.nptel.ac.in/noc22_mg55/preview

Equipment / Facilities required to conduct the Practical Course. (Batch Strength: 30 Students)

- Safety audit forms
- Forms developed for the audit and relevant act rules / standard
- Relevant code.

END SEMESTER EXAMINATION – PRACTICAL EXAM

Note: All the exercises should be given in the question paper and students are allowed to select by a lot or the question paper allotted from the DOTE shall be used.

Practical document should be submitted for the examination with a bonafide certificate.

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	5
B	Procedure/Material preparation/ Arrangements	20
C	Demonstration/ Flow chart/Data analysis	25
D	Output / Result	10
E	Written Test (Theory Portions)	30
F	Viva voce	10
	TOTAL	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

1122235543	Explosion Theory and Control	L	T	P	C
Practicum		1	0	4	3

Introduction:

All students must possess a basic understanding of explosion theory and control before going into complex applications, they have to completely understand the components of explosion includes identifying the different types of Explosion energy and energy calculation, typical Explosion and classification, fire dynamics, explosion protecting system. A thorough understanding and practice are an essential one to excel in this course.

Course Objectives:

The objective of this course is to enable the student to

- To provide an in-depth knowledge about the explosion.
- To understand the explosion energy.
- To know the various types of explosions.
- To understand the science of explosion and fire dynamics.
- To understand the various explosion protecting systems.

Course Outcomes:

On successful completion of this course, the student will be able to

CO1: understand the explosion theory.

CO2: Identify the different types of Explosion theory and energy.

CO3: understand the various explosion control theory.

CO4: Identify the science of explosion and fire dynamics.

CO5: Prepare the various explosion protecting systems.

Pre-requisites:

Knowledge of basic Science

CO/PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	2	-	2	2	-
CO2	3	1	2	-	2	2	-
CO3	3	1	2	-	2	2	-
CO4	3	1	2	-	2	2	-
CO5	3	1	2	-	2	2	-

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- **Engage and Motivate:** Instructors should actively engage students to boost their learning confidence.
- **Real-World Relevance:** Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- **Interactive Learning:** Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- **Application-Based Learning:** Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- **Simulation and Real-World Practice:** Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- **Encourage Critical Analysis:** Foster an environment where students can honestly assess experiment outcomes and analyse potential sources of error in case of discrepancies

Assessment Methodology:

	Continuous Assessment (40 marks)				**End Semester Examination (60 marks)**
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Cycle I Exercises 50% Exercises	Cycle II Exercises	All Units	All Exercises	All Exercises
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 hours

Exam Marks	60	60	100	100	100
Converted to Marks	10	10	15	15	60
Marks	10		15	15	60
Internal Marks	40				
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

Note:

- **CA1 and CA2:** All the exercises/experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

The details of the documents to be prepared as per the instruction below.

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	5
B	Procedure/Material preparation/ Arrangements	15
C	Demonstration/ Flow chart/Data analysis	20
D	Output / Result	10
TOTAL		50
E	Practical Documents (As per the portions)	10

	60

- **CA 3:** Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

Question pattern – Written Test Theory

Description		Marks	
Part – A	30 MCQ Questions.	30 X 1 Mark	30 Marks
Part – B	7 Questions to be answered out of 10 Questions.	7 X 10 Marks	70 Marks
TOTAL			100 Marks

- **CA 4:** All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

SCHEME OF EVALUATION

Model Practical Examination and End Semester Examination - Practical Exam

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	5
B	Procedure/Material preparation/ Arrangements	20
C	Demonstration/ Flow chart/Data analysis	25
D	Output / Result	10
E	Written Test (Theory Portions)	30
F	Viva voce	10

TOTAL	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

1122235543 Practicum	Explosion Theory and Control	L 1	T 0	P 4	C 3
UNIT 1	**EXPLOSION**				
Explosions- different types of explosions - causes – properties- Energy release in an explosion - energy release in a chemical reaction, standard heats of formation – stoichiometry - equivalence ratio and heat release in fuel - rich and oxidizer-rich compounds - energy release calculations, higher and lower calorific values, Internal energy of formation.					8
UNIT 2	**FIRE DYNAMICS AND EXPLOSION PROTECTING SYSTEMS**				
Flame spread - liquid surfaces, O_2 enriched atmosphere - Phases of fire development - smoldering combustion, spontaneous ignition. Explosion protection systems-protection techniques- Containment, flame arrestors, isolation, suppression, venting.					7
Ex.No	**NAME OF THE EXPERIMENT**				
1	Study on explosion theory and control.				6
2	Study on general industrial ventilation system.				6
3	Study on air cleaning devices and selection.				6
4	Design and testing of industrial ventilation.				6
5	Identification of fire work chemicals and control systems.				6
6	Identification of explosion protecting system.				6
7	Identification of metal powders in industry-Particle size analyser and testing.				6
8	Identification of Dust explosion and prevention system.				6
9	Dust handling in plants and control.				6
10	Dust evaluation and control (sampling, Measurement).				6

Total Hours	75

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based on the course.
- Periodic class quizzes conducted on a weekly/fortnightly based on the course.
- Mini project that shall be an extension of any practical lab exercise to real-world application.

