



**UNIVERSITY OF PETROLEUM AND ENERGY STUDIES**



**SCHEME OF INSTRUCTION AND SYLLABI**

**FOR**

**M.TECH PROGRAM IN HEALTH, SAFETY AND  
ENVIRONMENT WITH SPECIALIZATION IN DISASTER  
MANAGEMENT**

**Effective from 2004-2005**

**DEPARTMENT OF HEALTH, SAFETY AND ENVIRONMENT**

# **UNIVERSITY OF PETROLEUM AND ENERGY STUDIES**

## **VISION**

To be an Institution of Global standing for developing professionally competent talent contributing to nation building

## **MISSION**

- Develop industry focused professionals with global outlook in Energy, Infrastructure, Transportation, IT and allied sectors.
- Deliver world class education meeting or preferably exceeding students' expectations.
- Inculcate integrative thought process among students that draws professional respect.
- Develop knowledge creation environment through training, research & development, and consultancy.
- Facilitate effective interactions among faculty and students, and foster networking with stakeholders.
- Practice and promote high standards of professional ethics, transparency and accountability at all levels.
- Develop Environmentally sustainable & reciprocal relationship with society at large.

## **DEPARTMENT OF HEALTH, SAFETY AND ENVIRONMENT**

### **VISION**

To be an Institution of Global standing for developing professionally competent talent contributing to nation building

### **MISSION**

- To generate competent professionals in the areas of Health, safety and Environment – mainly, though not restricted to, Power, Process, Oil & Gas and Construction sectors
- To provide knowledge base and consultancy services to community in all areas of HSE
- To promote innovative and original thinking among engineers thus enabling them to face future challenges
- To inculcate the ability to deal effectively with ethical and professional issues while taking into account the broader societal implications

## GRADUATE ATTRIBUTES

The Graduate Attributes are the knowledge skills and attitudes which the students have at the time of graduation. These attributes are generic and are common to all engineering programs. These Graduate Attributes are identified by National Board of Accreditation.

- 1. Scholarship of Knowledge:** Acquire in-depth knowledge of specific discipline or professional area, including wider and global perspective, with an ability to discriminate, evaluate, analyze and synthesize existing and new knowledge, and integration of the same for enhancement of knowledge.
- 2. Critical Thinking:** Analyze complex engineering problems critically, apply independent judgment for synthesizing information to make intellectual and/or creative advances for conducting research in a wider theoretical, practical and policy context.
- 3. Problem Solving:** Think laterally and originally, conceptualize and solve engineering problems, evaluate a wide range of potential solutions for those problems and arrive at feasible, optimal solutions after considering public health and safety, cultural, societal and environmental factors in the core areas of expertise.
- 4. Research Skill:** Extract information pertinent to unfamiliar problems through literature survey and experiments, apply appropriate research methodologies, techniques and tools, design, conduct experiments, analyze and interpret data, demonstrate higher order skill and view things in a broader perspective, contribute individually/in group(s) to the development of scientific/technological knowledge in one or more domains of engineering.
- 5. Usage of modern tools:** Create, select, learn and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling, to complex engineering activities with an understanding of the limitations.
- 6. Collaborative and Multidisciplinary work:** Possess knowledge and understanding of group dynamics, recognize opportunities and contribute positively to collaborative-multidisciplinary scientific research, demonstrate a capacity for self-management and teamwork, decision-making based on open-mindedness, objectivity and rational analysis in order to achieve common goals and further the learning of themselves as well as others.
- 7. Project Management and Finance:** Demonstrate knowledge and understanding of engineering and management principles and apply the same to one's own work, as a member and leader in a team, manage projects efficiently in respective disciplines and multidisciplinary environments after consideration of economic and financial factors.
- 8. Communication:** Communicate with the engineering community, and with society at large, regarding complex engineering activities confidently and effectively, such as, being able to comprehend and write effective reports and design documentation by adhering to appropriate standards, make effective presentations, and give and receive clear instructions.
- 9. Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in life-long learning independently, with a high level of enthusiasm and commitment to improve knowledge and competence continuously.
- 10. Ethical Practices and Social Responsibility:** Acquire professional and intellectual integrity,

professional code of conduct, ethics of research and scholarship, consideration of the impact of research outcomes on professional practices and an understanding of responsibility to contribute to the community for sustainable development of society.

- 11. Independent and Reflective Learning:** Observe and examine critically the outcomes of one's actions and make corrective measures subsequently, and learn from mistakes without depending on external feedback.

**DEPARTMENT OF HEALTH, SAFETY AND ENVIRONMENT**  
**M.TECH IN HEALTH, SAFETY AND ENVIRONMENT WITH SPECIALIZATION IN**  
**DISASTER MANAGEMENT**

**PROGRAM EDUCATIONAL OBJECTIVES**

<b>PEO1</b>	An ability to select and apply the knowledge, techniques and modern tools of the discipline to fields broadly-defined as fire protection, health, environment and safety engineering and technology
<b>PEO2</b>	Demonstrate a mastery of Health safety and environment knowledge and safety management skills, to reach higher levels in their profession
<b>PEO3</b>	Effectively communicate on Health safety and environment, facilitating collaboration with experts across various disciplines so as to create and execute safe methodology in complex engineering environment
<b>PEO4</b>	Demonstrate professional expertise to the industrial and societal needs at national and global level subject to legal requirements

**Mapping of Mission statements with program educational objectives**

<b>Mission Statement</b>	<b>PEO1</b>	<b>PEO2</b>	<b>PEO3</b>	<b>PEO4</b>
<b>MS1</b>	3	2	2	1
<b>MS2</b>	2	3	2	3
<b>MS3</b>	1	3	3	3
<b>MS4</b>	2	3	3	1

**Mapping of program educational objectives with graduate attributes**

<b>Programme Educational Objectives</b>	<b>GA1</b>	<b>GA2</b>	<b>GA3</b>	<b>GA4</b>	<b>GA5</b>	<b>GA6</b>	<b>GA7</b>	<b>GA8</b>	<b>GA9</b>	<b>GA10</b>	<b>GA11</b>
<b>PEO1</b>	3	1	3	2	2	0	0	1	3	3	3
<b>PEO2</b>	2	3	3	2	3	1	3	2	2	3	3
<b>PEO3</b>	1	3	2	2	3	3	3	3	2	3	3
<b>PEO4</b>	3	3	3	1	3	3	3	1	2	3	3

**PROGRAM OUTCOMES:** At the end of the program the student will be able to:

<b>PO1</b>	Apply knowledge of Engineering fundamentals for hazard identification, risk assessment and control of occupational hazards.
<b>PO2</b>	Design, Establish, Implement maintain and continually improve an occupation health and management system to improve safety.
<b>PO3</b>	Conduct investigations on unwanted incidents using root cause analysis and generate corrective and preventive action to prevent recurrence and occurrence of such incidents.
<b>PO4</b>	Design man-machine systems using human factors engineering tools so as to achieve better work Environment to improve efficiency and reduce Human error at the work place.
<b>PO5</b>	Function effectively as an individual or leader in diverse teams and in multi-disciplinary settings so as to provide practical solutions to safety problems.
<b>PO6</b>	Demonstrate understanding of the health, safety, legal and Behavioral issues and the consequent responsibilities relevant to occupational health and safety practices in the industry.
<b>PO7</b>	Understand and commit to comply with contractual requirements, statutory rules & regulations for maintaining Occupational Health, Safety and Environment in the organization.
<b>PO8</b>	Understand and Communicate effectively on the impact of Health, safety and environment solutions on productivity, quality and society at large.
<b>PO9</b>	Demonstrate the understanding of the dynamically changing HSE practices in increasing complex industrial setup.

### Mapping of program outcomes with graduate attributes

<b>Programme Outcomes</b>	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11
PO1	3	3	3	2	3	1	1	1	2	3	3
PO2	1	3	3	2	3	2	3	0	0	3	3
PO3	0	1	3	0	2	0	0	1	0	2	0
PO4	1	3	3	2	3	0	0	1	1	0	1
PO5	0	1	2	0	2	3	3	3	0	1	1
PO6	0	1	2	0	2	0	2	3	1	1	0
PO7	3	1	3	2	3	2	2	3	2	3	1
PO8	3	2	0	1	3	0	0	3	2	3	1
PO9	2	3	3	1	3	3	3	1	1	2	1

**Mapping of program outcomes with program educational objectives**

Programmes Outcomes	PEO1	PEO2	PEO3	PEO4
PO1	3	3	2	1
PO2	1	3	1	3
PO3	2	3	3	3
PO4	2	1	1	3
PO5	2	1	1	3
PO6	3	2	3	3
PO7	3	1	3	1
PO8	3	3	2	1
PO9	2	3	1	3

## **CURRICULAR COMPONENTS**

The total course package for M. Tech. Degree program will typically consist of the following components.

- a) Core Courses            $\geq$  30 Credits
- b) Elective Courses  $\geq$  15 Credits
- c) Dissertation           = 26 Credits

### **Degree Requirements for M. Tech in HEALTH, SAFETY AND ENVIRONMENT WITH SPECIALIZATION IN DISASTER MANAGEMENT**

<b>Category of Courses</b>	<b>Credits Offered</b>	<b>Min. credits to be earned</b>
Program Core Courses (PCC)	32	32
Departmental Elective Courses (DEC)	15	15
Dissertation (PCC)	22	22
Total	69	69



## SCHEME OF INSTRUCTION

### M. Tech. Health, Safety and Environment with specialization in disaster management-Course Structure

#### M. Tech. I - Year I - Semester

S No	Course Code	Course Title	L	T	P	Credits	Cat. Code
1	HSFS7001	Environmental Engineering & Management	3	0	0	3	PCC
2	HSFS7002	Statutory Rules & Regulation	3	0	0	3	PCC
3	HSFS7003	Occupational Health & Safety Management	3	0	0	3	PCC
4	HSFS7004	Behavioral Based Safety Management	3	0	0	3	PCC
5	HSFS7005	Electrical Safety	2	0	0	2	PCC
6	HSFS7101	Health, Safety & Environment Lab	0	0	2	2	PCC
		<b>TOTAL</b>	<b>14</b>	<b>0</b>	<b>2</b>	<b>16</b>	

#### M. Tech. I - Year II - Semester

S No	Course Code	Course Title	L	T	P	Credits	Cat. Code
1	HSFS 7006	Safety in Industrial Operations & Design	3	0	0	3	PCC
2	HSFS 7007	Fire Risk and Control	2	0	0	2	PCC
3	HSFS 7008	Safety in Drilling	3	0	0	3	PCC
4	HSFS 7009	Fundamentals of Sustainable Development	2	0	0	2	PCC
5	HSFS 7010	Safety in Construction	3	0	2	3	PCC
6	HSFS 7011	Hazard Identification, Risk Analysis and Management	3	0	0	3	PCC
7	SEMI 7101	Seminar I	0	0	1	1	PCC
		<b>TOTAL</b>	<b>16</b>	<b>0</b>	<b>1</b>	<b>17</b>	

#### M. Tech. II - Year I - Semester

S No	Course Code	Course Title	L	T	P	Credits	Cat. Code
1	HSFS 8009	Global disaster scenario and types of natural disaster	3	0	0	3	PCC
2	HSFS 8010	Water supply, refugee health and sanitation in emergency	3	0	0	3	PCC
3	HSFS 8011	Shelter and settlement in disaster (Disaster Response Management)	3	0	0	3	PCC
4	HSFS 8001	TPM and TQM	3	0	0	3	PCC
5	HSFS 8002	Safety in engineering industry	3	0	0	3	PCC
6	SIIB 8101	Summer Internship	0	0	2	2	PCC
7	SEMI 8101	Seminar II	0	0	1	1	PCC
8	PROJ 8101	Project I	0	0	2	2	PCC
		<b>TOTAL</b>	<b>15</b>	<b>0</b>	<b>5</b>	<b>20</b>	