References:

1. “Accident Prevention manual for industrial operations” N.S.C., Chicago,1992.
2. ACGIH Industrial Ventilation “A Manual of Recommended Practice for Design”, 28th edition 2013.

Web-based/Online Resources:

1 Prof. K. Ramamurthi, Prof. Prasad Patnaik BSV. Introduction to Explosions and Explosion Safety, IIT Madras, https://nptel.ac.in/courses/112106177

Equipment / Facilities required to conduct the Practical Course. (Batch Strength: 30 Students)

- Industrial ventilation system
- Industry-Particle size analyser and testing.
- Explosion protecting system
- Dust explosion and prevention system

END SEMESTER EXAMINATION – PRACTICAL EXAM

Note: All the exercises should be given in the question paper and students are allowed to select by a lot or the question paper allotted from the DOTE shall be used.

Practical document should be submitted for the examination with a bonafide certificate.

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	5

B	Procedure/Material preparation/ Arrangements	20
C	Demonstration/ Flow chart/Data analysis	25
D	Output / Result	10
E	Written Test (Theory Portions)	30
F	Viva voce	10
	TOTAL	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

1122236111	Regulations for Safety, Health and Environment	L	T	P	C
Theory		3	0	0	3

Introduction:

All students must possess a basic understanding the regulation for safety, health and environment, before going into complex applications, they have to completely understand the components of the regulation for safety which includes the factory acts, environment act, hazardous material handling and other international acts, standards. A thorough understanding of the concepts is an essential one to excel in this course.

Course Objectives:

The objective of this course is to enable the student to

- To explain about the Factories acts and environment acts.
- To describe the industry working conditions.
- To understand the Manufacture, Storage & Import of Hazardous Chemical Rules.
- To know the international acts and standards.

Course Outcomes:

On successful completion of this course, the student will be able to

CO1: Understand the basic of Factory acts.

CO2: Understand the basic of Environmental acts.

CO3: Acquire basic knowledge of handling the hazardous chemical rules.

CO4: Understand the basics of general industry acts.

CO5: Acquire basic knowledge of international standards and rules.

Pre-requisites:

Knowledge of basic Science

CO/PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	2	2	1	2	2
CO2	3	2	2	2	1	2	2
CO3	3	2	2	2	1	2	2
CO4	3	2	2	2	1	2	2
CO5	3	2	2	2	1	2	2

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- **Engage and Motivate:** Instructors should actively engage students to boost their learning confidence.
- **Real-World Relevance:** Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- **Interactive Learning:** Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- **Application-Based Learning:** Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- **Simulation and Real-World Practice:** Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- **Encourage Critical Analysis:** Foster an environment where students can honestly assess experiment outcomes and analyse potential sources of error in case of discrepancies

Assessment Methodology:

	Continuous Assessment (40 marks)				**End Semester Examination (60 marks)**
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Written test (Two units)	Written test (Another Two units)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 Hour	3 Hours	3 Hours

Exam Marks	50	50	60	100	100
Converted to	15	15	5	20	60
Marks	15		5	20	60
Tentative Schedule	6th Week	12th Week	13-14th Week	16th Week	

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 15 Marks. Best of one will be considered for the internal assessment of 15 Marks.

CA1and CA2, Assessment test should be conducted for two units as below.

PART A: (5 X 10 Marks = 50 Marks).

Eight questions will be asked; students should write Five questions. Each unit Four questions can be asked. Each question may have subdivisions. Maximum two subdivisions shall be permitted.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The marks scored should be converted to 5 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 20 marks for the internal assessment.

Question Pattern:

Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

1122236111	**Regulations for Safety, Health and Environment**	**L**	**T**	**P**	**C**
Theory		**3**	**0**	**0**	**3**
UNIT 1	**FACTORIES ACT, 1948**				

Statutory authorities – inspecting staff, health, safety, provisions relating to hazardous processes- welfare, working hours, employment of young person's – special provisions – penalties and procedures- Tamilnadu factories rules 1950 under safety and health chapters of factories Act 1948.		9
UNIT 2	**ENVIRONMENT ACT- 1986**	
General powers of the central government, prevention, control and abatement of environmental pollution- biomedical waste (management and handling rules, 1989- the noise pollution regulation and control) rules 2000- the batteries (management and handling rules) 2001- No objection certificate from statutory authorities like pollution control board. air Act 1981 and water Act 1974: central and state boards for the prevention and control of air pollution-powers and functions of boards – prevention and control of air pollution and water pollution – fund – accounts and audit, penalties and procedures.		9
UNIT 3	**MANUFACTURE, STORAGE AND IMPORT OF HAZARDOUS CHEMICAL RULES, 1989**	
Definitions – duties of authorities – responsibilities of occupier – notification of major accidents – information to be furnished – preparation of offsite and onsite plans – list of hazardous and toxic chemicals – safety reports – safety data sheets.		9
UNIT 4	**OTHER ACTS & RULES**	
Indian Boiler Act 1923, static and mobile pressure vessel rules (SMPV), motor vehicle rules, mines Act 1952, workman compensation act and rules – electricity act and rules – hazardous wastes (management and handling) rules1989 with amendments In 2000- the building and other construction workers act 1996- petroleum rules- gas cylinder rules-explosives act 1983-pesticides act.		9
UNIT 5	**INTERNATIONAL ACTS & STANDARDS**	
Occupational safety and health Act of USA (The william- steiger Act of 1970) – health and safety work Act (HASAWA 1974, UK) – OSHAS 18000 – ISO 14000 – American national standards institute (ANSI).		9
Total Hours		**45**

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based on the course.
- Periodic class quizzes conducted on a weekly/fortnightly based on the course.
- Mini project that shall be an extension of any practical lab exercise to real-world application.

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. The Indian boilers act 1923, Commercial Law Publishers (India) Pvt.Ltd., Allahabad.
6. The Mines Act 1952, Commercial Law Publishers (India) Pvt.Ltd., Allahabad.
7. The manufacture, storage and import of hazardous chemical rules 1989, Madras.

Web-based/Online Resources:

1. Prof.Srinivasan Chandarsekaran. HSE Practices for Offshore and Petroleum Industries, IIT Madras. https://onlinecourses.nptel.ac.in/noc19_oe02/preview

END SEMESTER QUESTION PATTERN - THEORY EXAM

Duration: 3 Hrs. **Max. Marks: 100**

Note: Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Instruction to the Question Setters

Four questions will be asked from every unit, students should write any two questions for 10 marks. The question may have two subdivisions only.

1122236112	Disaster Management	L	T	P	C
Theory		3	0	0	3

Introduction:

All students must possess a basic understanding the disaster management, before going into complex applications, they have to completely understand the components of the Philosophy of disaster management, Technological, Sustainable development and environmental education. A thorough understanding of the concepts is an essential one to excel in this course.

Course Objectives:

The objective of this course is to enable the student to

- To explain about the Philosophy of Disaster management.
- To explain the technological disasters and sustainable development.
- To describe the offshore and on shore drilling.
- To understand environmental education.

Course Outcomes:

On successful completion of this course, the student will be able to

CO1: Understand the basic philosophy of Disaster Management.

CO2: Understand the basic of Technological Disasters.

CO3: Acquire basic knowledge of sustainable development.

CO4: Understand the basics offshore and onshore drilling.

CO5: Acquire basic knowledge of environmental education.

Pre-requisites:

Knowledge of basic Science

CO/PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7

CO1	3	1	2	1	1	2	2
CO2	3	1	2	1	1	2	2
CO3	3	1	2	1	1	2	2
CO4	3	1	2	1	1	2	2
CO5	3	1	2	1	1	2	22

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- **Engage and Motivate:** Instructors should actively engage students to boost their learning confidence.
- **Real-World Relevance:** Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- **Interactive Learning:** Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- **Application-Based Learning:** Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- **Simulation and Real-World Practice:** Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- **Encourage Critical Analysis:** Foster an environment where students can honestly assess experiment outcomes and analyse potential sources of error in case of discrepancies

Assessment Methodology:

	Continuous Assessment (40 marks)				**End Semester Examination (60 marks)**
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Written test (Two units)	Written test (Another Two units)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 Hour	3 Hours	3 Hours
Exam Marks	50	50	60	100	100

Converted to	15	15	5	20	60
Marks	15		5	20	60
Tentative Schedule	6th Week	12th Week	13-14th Week	16th Week	

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 15 Marks. Best of one will be considered for the internal assessment of 15 Marks.

CA1and CA2, Assessment test should be conducted for two units as below.

PART A: (5 X 10 Marks = 50 Marks).

Eight questions will be asked; students should write Five questions. Each unit Four questions can be asked. Each question may have subdivisions. Maximum two subdivisions shall be permitted.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The marks scored should be converted to 5 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 20 marks for the internal assessment.

Question Pattern:

Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

1122236112	**Disaster Management**	**L**	**T**	**P**	**C**
Theory		**3**	**0**	**0**	**3**
UNIT 1	**PHILOSOPHY OF DISASTER MANAGEMENT**				
Introduction- disaster mitigation-hydrological, coastal and marine disasters- atmospheric disasters- geological, meteorological phenomena- mass movement and land disasters- forest related disasters- wind and water related disasters-use of					9

space technology for the control of geological disasters.		
UNIT 2	**TECHNOLOGICAL DISASTERS**	
Introduction- Case studies of technological disasters with statistical details- emergencies and control measures- APELL-onsite and offsite emergencies- crisis management groups- emergency centers and their functions throughout the country- software's on emergency controls- monitoring devices for detection of gases in the atmosphere.		9
UNIT 3	**SUSTAINABLE DEVELOPMENT**	
Introduction - sustainable development- bio diversity-atmospheric pollution- global warming and ozone depletion-ODS banking and phasing out- sea level rise-El Nino and climate changes-Eco friendly products - Green movements- green philosophy- environmental policies- environmental impact assessment-case studies-life cycle.		9
UNIT 4	**OFFSHORE AND ONSHORE DRILLING**	
Introduction - offshore and onshore drilling-control of fires-case studies-marine pollution and control- toxic, hazardous and nuclear wastes-state of India's and global environmental issues- carcinogens- complex emergencies- earthquake disasters- extreme event analysis.		9
UNIT 5	**ENVIRONMENTAL EDUCATION**	
Introduction- environmental education-population and community ecology- conservation of natural resources - environmental protection and law- research methodology and systems analysis- policy initiatives and future prospects-risk assessment process, assessment for different disaster types- assessment data use, destructive capacity-risk adjustment-choice-loss acceptance- disaster aid- public liability insurance-stock taking and vulnerability analysis-disaster profile of the country-national policies-objectives and standards-physical event modification- preparedness, forecasting and warning, land use planning.		9
Total Hours		**45**

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based on the course.
- Periodic class quizzes conducted on a weekly/fortnightly based on the course.