**M. Tech. II - Year II - Semester**

<b>S No</b>	<b>Course Code</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Cat. Code</b>
1	PROJ 8102	Project II	0	0	16	16	PCC
		<b>TOTAL</b>	<b>0</b>	<b>0</b>	<b>16</b>	<b>16</b>	

## LIST OF ELECTIVES

### I Year I Semester

NOT APPLICABLE

### I Year II Semester

NOT APPLICABLE

### II Year I Semester

HSFS 8003	HAZOP & HAZAN Techniques
HSFS 8004	Hazards Safety measures in Process Industry
HSFS 8005	Concepts of Fire Safety in buildings, structures & Installations
HSFS 8006	Safety in Electrical Design
HSFS 8007	Fire Fighting Appliances and Operations
HSFS 8008	Green Fuels & Their Env. Impact
HSFS 8009	Global Disaster Scenario and Types of Natural Disaster
HSFS 8010	Water supply, Refugee Health and Sanitation in Emergency

### II Year II Semester

NOT APPLICABLE

## DETAILED SYLLABUS

<b>HSFS7001</b>	<b>Environmental engineering &amp; management</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Version 1.0</b>		3	0	0	3
<b>Pre-requisites/Exposure</b>	Basic knowledge of physics and chemistry (Basic science), Basic knowledge of biology				
<b>Co-requisites</b>					

### **Course Objectives:**

1. To help the students understand the fundamentals and relevance of Environmental standards and laws for water, air and land quality by Pollution Control board.
2. To enable students to understand water Quality Parameters and learn various water treatment processes.
3. To empower students with the expertise of experimentation, in water, air, soil and noise and the fundamental concepts that are required to translate a novel engineering idea to reality for sustainable development.
4. To expose students to a wide variety of research areas of Air pollutants and different models to study them.
5. To equip students with necessary engineering skills such as solving engineering problems in pollution control methodologies in process.

### **Course Outcomes:**

On completion of this course, the students will be able to:

- CO1. Gain knowledge on Various Environmental standards and laws for water, air and land quality by Pollution Control boards
- CO2. Gain knowledge on steady state conservative systems and types of reactors.
- CO3. Learn various water Quality Parameters.
- CO4: Understand and learn various water treatment processes
- CO5. Gain Knowledge on various kinds of Air pollutants and different models to study them.
- CO6. Understand and learn pollution control methodologies in process industries
- CO7. Learn concept of Sustainable Development and its Role in Building of Environment

### **Catalog Description**

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Environmental engineering and management is important in many scientific and technological problems including natural resource conservation, Pollution control and different equipment's to control it, atmospheric and oceanic circulation, renewable energy generation, energy production by chemical or

green technology, optimum energy utilization in vehicles, buildings and industrial processes, and biological processes for sustainable development. The highly multidisciplinary nature of the subject can be gauged from the fact that it is taught across multiple disciplines ranging from Mechanical, Aerospace, Civil, Chemical to Biotechnology. The current course covers the fundamental background in the environmental resource conservation, with a special emphasis on *water air and noise*, as relevant to sustainable development in general and environmental engineering in particular. The course begins with a description of different fundamentals and relevance of Environmental standards and laws for water, air and land quality by Pollution Control board. The students will learn the fundamental laws of environmental conservation and then apply it to two distinct type of process commonly found in real life. The students will thus get an adequate exposure to water, air, soil and noise and the fundamental concepts that are required to translate a novel engineering idea to reality for sustainable development.

## **Course Content**

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### **Unit 1:**

#### **Introduction to Environmental Engineering**

**04 lecture hours**

Introduction to Environment, its impact, Present scenario, Various Environmental standards and laws for water, air and land quality by Pollution Control boards and their working Modules.

Mass and energy transfer within the environmental system: Law of conservation of energy and Law of conservation of mass. Material Balance in an environmental system, Steady state conservative Systems-Steady state systems with non-conservative pollutants, -Type of reactors, Reaction rate and order of a reaction (Zero order, First order and Second order reactions).

### **Unit 2:**

#### **Water Pollution and Water Quality Control**

**09 lecture hours**

Water Resources- Hydrologic Cycle, Water Quality Parameters: Physical characteristics like Color, Odour, Temperature, Turbidity and Total Solids; Chemical Characteristics like pH, Hardness, Alkalinity, Acidity, Oxygen Demanding (COD, BOD, Nitrates, Sulfates and phosphates; Microbiological characteristics). Effect of Oxygen Demanding Wastes on Rivers.

BOD and DO Profile: Deoxygenation and Reaeration of the polluted water, Exertion of BOD with ultimate BOD loading. -Streeter Phelps Model and Oxygen Sag Curve, -Self Purification Phenomenon.

Ground Water- Aquifers, Flow Rate and Hydraulic Gradient by Darcy's Law, Cone of Depression, Treatment of Water, Water Quality: Drinking water quality standards, Treatment Systems: Screening, Coagulation and Flocculation, Sedimentation, Filtration, Disinfection and Softening, Wastewater Treatment, Typical Range of Composition of Domestic Sewage and Regulatory Standards, Primary Treatment: Screening, Grit Chamber, Equalization Basins, Primary

Settling, Sedimentation with Coagulation and Flocculation. Secondary Treatment Systems; Activated Sludge Process, Trickling Filter, RBC, Oxidation Ponds. Advanced Treatment- Nitrogen and Phosphorous Removal.

### **Unit 3:**

#### **Air Pollution**

**08 lecture hours**

Introduction- Definition, Overview of Emissions, Type of Pollutants, Chemical Composition. • Sources and Effects of Major Air Pollutants- CO, SO<sub>x</sub>, NO<sub>x</sub>, Hydrocarbons, Ozone, Photochemical Oxidants, Lead, Particulate Matter.

Air Pollution and Metrology- Environmental Lapse Rate and Adiabatic Lapse Rate, Atmospheric Stability, Inversion, Type of Plumes., Gaussian Atmospheric Dispersion Model for Point Sources, Emission Controls., Control Devices for Particulate Pollutants- Gravity Settling Chambers, Centrifugal Separators, Wet Scrubber, Electrostatic precipitator, Control devices for Gaseous Pollutants- Adsorption, Absorption, Condensation and Combustion.

### **Unit 4:**

#### **Pollution Control in Process Industries Pollution Control Methodologies**

**05 lecture hours**

Pollution Control in Process Industries like Cement, Paper, Petroleum -Petroleum Products-Textile-Tanneries-Thermal Plants-Eco-Friendly Energy and Environment, Hazardous Waste Treatment Technologies, Physical Treatment- Sedimentation, Adsorption, Aeration. Ion Exchange, Electro Dialysis. Chemical Treatment- Precipitation, Biological Remediation Techniques, Incineration and Land Disposal. Environmental Impact Assessment and Environmental Management.

### **Unit 5:**

#### **Introduction to EIA, Need and Scope of EIA**

**06 lecture hours**

Objectives and Purpose of EIA Studies, Indian Policies requiring EIA- Enactment of EIA as a Law, EIA Notifications, Siting Criteria. Components and Types of EIA, Roles in the EIA Process, Objectives and purpose of EIA studies., Indian policies requiring EIA- Enactment of EIA as a law, EIA notifications, Siting criteria, EIA cycle and procedure- Initial screening till Environmental Management plan. Components and Types of EIA, Roles in the EIA process, Environmental Audit-Need, Purpose, Criteria., Case studies.

### **Unit 6:**

#### **Sustainable Development**

**04 lecture hours**

Concept of Sustainable Development and its Role in Building of Environment, Background, Life Cycle Assessment, Source Reduction, Collection and Transfer Operations, Recycling and

Composting, Discarded Materials, Waste to Energy Combustion, Landfills, Problems, Hazardous Waste Management

### **Text Books and Reference Books**

1. MASTERS, G. M. & ELA, W. 2008. Introduction to environmental engineering and science, Prentice Hall Englewood Cliffs, NJ.
2. METCALF & EDDY 1979. Wastewater Engineering: Treatmentm Disposal, Reuse, McGraw-Hill.
3. PUNMIA, B., JAIN, A. K. & JAIN, A. K. 1998. Waste water engineering, Firewall Media.
4. TCHOBANOGLIOUS, G. & BURTON, F. L. 1991. Wastewater engineering. Management.
5. Air Pollution Control Engineering, N. de Nevers. McGraw Hill, Singapore, 2011.
6. Environmental Noise Pollution, P. E. Cunniff, McGraw Hill, New York, 1987.
7. Fundamentals of Air pollution, R. W. Boubel, D. L. Fox, and A. C. Stern, Academic press, NY, 2011.
8. Wastewater Engineering – Treatment and Reuse, Metcalf & Eddy, Inc., Revised by G. Tchobanoglous, F. L. Burton, and H. D. Stensel. Tata McGraw-Hill Publishing Company Limited, New Delhi, 2011.
10. Unit Operations and Processes in Environmental Engineering, T. D. Reynolds, P. Richards. PWS Series in Engineering, Boston, 2010.

### **Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination Examination Scheme:**

Components	Internal Assessment	ESE
Weightage (%)	30	70

### Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and Pos		
	Course Outcomes (COs)	Mapped Programme Outcomes
<b>CO1</b>	Gain knowledge on Various Environmental standards and laws for water, air and land quality by Pollution Control boards	<b>PO2,PO7,PO8</b>
<b>CO2</b>	Gain knowledge on steady state conservative systems and types of reactors.	<b>PO8</b>
<b>CO3</b>	Learn various water Quality Parameters.	<b>PO7</b>
<b>CO4</b>	Understand and learn various water treatment processes	<b>PO8,PO7</b>
<b>CO5</b>	Gain Knowledge on various kinds of Air pollutants and different models to study them.	<b>PO8,PO7</b>
<b>CO6</b>	Understand and learn pollution control methodologies in process industries	<b>PO1,PO2,PO8</b>
<b>CO7</b>	Learn concept of Sustainable Development and its Role in Building of Environment	<b>PO7,PO8</b>

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
HSFS7001	Environmental engineering & management	1	2		2			3	3	

- 1=Weakly mapped  
 2= Moderately mapped  
 3=Strongly mapped



<b>HSFS 7002</b>	<b>Statutory Rules and Regulations</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
Version 1.0		3	0	0	3
Pre-requisites/Exposure	Basic knowledge of legal jurisdiction				
Co-requisites	--				

### Course Objectives

1. To help the student to gain and understand the basic idea of Factories Act and fundamentals of provisions relating to hazardous process, welfare, working hours, penalties etc.
2. To help the students to gain and understand a detailed idea and provisions relating to Health, Safety & Environment relating to legal obligations and their applicable Acts like Dock Workers Act 1986, Explosives Act, Employers Liability act, Water Act, Air act and other relevant Environmental; Acts.

### Course Outcomes

On completion of this course, the students will be able to

CO1. Gain knowledge and to apply the knowledge on provisions relating to Hazardous process.

CO2. Gain knowledge on laws relevant and concerning towards welfare, working hours and health and safety of workers engaged in industries.

CO3. Learn various laws relevant for inquiry into certain accidents, Advisory Committee, Inquiry in Public, and Reporting of accidents, Emergency Action Plan, Safety Committee, Occupational Health services for dockworkers, various safety and health regulations in brief.