- Mini project that shall be an extension of any practical lab exercise to real-world application.

References:

1. S. C. Sharma, Disaster management, Second Edition, Khanna Publishing, 1 January 2022.
2. Nidhi Gauba, Disaster Management and Preparedness, CBS Publication, 1 January 2012.
3. R. Subramanian, Disaster Management, Vikas Publishing House, 1 January 2018.
4. Mrinalini Pandey, Disaster Management, 2ed, Wiley India Pvt Ltd. 22 August 2023.

Web-based/Online Resources:

1. Naveen Kumar Nanjundan. Disaster Management, University of Hyderabad. https://onlinecourses.swayam2.ac.in/cec19_hs20/preview

END SEMESTER QUESTION PATTERN - THEORY EXAM

Duration: 3 Hrs. **Max. Marks: 100**

Note: Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Instruction to the Question Setters

Four questions will be asked from every unit, students should write any two questions for 10 marks. The question may have two subdivisions only.

1122236113	Safety in Material Handling	L	T	P	C
Theory		3	0	0	3

Introduction:

All students must possess a basic understanding of safety in material handling, before going into complex applications, they have to completely understand the components of the safety includes manual material handling, Cranes, derricks, conveyors, hoists, and vehicles, Industrial trucks. A thorough understanding of the concepts is an essential one to excel in this course.

Course Objectives:

The objective of this course is to enable the student to

- To explain about the manual material handling.
- To describe the industry working cranes, Derricks, Conveyors, and Hoists & Vehicles.
- To understand about the rigging and industrial trucks.

Course Outcomes:

On successful completion of this course, the student will be able to

CO1: Understand the basic of manual material handling.

CO2: Identify the cranes and its applications.

CO3: Understand the basics of derricks, conveyors, hoists, and vehicles.

CO4: Acquire basic knowledge of rigging.

CO5: Understand the basic needs of Industrial trucks.

Pre-requisites:

Knowledge of basic Science

CO/PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	2	1	1	2	1
CO2	3	2	2	1	1	2	1

CO3	3	2	2	1	1	2	1
CO4	3	2	2	1	1	2	1
CO5	3	2	2	1	1	2	1

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- **Engage and Motivate:** Instructors should actively engage students to boost their learning confidence.
- **Real-World Relevance:** Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- **Interactive Learning:** Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- **Application-Based Learning:** Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- **Simulation and Real-World Practice:** Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- **Encourage Critical Analysis:** Foster an environment where students can honestly assess experiment outcomes and analyse potential sources of error in case of discrepancies

Assessment Methodology:

	Continuous Assessment (40 marks)				**End Semester Examination (60 marks)**
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Written test (Two units)	Written test (Another Two units)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 Hour	3 Hours	3 Hours
Exam Marks	50	50	60	100	100
Converted to	15	15	5	20	60
Marks	15		5	20	60

Tentative Schedule	6th Week	12th Week	13-14th Week	16th Week	

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 15 Marks. Best of one will be considered for the internal assessment of 15 Marks.

CA1and CA2, Assessment test should be conducted for two units as below.

PART A: (5 X 10 Marks = 50 Marks).

Eight questions will be asked; students should write Five questions. Each unit Four questions can be asked. Each question may have subdivisions. Maximum two subdivisions shall be permitted.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The marks scored should be converted to 5 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 20 marks for the internal assessment.

Question Pattern:

Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

1122236113	**Safety in Material Handling**	**L**	**T**	**P**	**C**
Theory		**3**	**0**	**0**	**3**
UNIT 1	**MANUAL MATERIAL HANDLING**				
Preventing common injuries- lifting by hand- team lifting and carrying- handling specific shape machines and other heavy objects –accessories for manual handling, hand tools, jacks, hand trucks, dollies and wheel barrows –storage of specific materials - problems with hazardous materials, liquids, solids –storage and handling of cryogenic liquids -shipping and receiving, stock picking, dock boards, machine and tools, steel 199 strapping and sacking, glass and nails, pitch and glue, boxes and cartons and					9

carloading–personal protection –ergonomic and safety considerations.		
UNIT 2	**CRANES**	
Types of cranes-reasons for crane accidents: power line contact, overloading, failure to use outriggers-load control-wire rope requirements-annual inspections-preventive maintenance-lifting tools & tackles-structural failure, two blocking, pinch point, moving parts, unsafe hooks, obstruction of vision, sheave caused cable damage, cable kinking, side pull, boom buckling, access, control confusion, turntable failure, removal of counter weight systems-pre lifting plan-job hazard analysis-hand signals-signaling devices-lifting capabilities-third party inspection-safe load indicator.		9
UNIT 3	**DERRICKS, CONVEYORS, HOISTS & VEHICLES**	
Derricks- Types of derricks- load ratings- inspections- testing- maintenance-handling the load- guard- operating near power lines- floating cranes. Conveyors- gravity or inertia conveyors-guidelines for using motorized or powered conveyors - conveyor regulations- conveyor safety. Hoists- Inspections-load testing-controls for hoist-moving a load- hoist limit switch- base mounted drum hoist- materials hoist- overhead hoist. Vehicles- highway trucks- off road vehicles -railroad cars.		9
UNIT 4	**RIGGING**	
Rigging and rigger-types of slings-size-weight and centre of gravity of the load-number of legs and angle-removal from service- selection of wire rope sling-strength, fatigue, abrasive wear, abuse- rated capacity of the sling-safe use and maintenance-chain slings- wire rope slings-rope lay-wire rope life-field lubrication-storage- U bolts-metal mesh slings-fiber rope and synthetic web slings- hooks and shackles.		9
UNIT 5	**INDUSTRIAL TRUCKS**	
Powered industrial trucks- requirements- operating principles- operators selection, training and performance test- inspection and maintenance- electric trucks- gasoline operated trucks- LPG trucks–power elevators- types of drives- hoist way and machine room emergency procedure- requirements for the handicapped- types- Escalator-safety devices and brakes- moving walks –man lifts, construction, brakes, inspection - ergonomic and safety consideration.		9
Total Hours		**45**

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based on the course.

- Periodic class quizzes conducted on a weekly/fortnightly based on the course.
- Mini project that shall be an extension of any practical lab exercise to real-world application.

References:

1. G.K. Agarwal, Plant Layout and Material Handling, Science Technology, 2nd Edition, 2020.
2. S.C.Sharma, Plant Layout and Materials Handling, Khanna Publishers, 1 January 2000.

Web-based/Online Resources:

1. Prof. Khanindra Pathak. Bulk Material Transport and Handling Systems, IIT Kharagpur. https://nptel.ac.in/courses/113105104

END SEMESTER QUESTION PATTERN - THEORY EXAM

Duration: 3 Hrs. **Max. Marks: 100**

Note: Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Instruction to the Question Setters

Four questions will be asked from every unit, students should write any two questions for 10 marks. The question may have two subdivisions only.

1122236241	Emergency Preparedness	L	T	P	C
Practicum		1	0	4	3

Introduction:

All students must possess a basic understanding of emergency preparedness before going into complex applications, they have to completely understand the components of the emergency on-site and off-site plan. Prepare the data sheet for chemical plant. A thorough understanding of the concepts is an essential one to excel in this course.

Course Objectives:

The objective of this course is to enable the student to

- Identify the work process of the awareness & preparedness for emergencies at local level.
- Preparation of awareness & preparedness for emergencies at local level.
- Exposure to the knowledge of hazardous installations and local community.
- Preparation of time table for implementing the awareness & preparedness for emergencies at local level process.

Course Outcomes:

On successful completion of this course, the student will be able to

CO1: Identify the different types on-site and off-site plan.

CO2: Prepare the excavation plan of a chemical plant.

CO3: Prepare the plan for emergency situation.

CO4: Identify the Government rules on emergency.

CO5: preparedness for any disaster based on local geography.

Pre-requisites:

Knowledge of basic Science

CO/PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	1	3	3	2	1

CO2	3	1	1	3	3	2	1
CO3	3	1	1	3	3	2	1
CO4	3	1	1	3	3	2	1
CO5	3	1	1	3	3	2	1

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- **Engage and Motivate:** Instructors should actively engage students to boost their learning confidence.
- **Real-World Relevance:** Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- **Interactive Learning:** Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- **Application-Based Learning:** Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- **Simulation and Real-World Practice:** Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- **Encourage Critical Analysis:** Foster an environment where students can honestly assess experiment outcomes and analyse potential sources of error in case of discrepancies

Assessment Methodology:

	Continuous Assessment (40 marks)				**End Semester Examination (60 marks)**
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Cycle I Exercises 50% Exercises	Cycle II Exercises	All Units	All Exercises	All Exercises
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 hours
Exam Marks	60	60	100	100	100
Converted	10	10	15	15	60

to Marks					
Marks	10		15	15	60
Internal Marks	40				
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

Note:

- **CA1 and CA2:** All the exercises/experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

The details of the documents to be prepared as per the instruction below.