CO4. Understand and learn about the legal aspects granting of license for storage, transportation and usage of explosive substance as applicable as per Petroleum Act and Explosive Act.

CO5: Understand the legal obligations regarding any injury by gaining knowledge of Workmen's Compensation Act. ESI Act & Rules. Public Liability Act & Rules.

CO6. Learn concept, powers and functions of Central, State and Joint Boards, provisions regarding prevention and control of Water & Air pollution, Penalties, Central & State Laboratories, Power of supersession and overriding effect and the rules on Consent for Establishment of an industries and their applicable no objection certificate.

### Catalog Description

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This module teaches systematic approaches and all the aspects of Health, Safety and Environmental for manufacturing industries. This module tells the students about the role and responsibility of the employer

towards the workers and his employees. In this way the students can understand, explain how risks will be controlled and tell you who is responsible for this. It also tells about working with workers and concerning about their health and also tells about the roles and responsibilities of safety representatives in protecting everyone from harm in the workplace.

Legislation on occupational health and safety has existed in India for several decades. The Factories Act, 1948 are been amended in 1954, 1990, 1976 and 1987. Following the Bhopal gas disaster, a special chapter on occupational health and safety to safeguard workers employed in hazardous industries were made. The amendments demanded a shift from dealing with disaster or disease to prevention of its occurrence. The Act, however, is applicable only to factories that employ 10 or more workers; it covers only a small proportion of workers. Other key legislations dealing with occupational safety and health (OSH) are Mines Act, 1952, Dock Workers (Safety, Health and Welfare) Act, 1986; Plantation Labor Act, 1951; Explosives Act, 1884; Petroleum Act, 1934; Insecticide Act, 1968; Indian Boilers Act, 1923; Dangerous Machines (Regulations) Act, 1923; Indian Atomic Energy Act, 1962. Radiological Protection Rules, 1971. Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989; Electricity Act, 2002. The Directorate General of Factory Advice Service and Labor Institutes in the Ministry of Labor provide inputs for national policies on occupational safety and health in factories and docks, and enforcing them through inspectorates of factories and inspectorates of dock safety. Directorate General of Mines Safety, Ministry of Labor, oversees the health and safety of mine workers and implementation of Mines Act, 1952.

## **Course Content**

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### **Unit 1:**

**07 lecture hours**

FACTORIES ACT: DEFINITIONS, Preliminary, inspecting staff, Health, Safety, Provisions relating to hazardous processes, welfare, working hours of adults, Employment of young persons, Special provisions, Penalties, Supplemental.

### **Unit 2**

**07 lecture hours**

DOCK WORKERS (SAFETY, HEALTH AND WELFARE) ACT, 1986: Definitions, Powers of Inspectors, Power of Govt. to direct Inquiry, Obligation of Dock workers, General Provisions relating to rules and regulations. Dock workers (SHW) Rules- Definitions, Inspection Procedure, Inquiry into certain accidents, Advisory Committee, Inquiry in Public. Dock workers (SHW) Regulations- Definitions, Power of Inspectors. Penalties, Responsibilities, Safety Officers, Reporting of accidents, Emergency Action Plan, Safety Committee, Occupational Health services for dock workers, various safety and health regulations in brief.

**Unit 3****07 lecture hours**

EXPLOSIVES ACT: DEFINITIONS, Grant of license, Notice of Accidents, Inquiry into ordinary and serious accidents, Punishment for offences, Extension of definition to other explosive substances. Petroleum Act - Definitions, Control over Petroleum import, transport, storage, production, refining and blending, Need for license, exemption. Inspection and sampling for testing, Notice of Accidents and Inquiries. Petroleum Rules - Definitions, brief idea on the rules relating to safety aspects in transport, storage, refining and blending of petroleum, Notice of Accidents.

**Unit 4****07 lecture hours**

Workmen's Compensation Act. ESI Act & Rules. Public Liability Act & Rules- Substantive provisions in the above Acts and Rules

**Unit 5****08 lecture hours**

WATER ACT: Definitions, Powers and Functions of Central, State and Joint Boards, Provisions regarding prevention and control of water pollution, Penalties, Central & State Water Laboratories, Power to make rules, Power of supersession and overriding effect. Rules on Consent for Establishment. Air Act - Definitions, Power & Functions of Boards, Prevention & Control of Air Pollution, Penalties, Application for Consent as per Air Pollution Rules. Environment (Protection) Act- Definitions, general powers of central government, prevention, control and abatement of environmental pollution. EP Rules- Definitions, standards for emission, prohibition and restrictions on siting and operation of industries. MSIHC Rules- Definitions, Duties of Authorities, Notification of Major Accidents Safety Reports, On-site & Off-site Emergency Plan, Giving safety information to public. Chemical Accidents (Emergency Planning, Preparedness and Response) Rules- Definitions, Constitution, functions & powers of various Crisis groups.

**Text Books and Reference Books**

1. Health Safety and Environment (Safety Management) by Ganguly & Changeriya
2. Factories Act,1948 by Dr. J.P. Sharma
3. The Petroleum Act, 1934 © Universal Law publishing
4. The Gas Cylinder Rules,2004, Professional Book publishers.

**Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination****Examination Scheme:**

Components	Internal Assessment	ESE
Weightage (%)	30	70

### Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and Pos		
	Course Outcomes (COs)	Mapped Programme Outcomes
CO1	Gain knowledge and to apply the knowledge on provisions relating to Hazardous process	PO7, PO8
CO2	Gain knowledge on laws relevant and concerning towards welfare, working hours and health and safety of workers engaged in industries.	PO6,PO7
CO3	Learn various laws relevant for inquiry into certain accidents, Advisory Committee, Inquiry in Public, and Reporting of accidents, Emergency Action Plan, Safety Committee, Occupational Health services for dockworkers, various safety and health regulations in brief	PO6,PO7
CO4	Understand and learn about the legal aspects granting of license for storage, transportation and usage of explosive substance as applicable as per Petroleum Act and Explosive Act.	PO6
CO5	Understand the legal obligations regarding any injury by gaining knowledge of Workmen's Compensation Act. ESI Act & Rules. Public Liability Act & Rules.	PO6, PO7,PO8
CO6	Learn various concept , powers and functions of Central, State and Joint Boards, provisions regarding prevention and control of Water & Air pollution, Penalties, Central & State Laboratories, Power of supersession and overriding effect and the rules on Consent for Establishment of an industries and their applicable no objection certificate.	PO6

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
HSFS 7002	Statutory Rules and Regulations	2		2			3	3	2	

1=Weakly mapped

2= Moderately mapped

3=Strongly mapped

<b>HSFS 7003</b>	<b>Occupational Health and Safety Management</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
Version 1.0		3	0	0	3
Pre-requisites/Exposure	a) Basic Knowledge of Industrial Safety. b) Basic Knowledge Safety & its implications in Work Places with special reference hydrocarbon industry. c) Basic knowledge human physiology & the surrounding factors and its effects.				
Co-requisites					

### **Course Objectives**

1. To understand the concepts of global scenario of Health & safety.
2. To analyses the gaps between reference standards & pertinent conditions of safety in India.
3. Students should be able to analyses and solve basic agronomical issues.
4. To be efficient in the operation of industrial hygiene equipment.
5. To understand the effects of various gases & treatments.

### **Course Outcomes**

On completion of this course, the students will be able to

CO1. Demonstrate the different fire & safety issues.

CO2. Should be efficient in Handling & storage of hydrocarbons.

CO3. Engineering solutions in a global, economic, environmental, and societal context with

CO4. Applying the knowledge of Industrial management towards the achievement of capacity planning & production management.

CO5. To render the concept of safety analysis and confined space

### **Catalog Description**

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Occupational safety and health (OSH), also commonly referred to as occupational health and safety (OHS), occupational health or workplace health and safety (WHS), is a multidisciplinary field concerned with the safety, health, and welfare of people at work. These terms of course also refer to the goals of this field, so their use in the sense of this article was originally an abbreviation of occupational safety and health program/department etc.

The goals of occupational safety and health programs include to foster a safe and healthy work environment. OSH may also protect co-workers, family members, employers, customers, and many others who might be affected by the workplace environment. In the United States, the term occupational health and safety is referred to as occupational health and occupational and non-occupational safety and includes safety for activities outside of work.

In common-law jurisdictions, employers have a common law duty to take reasonable care of the safety of their employees. Statute law may in addition impose other general duties, introduce specific duties, and create government bodies with powers to regulate workplace safety issues: details of this vary from jurisdiction to jurisdiction.

## **Course Content**

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### **Unit 1**

#### **Physical and Chemical Hazards**

**08 lecture hours**

Recognition, Evaluation and Control of Physical Hazards- Noise and Vibration - Effects and Control Measures- Thermal Stress - Parameter Control, Radiation - Types - Source - Effect and Control- Illumination & Lighting. Recognition, Evaluation and Control of Chemical Hazards- Types - Dust-Fumes -Mist -Vapor-Fog etc., Air Contaminants- Evaluation - Types of Sampling-Air Sampling System-Method Analysis-Control Measures.

### **Unit 2**

#### **Occupational Health**

**10 lecture hours**

Concept and Spectrum of Health-Functional Units and Activities of Occupational Health Services- Occupational and Work Related Disease-Levels of Prevention of Diseases - Notifiable Occupational Diseases such as Silicosis- Asbestosis- Pneumoconiosis-- Aluminosis and Anthrax. Lead-Nickel, Chromium and Manganese Toxicity-Gas Poisoning (such as CO, Ammonia, Coal Dust etc.,) their effects and Prevention- Cardio Pulmonary Resuscitation- Audiology-Hearing Conservation Programme-Effects of Ultra Violet Radiation and Infrared Radiation on Human Systems Industrial Toxicology-Local and Systemic and Chronic Effects Temporary and Cumulative Effects- Carcinogens Entry into Human System Ergonomics, Personnel Protective Equipment, Personnel Monitoring

### **Unit 3**

#### **Personal Hygiene and First Aid**

**13 lecture hours**

Hygiene Concepts-Correct and Clean Dresses-Clean Body - Washing - Good Habits-Oral and Stomach Hygiene-Cleaning - Compressed Air and Degreasing Agents-Long Hair and Nails and Torn and loosely Hanging Clothes-Smoking - Lavatories Maintenance- Living in Unhygienic Areas. First aid concept- -First Aid Boxes-Legal Requirements, Industrial Hygiene, Medical Surveillance, Medical Surveillance Program Development, Recommended Medical Programme, Emergency Treatment, Non-Emergency Treatment, Exposures to Hazardous Materials.

### **Unit 4**

#### **Radiation Control**

**05 lecture hours**

Radiation Shielding - Radiation Dose - Dose Measurements - Units of Exposure- Exposure Limits- Barriers for Control of Radioactivity Release, Control of Radiation Exposure to Plant Personnel, Health Physics Surveillance - Waste Management and Disposal Practices – Environmental, Releases.

**Text Books and Reference Books**

1. A Handbook on health, Safety and Environment, SC Bhatia
2. Safety in Hydrocarbon Industry- K.L.Max.
3. Lees Loss Prevention.

**Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination****Examination Scheme:**

Components	Internal Assessment	ESE
Weightage (%)	30	70

**Relationship between the Course Outcomes (COs) and Program Outcomes (POs)**

Mapping between COs and Pos		
	Course Outcomes (COs)	Mapped Programme Outcomes
CO1	Demonstrate the different fire & safety issues.	PO1, PO3, PO6
CO2	Should be efficient in Handling & storage of hydrocarbons.	PO1, PO3, PO4, PO6
CO3	Engineering solutions in a global, economic, environmental, and societal context with	PO4, PO6
CO4	Applying the knowledge of Industrial management towards the achievement of capacity planning & production management.	PO3, PO4
CO5	To render the concept of safety analysis and confined space	PO1, PO3, PO6

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
HSFS 7003	Occupational Health and Safety Management	3		3	3		3			

- 1=Weakly mapped  
 2= Moderately mapped  
 3=Strongly mapped

<b>HSFS 7004</b>	<b>Behaviour Based Safety</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Version 1.0</b>		3	0	0	3
<b>Pre-requisites/ Exposure</b>	a. Basic Knowledge Health, Environment and Safety. b. Basic Knowledge Safety & its implications in Work Place. c. Basic Knowledge of psychology and its factors pertaining to Management systems. d. Basic knowledge human physiology & the surrounding factors and its effects.				
<b>Co-requisites</b>	--				

### Course Objectives

1. To illustrate the importance and need of safety engineering.
2. To understand the concepts of global scenario of Occupational Health & safety Management system.
3. To analyses the gaps between reference standards & pertinent conditions of safety in India.

### Course Outcomes

On completion of this course, the students will be able to

- CO1. To demonstrate the role and Responsibility of safety officers, hazards in Petroleum industry
- CO2. To apply the statutory rules and regulations applicable in Petroleum industry mainly
- CO3. Conduct Accident Investigation process and find the root cause of Accident
- CO4. Calculate the compensation money for injured person and reporting to higher authorities
- CO5. Form a Safety policy for any organization and demonstrate its need
- CO6. To explain the various elements of Process Safety Management
- C07. To form Emergency Management plan for any Organization
- CO8. To explain and control major risk in Material Handling and Manufacturing industry.

### Catalog Description

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BBS, it is important for the students to have a knowledge about basic safety in the company. Health, safety and environment issues are very critical in the industrial operations in the current scenario. It helps the students how hazards lead to an immediate or sudden accidents like an injury, fire, explosion or toxic release. How the safety issues and safety management comes in the picture of Top and bottom Management It provides basic knowledge of HSE efforts of many organizations that are driven by statutory requirements and they do whatever minimum is required to avoid litigation and fines.



## Course Content

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### Unit 1

#### **Introduction to Behavioral Based Safety** **05 lecture hours**

Behavioral based safety – overview – psychology of behavior management – focus on behavior to manage the risk – leadership- behavior safety Programme for employees- measure safety Programme – ABC model – BBS - case studies

### Unit 2

#### **Introduction to SHE** **04 lecture hours**

Hazards in Petroleum Industry, Direct & Indirect costs of accidents, HSE Model & Integration with Business, Safety officer role & responsibility.

### Unit 3

#### **Regulatory Regimes and Regulatory Agencies** **07 lecture hours**

Regulatory Laws/ Acts, Petroleum Act 1934; Indian Explosives Act, 1884; The Static & Mobile Pressure Vessels, SMPV (UNFIRED) Rules, 1981. The Gas Cylinder Rules, 1981. The Indian Boilers Act, 1923; Factories Act 1948, Indian Electricity Act, 1910; The Mines Regulations, 1984; The Indian Aircraft Rules, 1937; International Maritime Organization (IMO), Dock Workers Act, 1986; Atomic Energy Act, 1962; Motor Vehicles Act, 1988, Tariff Advisory Committee, Responsibilities of an Occupier as per Factories Act 1948. Oil Industries Safety Directorate (OISD), Limitations of Indian Regulatory Bodies.

### Unit 4.

#### **Accidents** **04 lecture hours**

Types and Severity of Accidents, Accident Classification, Accident – Entitlement under Workmen's Compensation Act, Objectives & Methodology of conducting accident investigation

### Unit 5

#### **Safety Policy** **03 lecture hours**

Organization, Monitoring and Reporting

### Unit 6

#### **Process Safety Management** **04 lecture hours**

PSM and Safety Culture-an overview, Main Pillars of Process Safety Management,

### Unit 7

#### **Emergency/Disaster Plans** **05 lecture hours**

Objectives of DMP, On-site & Off-site emergencies, Levels of emergencies, Elements of Disaster Management Plan, Mutual-aid schemes. Major Industrial Disasters: PIPER ALPHA, BHOPAL Disaster.

### Unit 8

#### Personnel Risk in Industrial Operations

04 lecture hours

Mineral Exploitation, Material Handling Processes, Manufacturing Plant

#### Text books and Reference Books

1. Industrial Loss & Critical Investigation ( John Walkins)
2. An introduction to Production management techniques.( Wickens Christopher, Lee John).
3. Operation Forecasting & modelling, CLYDE.B, STRONG,M.S

**Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination**

#### Examination Scheme:

Components	Internal Assessment	ESE
Weightage (%)	30	70

#### Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Course Outcomes (COs)	Mapped Programme Outcomes
CO1. To demonstrate the role and Responsibility of safety officers, hazards in Petroleum industry	PO1,PO3 and PO9
CO2. To apply the statutory rules and regulations applicable in Petroleum industry mainly	PO6,PO7
CO3. Conduct Accident Investigation process and find the root cause of Accident	PO1,PO3
CO4. Calculate the compensation money for injured person and reporting to higher authorities	PO3,PO6,PO7
CO5. Form a Safety policy for any organization and demonstrate its need	PO1,PO8,PO9
CO6. To explain the various elements of Process safety Management	PO2,PO8
CO7. To form Emergency Management plan for any Organization	PO2,PO6,PO7
CO8. To explain and control major risk in Material Handling and Manufacturing industry.	PO1,PO2

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
HSFS 7004	Behaviour Based Safety	3	2	3			3	2	1	1

1=Weakly mapped

2= Moderately mapped

3=Strongly mapped

<b>HSFS 7005</b>	<b>ELECTRICAL SAFETY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Version 1.0</b>		2	1	0	3
<b>Pre-requisites/Exposure</b>	Basic Electrical Engg.				
<b>Co-requisites</b>	Basic Physics, Chemistry and Biology				

**Course Objectives:** Objectives of the subject are

1. To provide an overview of safety aspects of general workplace
2. To discuss a legislative background of electrical safety
3. To give a basic insight of hazardous areas-classification, Protection techniques for selection & installation of electrical equipment according to national/international (OISD/NEC/IEC/IEEE) codes & standards

**Course Outcomes:**

On completion of this course, the students will be able to:

- CO1. List out various electrical hazards associated with general workplace
- CO2. Describe the phenomenon of electrical hazards associated causes, effects and prevention/protection measures
- CO3. Identify & explain different types of current limiting devices & relays and their role in safety
- CO4. Enumerate legislative background for electrical safety (codes/standards/acts/rules, etc.)
- CO5. Elucidate the causes, phenomenon and effects of static charge generation and discharge, and prevention/protection measures
- CO5. Explicate the classification of hazardous areas, the protection schemes to be employed for the electrical equipment to be installed in Hazardous areas

**Catalog Description**

Most of the workplace accidents are occurring due to electricity, the invisible enemy. Understanding workplace electrical safety is essential for safeguarding life and property from damages caused by electrical hazards. Not only by direct contact but also by indirect ways it can hamper the workplace safety. Thus a thorough understanding of electrical hazards-causes and effects, prevention and protection is the basic need for a safety professional. The scope of the subject is to cover all workplace electrical safety concerns and issues and to impart knowledge about various protection systems or equipment used for ensuring safe workplace.

## Course Content

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### Unit 1

Introduction-Electrostatics-Electro Magnetism-Stored Energy- Energy Radiation and Electromagnetic Interference Working Principles of Electrical Equipment-Indian Electricity Act and Rules-Statutory Requirements from Electrical Inspectorate-International Standards on Electrical Safety-First Aid- Cardio Pulmonary Resuscitation (CPR)

### Unit 2

Primary and Secondary Hazards-Shocks, Burns, Scalds, Falls- Human Safety in the use of Electricity. Energy Leakage-Clearances and Insulation-Classes of Insulation-Voltage Classifications- Excess Energy-Current Surges –Over Current and Short Circuit Current-Heating Effects of Current-Electromagnetic Forces- Corona Effect-Static Electricity-Definition-Sources-Hazardous Conditions- Control- Electrical causes of Fire and Explosion-ionization-spark and Arc- Ignition Energy-Control- National Electrical Safety Code ANSI C2, Class II, Division 1& 2 Lightning - Hazards - Lightning Arrestor - Installation - Earthing - Specifications - Earth Resistance - Earth Pit Maintenance.

### Unit 3

Fuses - 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 & Connections-Means of Cutting of Power-Overload and Short Circuit Protection-No Load Protection-Earth Fault Protection-Earthing Standards-FRLS Insulation-Insulation and Continuity Test-System Grounding-Equipment Grounding -Earth Leakage Circuit Breaker (ELCB ) -Cable Wires-Maintenance of Ground-Ground Fault Circuit Interrupter-Use of Low Voltage-Electrical Guards- Personal Protective Equipments.

### Unit 4

Role of Environment in Selection-Safety Aspects in Application-Protection and Interlock-Self Diagnostic Features and Fail Safe Concepts-Surge withstand Capability Test Requirements-Lock Out and Work Permit System. -Discharge Rods and Earthing Devices-Safety in the use of Portable Tools-Cabling and Cable Joints-Preventive Maintenance.

### Unit 5

Classification of Hazardous Zones-Intrinsically Safe and Explosion Proof Electrical Apparatus-Increased Safe Equipment- Selection for Different Zones- Temperature Classification- Grouping of Gases- Barriers and Isolators-Equipment Certifying Agencies.

**Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination**

**Examination Scheme:**

Components	Internal Assessment	ESE
Weightage (%)	30	70

**Relationship between the Course Outcomes (COs) and Program Outcomes (POs)**

Mapping between COs and Pos		
	Course Outcomes (COs)	Mapped Programme Outcomes
<b>CO1</b>	List out various electrical hazards associated with general workplace	<b>PO 2-3, PO 5-6, PO 9</b>
<b>CO2</b>	Describe the phenomenon of electrical hazards associated causes, effects and prevention/protection measures	<b>PO 1-9</b>
<b>CO3</b>	Identify & explain different types of current limiting devices & relays and their role in safety	<b>PO 1-7, PO 9</b>
<b>CO4</b>	Enumerate legislative background for electrical safety (codes/standards/acts/rules, etc.,)	<b>PO 1-7, PO 9</b>
<b>CO5</b>	Elucidate the causes, phenomenon and effects of static charge generation and discharge, and prevention/protection measures	<b>PO 1-7, PO 9</b>

Course Code	Course Title	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO8	PO 9
HSFS 7005	Electrical Safety	3	3	3	2	1	-	-	-	-

1=Weakly mapped

2= Moderately mapped

3=Strongly mapped

<b>HSFS 7101</b>	<b>Health, Safety &amp; Environment Lab</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
Version 1.0		0	0	2	2
Pre-requisites/Exposure	Basic Knowledge of chemistry and environmental studies				
Co-requisites					

**Pre-requisites:** NONE

**Course Outcomes:** At the end of the course the student will be able to:

CO1	Identify and analyze physical parameters of water and wastewater.
CO2	Determine the concentration of Chlorides, Hardness, DO and other quality parameters.
CO3	Estimate BOD and COD of given wastewater samples.
CO4	Estimate the concentrations of water pollutant using flame photometer.
CO5	Estimate the concentration of air pollutant using UV spectrophotometer

### Mapping of course outcomes with program outcomes

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
HSFS 7101	Health, Safety and Environmental LAB	1	2	2	3	1	2	2	3	1

### Detailed Syllabus:

**Experiment No.1:** To Measure Sound/Noise Level at Various Location and Compare it with Standard Values Permissible for Exposure.