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	5
B	Procedure/Material preparation/ Arrangements	15
C	Demonstration/ Flow chart/Data analysis	20
D	Output / Result	10
TOTAL		50
E	Practical Documents (As per the portions)	10
		60

- **CA 3:** Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

Question pattern – Written Test Theory

Description		Marks	
Part – A	30 MCQ Questions.	30 X 1 Mark	30 Marks
Part – B	7 Questions to be answered out of 10 Questions.	7 X 10 Marks	70 Marks
TOTAL			100 Marks

- **CA 4:** All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

SCHEME OF EVALUATION

Model Practical Examination and End Semester Examination - Practical Exam

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	5
B	Procedure/Material preparation/ Arrangements	20
C	Demonstration/ Flow chart/Data analysis	25
D	Output / Result	10
E	Written Test (Theory Portions)	30
F	Viva voce	10
	TOTAL	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

1122236241	Emergency Preparedness	L	T	P	C
Practicum		1	0	4	3
UNIT 1	**ACCIDENT ANALYSIS AND MANAGEMENT**				
Accidents classification and analysis-fatal, serious, minor and reportable accidents – safety audits-recent development of safety engineering approaches - frequency rates-accident occurrence-investigation-measures for improving safety - cost of accident-emergency preparedness – disaster management.					8
UNIT 2	**PLANNING**				
Actions to address risk and opportunities – hazard identification and assessment of risks and opportunities – determination of legal and other requirements-planning action- OH & S objectives and planning to achieve them support – resources – competence –awareness- communication – documented information –operation planning & control – management of change – procurement – Emergency preparedness and response.					7
Ex.No	**Name of the Experiment**				
1	Study of an On-site emergency plan.				6
2	Study of an off-site Emergency plan.				6
3	Reading and demonstration of excavation plan of a chemical plant / facility.				6
4	Mock drill of Assembling at the emergency assembling point.				6
5	Developing flowcharts for various possible emergency situations.				6
6	Demonstration of emergency preparedness in a chemical plant /facility.				6
7	Demonstration of emergency preparedness in the event of afire.				6
8	Demonstration on notifying the Government departments during an emergency.				6
9	Demonstration on warning the public during an emergency.				6

10	Demonstration on the preparedness for any disaster based on local geography.	6
Total Hours		**75**

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based on the course.
- Periodic class quizzes conducted on a weekly/fortnightly based on the course.
- Mini project that shall be an extension of any practical lab exercise to real-world application.

References:

1. Michael Karmis ed., “Mine Health and Safety Management”, SME, Littleton, Co. 2001.
2. Kejiriwal, B.K. “Safety in Mines”, Publisher Gyan Prakashan, Dhanbad, 2002.
3. DGMS Circulars-Ministry of Labour, Government of India press, OR Lovely Prakashan-DHANBAD, 2002.

Web-based/Online Resources:

1. Prof. Javed N. Malik. Natural Hazards, IIT Kanpur, https://nptel.ac.in/courses/105104183

Equipment / Facilities required to conduct the Practical Course. (Batch Strength: 30 Students)

- Sample on-site emergency plan
- Sample off-site emergency plan
- Sample excavation plan
- Mock drill procedures
- Engineering Drawing equipment and instruments
- Emergency plan
- Disaster Management plan
- Emergency vehicles
- Communicative equipment
- Emergency tools kit
- Cut section of fire extinguishers

- Personal protective equipment (as per hazards involved)
- All emergency phone numbers on display

END SEMESTER EXAMINATION – PRACTICAL EXAM

Note: All the exercises should be given in the question paper and students are allowed to select by a lot or the question paper allotted from the DOTE shall be used.

Practical document should be submitted for the examination with a bonafide certificate.

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	5
B	Procedure/Material preparation/ Arrangements	20
C	Demonstration/ Flow chart/Data analysis	25
D	Output / Result	10
E	Written Test (Theory Portions)	30
F	Viva voce	10
	TOTAL	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

1122236242	Transport and Road Safety	L	T	P	C
Practicum		1	0	4	3

Introduction:

All students must possess a basic understanding of the transport and road safety before going into complex applications, they have to completely understand the components of loading and unloading of truck, internal roadways in a plant, hazardous material handling vehicle. A thorough understanding of the concepts is an essential one to excel in this course.

Course Objectives:

The objective of this course is to enable the student to

- Preparation of loading and unloading of truck.
- Preparation of internal roadways in a plant.
- Identify the hazards operation.
- Preparation of transport vehicle permits and driver qualification.
- Identify the good lifting technique for material handling.

Course Outcomes:

On successful completion of this course, the student will be able to

CO1: Identify the different types loading and unloading of truck carrying chemicals.

CO2: Identification of hazards in crane operations.

CO3: Preparation of driving transport vehicles for transporting various products.

CO4: Understand the traffic and road safety signs in India.

CO5: preparedness material handling equipment.

Pre-requisites:

Knowledge of basic Science

CO/PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7

CO1	3	1	1	2	3	2	1
CO2	3	1	1	2	3	2	1
CO3	3	1	1	2	3	2	1
CO4	3	1	1	2	3	2	1
CO5	3	1	1	2	3	2	1

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- **Engage and Motivate:** Instructors should actively engage students to boost their learning confidence.
- **Real-World Relevance:** Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- **Interactive Learning:** Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- **Application-Based Learning:** Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- **Simulation and Real-World Practice:** Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- **Encourage Critical Analysis:** Foster an environment where students can honestly assess experiment outcomes and analyse potential sources of error in case of discrepancies

Assessment Methodology:

	Continuous Assessment (40 marks)				**End Semester Examination (60 marks)**
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Cycle I Exercises 50% Exercises	Cycle II Exercises	All Units	All Exercises	All Exercises
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 hours
Exam Marks	60	60	100	100	100

Converted to Marks	10	10	15	15	60
Marks	10		15	15	60
Internal Marks	40				
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

Note:

- **CA1 and CA2:** All the exercises/experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

The details of the documents to be prepared as per the instruction below.