**Experiment No.2:** To Determine the SPM Present in Working Atmosphere during the Working Period with the help of Respirable Dust Sampler.

**Experiment No.3:** To Determine the RSPM present in Working Atmosphere during the Working Period with the help of Respirable Dust Sampler

**Experiment No.4:** Standard Method for Determination of Oxide of Sulfur in Flue Gases using UV Spectrophotometer.

**Experiment No.5:** Standard Method for Determination of Oxides of Nitrogen in Flue Gases using UV Spectrophotometer

**Experiment No.6:** To Find the pH and Conductivity of given Solution.

**Experiment No.7:** To Determine the Total suspended Solid in the given Water Samples.

**Experiment No.8:** To Determine the SPM and Oxides of Sulfur and Nitrogen from the Stack/Chimney using Stack Monitoring kit.

**Experiment No.9:** To Determine the SPM and Oxides of Sulfur and Nitrogen using Fugitive Emission Kit.

**Experiment No.10:** To Determine  $\text{HCO}_3$  in Water Quality.

**Experiment No.11:** To Determine Na & K with the help of Flame Photometer.

**Experiment No.12:** To Determine Ca & Mg of Wastewater

**Experiment No.13:** To Determine Hardness of the Wastewater

**Experiment No.14:** To Determine Cl & COD of the effluents.

**Experiment No.15:** To Determine Si & Fe of the Waste

**Experiment No.16:** To Determine TSS of the Waste Water.

**Experiment No.17:** To Determine pH, TDS, Temperature, DO of water with the help of Multiparameter Monitoring Instrument.

**Readings:**

1. Standard methods for the examination of water and wastewater, 21st Edition, Washington: APHA, 2012.
2. Sawyer, C. N., McCarty, P. L., and Perkin, G.F., Chemistry for Environmental Engineering and Science, 5th edition McGraw-Hill Inc., 2002.
3. 3. B. Kotaiah and Dr. N. Kumara Swamy, Environmental Engineering Laboratory Manual, Charotar Publishing House Pvt. Ltd., 1st Ed., 2007



<b>HSFS 7006</b>	<b>Safety in Industrial Operations &amp; Design</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Version 1.0</b>		3	0	0	3
<b>Pre-requisites/Exposure</b>	a. Importance of Safety at various stages of a project in industry b. Interlink between Environmental, Social, Economic factors with Safety Issues				
<b>Co-requisites</b>					

### Course Objectives

1. Make students to understand the importance of Inherent Safety with qualitative measurement
2. Finding out a proper workplace/ location and making layout of plant for safe/time saving and low cost work practice
3. Modelling of best working conditions (ergonomics and environment) and material handling techniques for engineering works

### Course Outcomes

On completion of this course, the students will be able to

- CO1. Recall the importance of safety culture in various industry
- CO2. Develop an inherent safe process unit and its evaluation
- CO3. Find out a hazard free site for making a plant layout
- CO4. Develop of safe workplace and work culture within a particular system
- CO5. Report Industrial Incident/ accidents/ issues/ suggestions to authorized person.

### Catalog Description

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Industrial safety was realized because of the fact that every year millions occupational/ industrial accidents occur which result in loss of production time equivalent to millions of man hours, machine hours etc. of these about one-fifth production time is lost by those actually injured due to temporary and permanent disablement and the remaining production time is lost by fellow operators/ people in helping the injured, in taking care of the damage caused by accident etc. the loss to the industrial unit would appear much more alarming when death cases due to accidents are considered.

It is therefore essential to identify/examine the causes of industrial accidents and take steps to control them. Many disciplines are concerned with this safety approach. Industrial engineering is one field which deals with design of efficient work place, equipment and industrial layout design. Other

disciplines which can contribute to safe working environment are psychology, sociology and Medicare science.

## **Course Content**

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### **Unit 1**

#### **Inherent Safety Concepts**

**09 lecture hours**

Special Design Considerations for Hazardous Operations (Loading & Unloading, Start –Up/Shutdown, Burner Lighting, Flare Ignition, Storage Tank Operation), Electrical Area Classification and Special Purpose Equipment, Siting & Layout, Petroleum Storage Installations, LNG Terminals, Bulk Handling, Distribution of Petroleum, products/Terminals, Safety with Thermal Power Equipment.

### **Unit 2**

#### **Plant Locations**

**08 lecture hours**

Selection of Plant Location- Territorial Parameters - Considerations of Land- Water- Electricity- Location for Waste Treatment & Disposal- Further Expansions - Safe Location of Chemical Storages -LPG-LNG-CNG-Acetylene Ammonia- Chlorine-Boilers etc.- Location for Chemical Industries-Tanneries-Power Plants-Quarries Etc. Safe Layout: Safety System-Fire Hydrant Location- Fire Service Rooms- Facilities for Safe Effluent Disposal and Treatment Tanks - Site Consideration - Approach Roads - Plant Railway Lines --Security Towers-Safe Layout for- Process Industries-Engineering Industry-Construction Sites.

### **Unit 3**

#### **Working Conditions**

**06 lecture hours**

Principles of Good Ventilation: Purpose -Physiological and Comfort Level types- Hood and Duct Design-Air Conditioning-Ventilation Standards. Purpose of Lighting -Types, Advantages of Good Illumination-Lighting Requirements for various Works. -standards. Housekeeping-Principles, Industrial Noise and Vibration-Thermal Stress.

### **Unit 4**

#### **Material Handling Equipment**

**07 lecture hours**

Principles of Material Handling-Ergonomic Considerations-Methods of Manual Handling-Simple Devices-Hand Contrivances-Lifting Tackles-Lifts-Pulleys-Pulley Blocks-Chain Blocks-Selection and Operations- Fork Lifts, Front End Loaders-Cranes-Hoists-Mobile Cranes-Conveyors-Elevators-Winches-Derricks-Booms-different Ropes-Load Distribution in Slings-Automatic Load

Indicators-Load Radius Indicators-Inspection and Testing Procedures- Installation and Maintenance.

## Unit 5

### Working at Heights

**06 lecture hours**

Safe Access - Safe Use of Ladders and Scaffoldings-Types -Requirement for Safe Work Platforms- Stairways - Gangways and Ramps-Fall Prevention & Fall Protection - Safety Belts - Safety nets - Fall Arrestors- Working on Fragile Roofs - Work Permit Systems-Accident Case Studies.

### Text books and Reference Books

1. Guidelines for Engineering Design for Process Safety, 2<sup>nd</sup> Edition
2. Loss Prevention in process industries, Frank P. Lees, 2<sup>nd</sup> Edition
3. Hazop & Hazan: Identifying and Assessing Process Industry Hazards, Fourth Edition Hardcover – Import, 1 Sep 1999The Handbook of SafetyEngineering: Principles and Applications, Frank R. Spellman, Nancy E. Whiting 2009
4. Hazop & Hazan-Ref to Icheme (Chemical Engineering) Hardcover – Import, 1 Apr 1992

**Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination**

### Examination Scheme:

Components	Internal Assessment	ESE
Weightage (%)	30	70

### Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and Pos		
	Course Outcomes (COs)	Mapped Programme Outcomes
<b>CO1</b>	Recall the importance of safety culture in various industry	<b>PO1</b>
<b>CO2</b>	Develop an inherent safe process unit and its evaluation	<b>PO3, PO7</b>
<b>CO3</b>	Find out a hazard free site for making a plant layout	<b>PO2, PO5, PO8</b>
<b>CO4</b>	Develop of safe workplace and work culture within a particular system	<b>PO3, PO5, PO6</b>
<b>CO5</b>	Report Industrial Incident/ accidents/ issues/ suggestions to authorized person.	<b>PO5, PO7, PO8, PO9</b>

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
HSFS 7006	Safety in Industrial Operation and Design	1	1	2		3	2	3	3	1

1=Weakly mapped

2= Moderately mapped

3=Strongly mapped

<b>HSFS 8007</b>	<b>Fire Risk &amp; Control</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Version 1.0</b>		2	0	0	2
<b>Pre-requisites/Exposure</b>	a. Basic Knowledge of Industrial Safety. b. Basic Knowledge Safety & its implications in Work Place. c. Basic Knowledge of psychology and its factors pertaining to Management systems. d. Basic knowledge human physiology & the surrounding factors and its effects.				
<b>Co-requisites</b>	Fire investigation, Fire safety in building, BIS on fire safety				

### **Course Objectives**

4. To illustrate the importance and need of Fire & Safety engineering.
5. To analyses the gaps between reference standards & pertinent conditions of Fire & Safety in India.
6. Students should be able to know the basics of fire and its classification.
7. Students will be able to understand the fire protection system design requirements
8. To be efficient in the operation, maintenance and design of fire protection equipment's.
9. To understand the scenario and its occurrence of major industrial fires.

### **Course Outcomes**

On completion of this course, the students will be able to

CO1- At the end of this course, students would be able to know the basics of fire and its precautions in different industries.

CO2- Student will have clear idea about fire equipment design and its installation in industry.

CO3- Learning of suitable extinguishing media for all different fires.

CO4- Understanding of chemistry of fire.

CO5- After this course, student will be able to know the active and passive fire protection design and precaution in building or other industries/ premises.

### **Catalog Description**

Fire safety is major concern today in all types of industry. Number of fire incidences / fire risk has increased by increasing number of industries or occupancies according to their nature. Increasing fire risk has laden additional responsibilities to fire personnel (engineer

level & above) minimizing fire risk at work place. Number of technique and their application are available today controlling fire risk and therefore students should learn improving work place environment. With this course, students can learn basics of fire, their classification, extinguishing media, intensity of fire, and the equipment used while coping over any adverse fire situation. Tackle real fire situation, it is essential to understand and use of suitable fire safety equipment at work. With the help of this course, students will know fire vulnerability, they will be capable enough to identify fire risk according to their nature/ types, and henceforth they will take suitable control measure. By thorough learning of this course, proactive fire safety culture can be improved and fire losses can be minimized during any adverse situation.

### **Course Content**

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- Unit I:** **8 lecture hours**  
Physics and chemistry of fire, Fire Properties of Solids, Liquids 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. Toxic effects of combustion gases.
- Unit II:** **5 lecture hours**  
Sources of Ignition- Fire Triangle, Principles of Fire Extinguishing, Active and Passive Fire Protection Systems, Various Classes of Fires, A,B,C,D,E types of Fire Extinguishers, Fire Stoppers, Hydrant Pipes, Hoses, Monitors, Fire Watchers, Lay Out of Stand Pipes, Fire Station, Fire Alarms and Sirens, Maintenance of Fire Trucks, Foam Generators, Escape from Fire, Rescue Operations, Fire Drills, Notice, First Aid for burns
- Unit III:** **5 lecture hours**  
Industrial fire Protection System , Sprinkler-Hydrants -Stand Pipes, Special Fire Suppression Systems (Deluge and Emulsifier), Selection Criteria of the above Installations, Reliability, Maintenance , Evaluation and Standards, Alarm and Detection Systems, Other Suppression Systems (CO<sub>2</sub> 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
- Unit IV:** **2 lecture hours**

Fire Load, Fire Resistant Material and Fire Testing, Structural Fire Protection, Structural Integrity, Exits and Egress, Fire Certificates, Fire Safety requirements for high-rise Buildings.

**Unit V:**

**4 lecture hours**

Principles of Explosion, Detonation and Blast Waves, Explosion Parameter, Explosion Venting, Inert Gases, Plant for Generation of Inert Gas, Rupture Disc in Process Vessels & Lines Explosion, Suppression System based on Carbon Dioxide (CO<sub>2</sub>) & Halons Hazards in LPG, Ammonia(NH<sub>3</sub>), Sulphur Dioxide (SO<sub>3</sub>), Chlorine(CL<sub>2</sub>) etc.

Indian Explosive Act and Rules, Static and Mobile Pressure Vessel (SMPV) rules

**Text Books**

- 1 Royetman M Ya – Principles of fire safety standards for building construction
- 2 Jain V K – Fire Safety in Building
- 3 N Sesaprakash- Manual of fire safety
- 4 R S Gupta- Handbook of fire technology
- 5 Butcher and Parnell; Designing of Fire Safety;
- 6 T. Z Harmathy - Fire Safety Science and engineering

**Reference Books**

1. S Rao, H L Saluja- Electrical Safety, Fire Safety Engineering and Safety Management
2. Fire Insurance Policies of Public Sector insurance companies
3. David Scott; Fundamental of Fire Fighter Skills
4. AIFT (TAC) Regulations
5. BIS, “IS 2189:2008 –Selection, Installation and Maintenance of Automatic Fire Detection and Alarm System – Code of practice” Bureau of Indian Standards, New Delhi, 2008.

**Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination**

**Examination Scheme:**

Components	Internal Assessment	ESE
Weightage (%)	30	70

**Relationship between the Course Outcomes (COs) and Program Outcomes (POs)**

<b>Mapping between COs and Pos</b>		
	<b>Course Outcomes (COs)</b>	<b>Mapped Programme Outcomes</b>
<b>CO1</b>	At the end of this course, students would be able to know the basics of fire and its precautions in different industries	<b>PO1, PO9</b>
<b>CO2</b>	Student will have clear idea about fire equipment design and its installation in industry.	<b>PO1, PO5, PO7</b>
<b>CO3</b>	Learning of suitable extinguishing media for all different fires.	<b>PO5</b>
<b>CO4</b>	Understanding of chemistry of fire.	<b>PO7, PO9</b>
<b>CO5</b>	After this course, student will be able to know the active and passive fire protection design and precaution in building or other industries/ premises.	<b>PO5, PO7, PO9</b>

<b>Course Code</b>	<b>Course Title</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>
<b>HSFS 7007</b>	<b>Fire Risk &amp; Control</b>	<b>2</b>		<b>1</b>		<b>3</b>		<b>3</b>	<b>2</b>	<b>2</b>

1=Weakly mapped

2= Moderately mapped

3=Strongly mapped



<b>HSFS 7008</b>	<b>Safety in Drilling</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Version 1.0</b>		3	0	0	3
<b>Pre-requisites/ Exposure</b>	a. Basic Knowledge of Risk analysis b. Basic knowledge of various Industrial and manmade Disasters c. Case studies of various disasters				
<b>Co-requisites</b>	--				

### Course Objective

#### The objectives of this course are to:

1. To Gain Knowledge On Methods Of Exploration And Production Of Petroleum Resources
2. To gain fundamental knowledge in Design Consideration, Circulation System: Drilling Fluid Types, Preparation and Conditioning System, Additive, Pumping System, Cutting Removal, Pressure Loss Circulation, Drilling Practices: Bit Choice, Weight on Bit, Rotary Speed, Hydraulic Effect, Air- Gas Drilling, Coring, Drilling Efficiency

### Course Outcomes

On completion of this course, the students will be able to

**CO1-** To describe the function, working principle of Drilling rig and its various components.

**CO2-** To Calculate drilling efficiency and selection of Drilling tubulars & Circulation

**CO3-** To demonstrate the various safety issued considered during drilling

**CO4-** To detail and suggest prevention of Kick Causes and Indicators

**CO5-** To describe about Safety Issued in Oil and Gas Production

### Catalog Description

Exploration and production is the common terminology applied to that portion of the petroleum industry which is responsible for exploring for and discovering new crude oil and gas fields, drilling wells and bringing the products to the surface. Historically, crude oil, which had naturally seeped to the surface, was collected for use as medicine, protective coatings and fuel for lamps. Natural gas seepage was recorded as fires burning on the surface of the earth. It was not until 1859 that methods of drilling and obtaining large commercial quantities of crude oil were developed.

Crude oil and natural gas are believed to have been formed over millions of years by the decay of vegetation and marine organisms, compressed under the weight of sedimentation. Because oil and gas are lighter than water, they rose up to fill the voids in these overlying formations. This upward movement stopped when the oil and gas reached dense, overlying, impervious strata or nonporous rock. The oil and gas filled the spaces in porous rock seams and natural underground reservoirs, such

as saturated sands, with the lighter gas on top of the heavier oil. These spaces were originally horizontal, but shifting of the earth's crust created pockets, called faults, anticlines, salt domes and stratigraphic traps, where the oil and gas collected in reservoirs.

## **Course Content**

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### **Unit 1**

#### **Introduction to Drilling Rig and Components (7 hours)**

Hoisting System: Component Parts; Derricks, Mast, Substructures, Weight Indicator, Wire Line and Draw Works, Power System: Prime Moves, Transmission System, Rotary System: Swivel, Kelly, Rotary Table

### **Unit 2**

#### **Fundamentals of Drilling tubulars & Circulation (8 hours)**

Tubulars: Drill Pipe, Tool Joint, Casing Pipe, Design Consideration, Circulation System: Drilling Fluid Types, Preparation and Conditioning System, Additive, Pumping System, Cutting Removal, Pressure Loss Circulation, Drilling Practices: Bit Choice, Weight on Bit, Rotary Speed, Hydraulic Effect, Air- Gas Drilling, Coring, Drilling Efficiency.

### **Unit 3**

#### **Cementation & Safety Issues in Drilling (7 hours)**

Cementing Operations: Cement Types, Additives, Process and Equipment, Complication: Lost Circulation, Fishing, Blow Outs, Well Planning: GTO, Safety Consideration in well Completion

### **Unit 4**

#### **Basics of Well Control (7 hours)**

Oil field Pressure, Kick Causes and Indicators, well control equipment's, Types of Well control, Kill Sheet

### **Unit 5**

#### **Production (7 hours)**

Well Completion Practices: Well- Head Assemble, Installation and Testing, Activation, Well Testing, Self-Flowing Wells, Gas Lift: Sucker Rod and Down Hole Motor Pumping of Oil, Safety Issued in Oil and Gas Production

## **Reference Books**

1. Methods of Exploration and Production of Petroleum Resources - Ione L. Taylor- Vol. V –

2. Dictionary of Petroleum Exploration, Drilling & Production by Forman J. Hyne published by PennWell Books, 1991
3. Nontechnical Guide to Petroleum Geology, Exploration, Drilling and Production 2012 by Norman J. Hyne

**Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination**

**Examination Scheme:**

Components	Internal Assessment	ESE
Weightage (%)	30	70

**Relationship between the Course Outcomes (COs) and Program Outcomes (POs)**

Course Outcomes (COs)	Mapped Programme Outcomes
<b>CO1-</b> To describe the function, working principle of Drilling rig and its various components.	<b>PO1</b>
<b>CO2-</b> To Calculate drilling efficiency and selection of Drilling tubulars & Circulation	<b>PO3 ,PO5 ,PO8</b>
<b>CO3-</b> To demonstrate the various safety issued considered during drilling	<b>PO1, PO5</b>
<b>CO4-</b> To detail and suggest prevention of Kick Causes and Indicators	<b>PO1, PO5</b>
<b>CO5-</b> To describe about Safety Issued in Oil and Gas Production	<b>PO1, PO5</b>

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
<b>HSFS 7008</b>	<b>Safety In Petroleum Exploration, Drilling and storage</b>	<b>2</b>		<b>1</b>		<b>3</b>			<b>2</b>	

1=Weakly mapped

1= Moderately mapped

2=Strongly mapped

<b>HSFS 7009</b>	<b>Fundamentals of sustainable development</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		2	0	0	2
Pre-requisites/Exposure	Basic knowledge of physics and chemistry (Basic science), Basic knowledge of Environment				
Co-requisites					

### **Course Objectives**

1. To help the students understand the fundamental key concepts on Sustainable Development (SD), such as intra- and inter-generational equity, economic, social and environmental, sustainability; strong and weak sustainability, natural capitalism, steady state and green economy;
2. To enable students to understand to identify and discuss in detail the key empirical issues on sustainable development, such as renewable energy transitions, urban agriculture, and green architecture;
3. To empower students with the expertise to distinguish between “green economy” and “sustainability”, and various efforts at multiple levels of governance: from individual to governments;
4. To expose students to a wide variety of research areas to apply and therefore appropriate theoretical knowledge on public policy and international relations to the issue area of sustainable development, in such aspects as international aid, global climate change negotiations, the importance of international regimes as opposed to voluntary private governance;
5. To empower Students to make their own lives more sustainable and join social movements to bring about more of sustainable development;

### **Course Outcomes**

On completion of this course, the students will be able to

- CO1. Gain knowledge of sustainability
- CO2. Gain knowledge on biodiversity
- CO3. Study about greenhouse gases
- CO4: Learn dynamics of sustainability
- CO5. Gain Knowledge on socio-economic systems
- CO6. Study about the conventions on sustainable development

CO7. Learn concept of Sustainable Development and its Role in Building of Environment

### **Catalog Description**

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Sustainable Development is the key policy concept of the contemporary world, both in academic and policy circles. The world has entered the new geological era of Anthropocene, that is, we, as human beings, change the structure of Earth and its climate to an extent that it warrants a new geological era. This comes with the depletion of resources, growing climate instabilities, demographic changes of unprecedented scale and the social inequality. The world is currently discussing the Sustainable Development Goals to take humanity to 2030 in place of the expired Millennium Development Goals. This course will give the students the key concepts to discuss sustainable development and its three pillars: the social, the environmental, and the economic. The course will consist of three parts: in the first part, we will deal with the global trends and the changing conditions of our lives and habitats. This would cover the population explosion, urbanization, the situation with energy, water, food and agriculture and globalization more generally. In part 2 of the course we will talk about various actors involved in efforts towards sustainable development, such as the governments, non-state actors, sustainable communities and the private sector. We are interested in what these various actors can do (and have done) to shift humanity on the course towards sustainability. Finally, in the third part of the course, we will discuss the global policy framework towards sustainability, such as policy indicators, national strategies, global summits and legal and policy frameworks for sustainability. Here, we will also talk about what we can do, as individuals and communities, to encourage a more sustainable future.

### **Course Content**

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#### **Unit 1**

##### **Concept of Sustainable Development**

**07 lecture hours**

Definition of sustainability - History and emergence of the concept of sustainable development – Our Common Future - Objectives of Sustainable Development - Millennium Development Goals - Environment and Development linkages – Globalization and environment - Population, Poverty and Pollution – Global, Regional and Local environmental issues – Resource Degradation – Greenhouse gases and climate Change – Desertification – Industrialization – Social insecurity.