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	5
B	Procedure/Material preparation/ Arrangements	15
C	Demonstration/ Flow chart/Data analysis	20
D	Output / Result	10
TOTAL		50
E	Practical Documents (As per the portions)	10
		60

- **CA 3:** Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

Question pattern – Written Test Theory

Description		Marks	
Part – A	30 MCQ Questions.	30 X 1 Mark	30 Marks
Part – B	7 Questions to be answered out of 10 Questions.	7 X 10 Marks	70 Marks
TOTAL			100 Marks

- **CA 4:** All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

SCHEME OF EVALUATION

Model Practical Examination and End Semester Examination - Practical Exam

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	5
B	Procedure/Material preparation/ Arrangements	20
C	Demonstration/ Flow chart/Data analysis	25
D	Output / Result	10
E	Written Test (Theory Portions)	30
F	Viva voce	10
	TOTAL	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

1122236242	Transport and Road Safety	L	T	P	C
Practicum		1	0	4	3
UNIT 1	**TRANSPORTATION OF HAZARDOUS GOODS**				
Transport emergency card (TREM) – driver training-parking of tankers on the highways speed of the vehicle – warning symbols – design of the tanker lorries -static electricity, responsibilities of driver – inspection and maintenance of vehicles-check list- loading and decanting procedures – communication.					8
UNIT 2	**ROAD SAFETY**				
Road alignment and gradient-reconnaissance-ruling gradient-maximum rise per k.m.-factors influencing alignment like tractive resistance, tractive force, direct alignment, vertical curves-breaking characteristics of vehicles- 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.					7
Ex.No	**Name of the Experiment**				
1	Study of safe loading and unloading of truck carrying chemicals.				6
2	Demonstration of safe design of internal roadways in a facility /plant				6
3	Identification of hazards in crane operations.				6
4	Identification of Hazards in fork lift operations.				6
5	Audit for Compliance of vehicle permits for transporting various products.				6
6	Audit for compliance of driver qualifications for driving transport vehicles.				6
7	Identification of symbols used in vehicles transporting hazardous products.				6
8	Study of traffic and road safety signs in India.				6
9	Exercise on placing suitable road safety sign boards in a facility				6

	/plant.	
10	Demonstration of signs used while operating material handling equipment.	6
	Total Hours	**75**

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based on the course.
- Periodic class quizzes conducted on a weekly/fortnightly based on the course.
- Mini project that shall be an extension of any practical lab exercise to real-world application.

References:

1. Dr. S.N. Bansal and Sharad, Transport Planning with Special Focus on Road Safety, AG Publishing House (AGPH Books), 3 March 2024.

Web-based/Online Resources:

1. Dr. K.S. Reddy, Dr. Bhargab Maitra. Introduction to Transportation Engineering, IIT Kharagpur, https://nptel.ac.in/courses/105105107

Equipment / Facilities required to conduct the Practical Course. (Batch Strength: 30 Students)

- Standard operating procedures
- Design of internal roadways
- Forms relevant for hazard identification and recording, Appropriate Industrial visits, visual media
- Forms developed for the audit and relevant act/ rules /standard
- Transport hazard pictograms
- Road safety signs
- Road safety signs, plant / facility map
- Standard operating procedures
- Traffic signs and symbols board

- India Map showing National highways
- TREM Card
- Emergency Information Panel

END SEMESTER EXAMINATION – PRACTICAL EXAM

Note: All the exercises should be given in the question paper and students are allowed to select by a lot or the question paper allotted from the DOTE shall be used.

Practical document should be submitted for the examination with a bonafide certificate.

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	5
B	Procedure/Material preparation/ Arrangements	20
C	Demonstration/ Flow chart/Data analysis	25
D	Output / Result	10
E	Written Test (Theory Portions)	30
F	Viva voce	10
	TOTAL	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

1122236243	Construction and Material handling	L	T	P	C
Practicum		1	0	4	3

Introduction:

All students must possess a basic understanding of the construction and material handling, before going into complex applications, they have to completely understand the components of work permit environment, construction environment, material handling techniques and accessories. A thorough understanding of the concepts is an essential one to excel in this course.

Course Objectives:

The objective of this course is to enable the student to

- Preparation of work permit environment
- Preparation of inspection report sheet
- Identify the risk assessment for confined space work in construction environment
- Identify the risk assessment for manual handling
- Identify the good lifting technique for material handling
- Prepare inspection for material handling equipment.

Course Outcomes:

On successful completion of this course, the student will be able to

CO1: Preparation of work permit environment and inspection report.

CO2: Identification of risk assessment from construction environment.

CO3: Understand the process of lifting technique for material handling.

CO4: preparation inspection data sheet for material handling.

CO5: Preparedness of material handling lifting accessories.