#### **Unit 2**

##### **Sustainability and The Triple Bottom Line**

**08 lecture hours**

Components of sustainability – Complexity of growth and equity - Social, economic and environmental dimensions of sustainable development – Environment – Biodiversity – Natural Resources – Ecosystem integrity – Clean air and water – Carrying capacity –Equity, Quality of Life, Prevention, Precaution, Preservation and Public participation. - Structural and functional linking of developmental dimensions – Sustainability in national and regional context

### **Unit 3**

#### **Sustainable Development and International Response**

**05 lecture hours**

Role of developed countries in the development of developing countries – International summits – Stockholm to Johannesburg – Rio Principles – Agenda 21 - Conventions –Agreements – Tokyo Declaration-Doubling Statement-Transboundary issues –Integrated approach for resource protection and management

### **Unit 4**

#### **Sustainable Development of Socio-Economic Systems**

**07 lecture hours**

Demographic dynamics of sustainability – Policies for socio-economic development – Strategies for implementing eco-development programmes – Sustainable development through trade – Economic growth – Action plan for implementing sustainable development – Urbanization and Sustainable Cities – Sustainable Energy and Agriculture – Sustainable Livelihoods – Ecotourism

### **Unit 5**

#### **Framework for Achieving Sustainability**

**09 lecture hours**

Sustainability indicators - Hurdles to Sustainability - Operational guidelines –Interconnected prerequisites for sustainable development – Empowerment of Women, Children, Youth, Indigenous People, Non-Governmental Organizations, Local Authorities, Business and Industry - Science and Technology for sustainable development –Performance indicators of sustainability and Assessment mechanism – Constraints and barriers for sustainable development.

### **Text Books and Reference Books**

1. Austin, James and Tomas Kohn. 1990. Strategic Management in Developing Countries. The Free Press.
2. Berger. 1994. “The Environment and the Economy.” In Smelser and Swedberg (eds.)
3. The Handbook of Economic Sociology. Russel Sage Foundation. D’Arcy, David. Transcript of broadcast, Dec. 5, 2002, “In Houston, a Treasure of Exiled Afghan Art,” National Public Radio,

4. Elkington, John. Cannibals with Forks: The Triple Bottom Line for 21st Century Business Oxford: Capstone Publishing, October 1997.
5. Guillen, Mauro and Sandra L. Suarez. 2002. "The Institutional Context of Multinational Activity." In Organization Theory and the Multinational Corporation. 2nd edition. New York: St. Martin's Press

**Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination**

**Examination Scheme:**

Components	Internal Assessment	ESE
Weightage (%)	30	70

**Relationship between the Course Outcomes (COs) and Program Outcomes (POs)**

<b>Mapping between COs and Pos</b>		
	<b>Course Outcomes (COs)</b>	<b>Mapped Programme Outcomes</b>
<b>CO1</b>	Gain knowledge on Various Environmental standards and laws for water, air and land quality by Pollution Control boards	<b>PO2,PO7,PO8</b>
<b>CO2</b>	Gain knowledge on steady state conservative systems and types of reactors.	<b>PO8</b>
<b>CO3</b>	Learn various water Quality Parameters.	<b>PO7,PO9</b>
<b>CO4</b>	Understand and learn various water treatment processes	<b>PO8,PO7</b>
<b>CO5</b>	Gain Knowledge on various kinds of Air pollutants and different models to study them.	<b>PO8,PO7</b>
<b>CO6</b>	Understand and learn pollution control methodologies in process industries	<b>PO1,PO2,PO8</b>
<b>CO7</b>	Learn concept of Sustainable Development and its Role in Building of Environment	<b>PO7,PO8</b>

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
HSFS 7009	Fundamentals of Sustainable Development	2	1					3	3	2

1=Weakly mapped

2= Moderately mapped

3=Strongly mapped



<b>HSFS 7010</b>	<b>Safety in Construction</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Version 1.0</b>		3	0	0	3
<b>Pre-requisites/Exposure</b>					
<b>Co-requisites</b>					

HSFS 7011	Hazard Identification, Risk Analysis and Managemnet	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/ Exposure	a. Principles of safety management b. Basic Knowledge of safety at work. c. Basic knowledge human physiology & the surrounding factors and its effects				
Co-requisites	--				

### Course Objectives

The objectives of this course are to:

1. To provide knowledge in Quantitative Risk Analysis Process Industries
2. To provide in-depth knowledge of risk Control and Management
3. To familiarize the student with various types of Hazard Identification techniques

### Course Outcomes

On completion of this course, the students will be able to

- CO1. Identify various Hazards related to the work practices and activity using various technique.
- CO2. Carryout Risk assessment methods to various Industries and work practices and activity
- CO3. Understand advantage and disadvantage of various risk analysis techniques
- CO4. Compute the consequence modelling using ALOHA
- CO5. Create Bow tie diagram, ETA, FTA and FMEA
- CO6. Create various components in MSDS and its uses
- CO7. Access the Human error, Fatigue involved for various categories of Person in an Industry.

### Catalog Description

Hazard Identification, Risk Analysis and Management helps students to apply during system development to identify and mitigate hazards, and in so doing eliminate or reduce the risk of potential mishaps and accidents. With systems and technology also comes exposure to mishaps because systems can fail or work improperly resulting in damage, injury, and deaths. The possibility that a system fails and results in death, injury, damage, and the like is referred to as mishap risk will be identified from this subject.

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## Course Content

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### Unit 1

#### Hazard Identification and Risk Analysis

13 lecture hours

Introduction - Hazard - Process - Hazard - Monitoring - Risk - Issues - Perception - Management Assessment-Analysis-Safety Audits-Management System Audits-Check Lists-Material Safety Data-What If Analysis-Event Tree-Fault Tree Analysis-Hazard and Operability Studies- Coarse Hazard Studies-Human Error Analysis-Safety Review System-Hazard Warning Methods-Hazard Warning Analysis- Plant Safety Audit.

### Unit 2

#### Software for Risk Analysis

13 lecture hours

Basic Concepts of Risk Analysis - Quantitative - Qualitative Methods - Hazard Models System-Hazard Assessment Systems - Principles of Applications of Software's- FETI - Hazard Operability Studies (HAZOP) - EFFECTS - Hazard Analysis (HAZAN) - PHAST - SAFETI - Failure Mode and Effect Analysis (FMEA).

### Unit 3

#### Risk Control & Management

10 lecture hours

Impact estimation: Property, People, Man and Machine System, Job and Personal Risk Factors- Standards-Selection and Training-Body Size and Posture-Body Dimension (Static/Dynamic)- Adjustment Range- Penalties. -Guide Lines for Safe Design and Postures- Evaluation and Methods of Reducing Posture Strain.

Man-Machine Interface-Controls-Types of Control-Identification and Selection-Types of Displays-Compatibility and Stereotypes of Important Operations-Fatigue and Vigilance-Measurement Characteristics and Strategies for Enhanced Performance Human Factor Engineering & Behavioral based safety.

### Reference Books

1. AIChE/CCPS, Guidelines for Hazard Evaluation Procedures second edition. Centre for Chemical Process Safety, American Institute of Chemical Engineers, New York, 1992.
2. AIChE/CCPS, Guidelines for Chemical Process Quantitative Risk Analysis second edition. Centre for Chemical Process Safety, American Institute of Chemical Engineers, New York, 2000.
3. Lees F.P. Loss Prevention in the Process Industries second edition. Butterworths, London, 1996.
4. Accident Prevention Manual for Business and Industry, Vol. I – National Safety Council, USA

**Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination**

**Examination Scheme:**

Components	Internal Assessment	ESE
Weightage (%)	30	70

**Relationship between the Course Outcomes (COs) and Program Outcomes (POs)**

Course Outcomes (COs)	Mapped Programme Outcomes
CO1. Identify Various Hazards related to the work practices and activity	<b>PO1,PO6,PO7</b>
CO2. Carryout Risk assessment methods to various Industries and work practices and activity	<b>PO1,PO6,PO7</b>
CO3. Understand advantage and disadvantage of various risk analysis techniques	<b>PO1</b>
CO4. Compute the consequence modelling using ALOHA	<b>PO1,PO7,PO9</b>
CO5. Create Bow tie diagram, ETA , FTA and FMEA	<b>PO1</b>
CO6. Create various components in MSDS and its uses.	<b>PO6,PO7</b>
CO7. Evaluate the Human error, Fatigue involved for various categories of Person in an Industry	<b>PO4</b>

**Table: Correlation of POs v/s COs**

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
<b>HSFS 7011</b>	<b>Hazard Identification, Risk analysis and Management</b>	<b>3</b>			<b>2</b>		<b>3</b>	<b>3</b>		<b>2</b>

1=Weakly mapped

2= Moderately mapped

3=Strongly mapped

<b>HSFS 8001</b>	<b>TQM &amp; TPM</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Version 1.0</b>		3	0	0	1
<b>Pre-requisites/Exposure</b>	Engineering graduate				
<b>Co-requisites</b>	--				

### Course Objectives

This course is designed to give students fundamentals of Total Quality Management (TQM) and Total Productive Maintenance (TPM) with emphasis on contemporary quality planning, control and management approaches, implementations and criticisms. Students who complete this course will be able to critically appraise management techniques, choose appropriate statistical techniques for improving processes and write reports to management describing processes and recommending ways to improve them. People need to be aware of what they can and can't do with data. This subject provides students with the knowledge to

1. Understand the philosophy and core values of TQM AND TPM;
2. Determine the voice of the customer and the impact of quality on economic performance and long-term business success of an organization;
3. Implement appropriate tool/ techniques for improving processes;
4. Apply and evaluate best practices for the attainment of total quality.

### Course Outcomes

On completion of this course, the students will be able to

- CO1. Understand the fundamental principles of TQM and TPM;
- CO2. Choose appropriate tool/ techniques for improving processes;
- CO3. Write reports to management describing processes and recommending ways to improve them;
- CO4. Develop research skills that will allow them to keep abreast of changes in the field of TQM/TPM;
- CO5. Emphasis the process of learning and discovery rather than the presentation of fact.

### Catalog Description

Total quality management (TQM) is a philosophy, methodology and system of tools aimed to create and maintain mechanism of organization's continuous improvement. It involves all departments and employees into improvement of processes and products. It helps to reduce costs and to meet and exceed needs and expectations of customers and other stakeholders of an organization. TQM

encompasses the concepts of business and social excellence that is sustainable approach to organization's competition, efficiency improvement, leadership and partnership.

In this course, the focus will be on methodology to understand and implement TQM and TPM tools i.e. FMEA, QFD, OEE, TAGUCHIS etc. Students will learn how to implement these tool effectively tin industry. Classroom activities will be designed to encourage students to play an active role in the construction of their own knowledge and in the design of their own strategies. We will combine traditional lectures with other active teaching methodologies, such as group discussions, cooperative group solving problems, analysis etc.

## **Course Content**

### **Unit 1**

#### **Introduction to Total Quality Management**

**5 lecture hours**

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - - Barriers to TQM - Quality statements - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, and Customer retention - Costs of quality.