Pre-requisites:

Knowledge of basic Science

CO/PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	1	3	3	-	-
CO2	3	2	1	3	3	-	-
CO3	3	2	1	3	3	-	-
CO4	3	2	1	3	3	-	-
CO5	3	2	1	3	3	-	-

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- **Engage and Motivate:** Instructors should actively engage students to boost their learning confidence.
- **Real-World Relevance:** Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- **Interactive Learning:** Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- **Application-Based Learning:** Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- **Simulation and Real-World Practice:** Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- **Encourage Critical Analysis:** Foster an environment where students can honestly assess experiment outcomes and analyse potential sources of error in case of discrepancies

Assessment Methodology:

	Continuous Assessment (40 marks)				**End Semester Examination (60 marks)**
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination

Portion	Cycle I Exercises 50% Exercises	Cycle II Exercises	All Units	All Exercises	All Exercises
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 hours
Exam Marks	60	60	100	100	100
Converted to Marks	10	10	15	15	60
Marks	10		15	15	60
Internal Marks	40				
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

Note:

- **CA1 and CA2:** All the exercises/experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

The details of the documents to be prepared as per the instruction below.

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	5
B	Procedure/Material preparation/ Arrangements	15
C	Demonstration/ Flow chart/Data analysis	20
D	Output / Result	10

TOTAL		50
E	Practical Documents (As per the portions)	10
		60

- **CA 3:** Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

Question pattern – Written Test Theory

Description		**Marks**	
Part – A	30 MCQ Questions.	30 X 1 Mark	30 Marks
Part – B	7 Questions to be answered out of 10 Questions.	7 X 10 Marks	70 Marks
TOTAL			100 Marks

- **CA 4:** All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

SCHEME OF EVALUATION

Model Practical Examination and End Semester Examination - Practical Exam

PART	**DESCRIPTION**	**MARKS**
A	Aim & Apparatus Required	5
B	Procedure/Material preparation/ Arrangements	20
C	Demonstration/ Flow chart/Data analysis	25
D	Output / Result	10
E	Written Test (Theory Portions)	30
F	Viva voce	10

TOTAL	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

1122236243	Construction and Material handling	L	T	P	C
Practicum		1	0	4	3
UNIT 1	**CONSTRUCTION**				
Accidents Causes and Management Systems - Hazards of Construction and Prevention - Excavations, basement and wide excavation, trenches, shafts – scaffolding, types, causes of accidents, scaffold inspection checklist – false work – erection of structural frame work, dismantling – tunnelling- Working at Heights - Construction Machinery - Safety in Demolition Work.					8
UNIT 2	**MATERIAL HANDLING**				
Manual Material Handling and Lifting Tackles - Preventing common injuries, lifting by hand, team lifting and carrying, handling specific shape machines and other heavy objects – accessories for manual handling, hand tools, jacks, hand trucks, dollies and wheel barrows – storage of specific materials - Mechanical Material Handling - Hoisting apparatus, types - cranes, types, design and construction, guards and limit devices, signals, operating rules, maintenance safety rules- conveyors, precautions, types, applications- Powered industrial trucks- electric trucks, gasoline operated trucks, LPG trucks – power elevators.					7
Ex.No	**Name of the Experiment**				
1	Prepare work permits for (a) Confined space work and (b) hot working construction environment.				6
2	Develop inspection report for scaffolds.				6
3	Develop inspection report for excavation work				6
4	Perform risk assessment for confined space work in construction environment.				6
5	Perform risk assessment for excavation work in construction environment.				6

6	Demonstrate the NEBOSH recommended weights for manual lifting for the given loads and persons.	6
7	Perform risk assessment for manual handling.	6
8	Demonstrate the good lifting technique for material handling.	6
9	Perform inspection for material handling equipment.	6
10	Perform inspection for material handling lifting accessories.	6
	Total Hours	75

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based on the course.
- Periodic class quizzes conducted on a weekly/fortnightly based on the course.
- Mini project that shall be an extension of any practical lab exercise to real-world application.

References:

1. David L. Goetsch, “Construction Safety and the OSHA Standards”, Prentice Hall, 2009.

2. Charles D. Reese and James V.Edison “Handbook of OSHA Construction safety and health” CRC Press, 2nd edition, 2012.

3. Philip Hagan, “Accident Prevention Manual for Business and Industry”, N.S.C. Chicago, 13th edition 2009.

4. R. K. Mishra, “Construction Safety”, AITBS Publishers, 2011

Web-based/Online Resources:

1. Prof. Indu Siva Ranjani Gandhi. Construction methods and equipment management, IIT Guwahati, https://onlinecourses.nptel.ac.in/noc21_ce21/preview

Equipment / Facilities required to conduct the Practical Course. (Batch Strength: 30 Students)

- Industry/ site visit, model forms/report
- Industry/ site visit, Risk Assessment forms
- NEBOSH recommended weights, volunteers
- Risk Assessment form

- Weight for manual handling volunteers
- Inspection forms
- Multiplier chart for NIOSH Lifting equation.

END SEMESTER EXAMINATION – PRACTICAL EXAM

Note: All the exercises should be given in the question paper and students are allowed to select by a lot or the question paper allotted from the DOTE shall be used.

Practical document should be submitted for the examination with a bonafide certificate.

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	5
B	Procedure/Material preparation/ Arrangements	20
C	Demonstration/ Flow chart/Data analysis	25
D	Output / Result	10
E	Written Test (Theory Portions)	30
F	Viva voce	10
	TOTAL	100

Note: For the written test 30 MCQ shall be asked from the theory portion