### **Unit 2**

#### **Juran on Quality**

**3 lecture hours**

Juran Approach to Quality: Juran,Trilogy, Contributions of Deming, Juran and Crosby Shigeo Shingo, Ishikawa

### **Unit 3**

#### **Kaizen:**

**2 lecture hours**

Meaning Kaizen –Innovation, Kaizen Management Practices, TQC

### **Unit 4**

#### **Supporting Tools and Technique in TQM**

**10 lecture hours**

The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

Control Charts - Process Capability - Quality Function Development (QFD) - Taguchi quality loss function

### **Unit 5**

**ISO 9000 Series Quality Standard****4 lecture hours**

Need for ISO 9000 - ISO 9001-2015 Quality System - Elements, Documentation, Quality Auditing - QS 9000 - ISO 14000 - Concepts, Requirements and Benefits - TQM Implementation in manufacturing and service sectors

**Unit 6****Total Productive Maintenance****5 lecture hours**

Introduction of TPM, Eight Pillars of TPM, Six big losses, Traditional model of TPM, Overall equipment efficiency (OEE) and its calculation

**Unit 7****Case Studies****3 lecture hours**

Changing Company Culture; Xerox Corporation – Using TQM as a Competitive Strategy; Motorola’s Secret to TQC; Motorola’s Quest for Quality

**Text Books and Reference Books**

1. Evans, J. R., Dean J. W. Total quality management, organization and strategy, Thomson, 2003. 399 p. 3.
2. Kanji G. K., Asher M. 100 Methods for Total Quality Management. London: SAGE Publications, 1996. 4.
3. Oakland G. F. Total Quality Management, Oxford, 1995. 5.
4. Goetsch D. L., Davis S. B. Quality management. Introduction to TQM for production, processing and services. New Jersey: Prentice Hall, 2003. Longman Publishers. ISBN: 9780582285972.
5. Besterfield, DH, et.al. 2003, Total Quality Management, 3<sup>rd</sup> edn, Prentice Hall
6. Goetsch, DL & Davis, B 2006, Quality Management: Introduction to Total Quality Management for Production, Processing and Services, 5<sup>th</sup> edn, Pearson
7. Gryna FM 2001, Quality Planning & Analysis, 4<sup>th</sup> edn, Jr., McGraw-Hill

**Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination****Examination Scheme:**

Components	Internal Assessment	ESE
Weightage (%)	30	70

### Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Programme Outcomes
CO1	Understand the fundamental principles of TQM and TPM	PO1
CO2	Choose appropriate tool/ techniques for improving processes	PO5
CO3	Write reports to management describing processes and recommending ways to improve them;	PO4
CO4	Develop research skills that will allow them to keep abreast of changes in the field of TQM/TPM	PO2
CO5	Emphasis the process of learning and implementing rather than the presentation of fact.	PO3

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
HSFS8001	TQM & TPM	3		2		3	3	2		

1=Weakly mapped

2= Moderately mapped

3=Strongly mapped



<b>HSFS 8002</b>	<b>Safety in Engineering Industry</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Version 1.0</b>		3	0	0	3
<b>Pre-requisites/Exposure</b>	Basic knowledge of Manufacturing Processes				
<b>Co-requisites</b>	Occupational Safety and Health Management				

**Course Objectives:** Objectives of the subject are:

1. To provide in-depth knowledge in safety in engineering industry it's applications in various fields
2. To provide in-depth knowledge of various processes involved in engineering industry and the associated hazards
3. To expose the students to the basics in hazard identification and hazardous process management
4. To familiarize the student with occupational hazards associated with various industrial processes

**Course Outcomes:** At the end of this course, student should be able to;

- CO1. Classify engineering industry.
- CO2. Describe various processes used in engineering industry.
- CO3. Identify method of operation and hazards involved in foundry operations
- CO4. Understand the operations and hazards involved in hot and cold rolling mills
- CO5. Understand the operation of power presses, associated hazards and method of safe operation
- CO6. Identify hazards associated with welding process and method of safe operations
- CO7. Describe various aspects of safety in material handling
- CO8. Describe and elaborate on various occupational diseases due to physical and chemical agents

### **Catalog Description**

Manufacturing Industry is the key role player of Indian Economy and oldest form of industry ever existed since the start of human civilization. However, as it one of the most hazardous materials like heavy metals and involves hazardous processes, many occupational injuries/illnesses were observed even in this modern era, with advent of engineering and technology. Thus, it would be imperative to deal with OHS & E aspects of Manufacturing Industry.

### **Course Content**

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#### **Unit 1**

Introduction - definitions - classification of engineering industry - different process in engineering industry.

**Unit 2**

Foundry operations - furnace - health hazard - safe methods of operation. Forging operations - heat radiation - maintenance of machines - final checking of tools, guards, lubrication, shop equipment and hand tools - safe work practice. Operations in hot and cold rolling mills.

**Unit 3**

Safety in the use of power presses - shearing -bending - rolling - drawing - turning - boring - milling - planning - grinding. Selection and care of tools - health hazards and prevention.

**Unit 4**

Safety in welding, cutting, finishing, cleaning, polishing, buffing. Safety in heat treatments - safety in handling and storage, disposal of effluents - health precautions, elimination and prevention of long time exposure to the hazardous fumes, source of fumes, ventilation and fume protection.

**Unit 5**

Care and maintenance of common elements used in material handling Equipment like rope chains slings, hooks, clamps. general safety consideration in material handling - manual and mechanical handling. Handling assessments - handling techniques – lifting, carrying, pulling, pushing, palletizing and stocking. Occupational diseases due to physical and chemical agents.

**Text Books and Reference Books**

1. Som, S C and Biswas, G. “Introduction to fluid mechanics and Fluid Machines” McGraw Hill Publishing Company, New Delhi
2. Young, D. F., Munson, B. R., Okiishi, T. H., & Huebsch, W. W. (2010). A brief introduction to fluid mechanics. John Wiley & Sons.
3. Kumar, D. S. (2015). Fluid Mechanics and Fluid Power Engineering. Katson Books
4. Accident Prevention Manual, 13<sup>th</sup> Edition, Engineering and Technology- NSC Chicago
5. ILO Encyclopedia of Occupational Health and Safety - Part XIII, Manufacturing Industries

**Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination**

**Examination Scheme:**

Components	Internal Assessment	MSE	ESE
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Weightage (%)	30	20	50
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### Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Programme Outcomes
<b>CO1</b>	CO1. Classify engineering industry	<b>PO 2, 3, 5, 6, 11 &amp; 12</b>
<b>CO2</b>	CO2. Describe various processes used in engineering industry.	<b>PO1-12</b>
<b>CO3</b>	CO3. Identify method of operation and hazards involved in foundry operations	<b>PO 1-7, PO 9, PO 11-12</b>
<b>CO4</b>	CO4. Understand the operations and hazards involved in hot and cold rolling mills	<b>PO 1-7, PO 9, PO 11-12</b>
<b>CO5</b>	CO5. Understand the operation of power presses, associated hazards and method of safe operation	<b>PO 1-7, PO 9, PO 11-12</b>
CO6.	CO6. Identify hazards associated with welding process and method of safe operations	<b>PO 1-7, PO 9, PO 11-12</b>
CO7.	CO7. Describe various aspects of safety in material handling	<b>PO 1-10 &amp; PO 12</b>
CO8.	CO8. Describe and elaborate on various occupational diseases due to physical and chemical agents	<b>PO 1-12</b>

### Correlation of POs v/s COs

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
HSFS8002	Safety in Engineering Industry	3	3	2		3	3	2	3	3

- 1=Weakly mapped  
 2= Moderately mapped  
 3=Strongly mapped

<b>HSFS 8004</b>	<b>Hazard &amp; Safety Measures In Process Industry</b>	L	T	P	C
<b>Version 1.0</b>		3	0	0	3
<b>Pre-requisites/Exposure</b>	Basic knowledge of process industries, Basic mathematic and chemistry.				
<b>Co-requisites</b>	--				

### Course Objectives

1. To help the students to gain and understand the basic and fundamental Knowledge of Safety precautions and measures to be taken Hydrocarbon industries while drilling, Piping, rigging etc.
2. To help the students to gain and understand the basic Knowledge Safety & its implications in Work Places with special reference hydrocarbon industry.
3. To help the students to gain and understand detailed idea about permit to work system and confine space entry procedures and the precaution to be taken while entering and various rules associated with it.
4. To help the students in finding out the various methods and analyze the types of inspection of industries.
5. To help the students to gain and understand the basic knowledge about safety and precautionary measures to be taken while receiving, transportation & Storage of hydrocarbons.

### Course Outcomes

On completion of this course, the students will be able to

CO1. Gain knowledge and analyze and implementation of Hazards in Process Industries.

CO2. Learn various measures and implementation of various methods for mitigating the hazards.

CO3. Understand and implement safety aspects and confine space entry procedure.

CO4: Understand and implement the methods and to implement these in Plant inspection.

CO5. Gain Knowledge on various kinds Hazard Identification and Risk Assessment techniques with case studies.

CO6. Understand and analyze the methods for safe transportation of Hydrocarbons.

## **Catalog Description**

This module teaches systematic approaches for identification of Hazards associated with Hydrocarbon Industry. It tells the students about all the processes which are involved in Hydrocarbon industry. And it also tells about the safety measures and precaution taken. It also helps the students to have a knowledge regarding Permit to work system as per OISD standards which are applicable in Oil industries throughout, India. It also helps the student to going a basic idea about Permit to work system and their types used inside a process industry. It also helps them to take all necessary precautions and safety measures while the transportation of hydrocarbon and their storage too.

## **Course Content**

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<b>Unit 1</b>	<b>08 lecture hours</b>
<b>Hazards &amp; Safety Measures in Hydrocarbon Industry</b>	
Fire, Safety & Health Issues in Hydrocarbon Industry, Health, Safety & Environmental Issues during Drilling & Exploration	
<b>Unit 2</b>	<b>06 lecture hours</b>
<b>Safety Aspects in Confined Spaces</b>	
OSHA Guideline for Confined Space Entry, Permit Requirement for Confined Space Entry, Duties of Persons involved in Confined Space Entry.	
<b>Unit 3</b>	<b>06 lecture hours</b>
<b>Work Permit Systems</b>	
Cold work permits system, Hot work permit, Confined space work permit, Electrical related work permit.	
<b>Unit 4</b>	<b>04 lecture hours</b>
<b>Plant Inspection</b>	
Methods of plant inspections, advantages of plant inspection.	
<b>Unit 5</b>	<b>08 lecture hours</b>
<b>Receiving and Storage of Hydrocarbon</b>	
Surface- Storage Types, Safety Features, Layout Design, U/G Aquifers, Caverns, Refrigerated Storage, Standards in Design, Safe Operating and Maintaining Practices.	
<b>Unit 6</b>	<b>04 lecture hours</b>
<b>Transportation of Hydrocarbons</b>	
Rail / Road, Tankers, Pipelines, Barges, Packages.	

## **Text Books and Reference Books**

1. Industrial Hazards and Safety handbook by Ralph W King and John Magid,1979
2. Chemical Process Safety, 2nd ed, Daniel A. Crowl, Joseph F. Louvar,2002

**Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination**

**Examination Scheme:**

Components	Internal Assessment	ESE
Weightage (%)	30	70

**Relationship between the Course Outcomes (COs) and Program Outcomes (POs)**

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Programme Outcomes
<b>CO1</b>	Gain knowledge and analyze and implementation of Hazards in Process Industries.	<b>PO1, PO2,PO6</b>
<b>CO2</b>	Learn various measures and implementation of various methods for mitigating the hazards	<b>PO2,PO7,PO8</b>
<b>CO3</b>	Understand and implement safety aspects and confine space entry procedure.	<b>PO2, PO6, PO7, PO8,PO9</b>
<b>CO4</b>	Understand and implement the methods and to implement these in Plant inspection.	<b>PO4, PO6,PO7,PO8,PO9</b>
<b>CO5</b>	Gain Knowledge on various kinds Hazard Identification and Risk Assessment techniques with case studies.	<b>PO7, PO8</b>
<b>CO6</b>	Understand and analyze the methods for safe transportation of Hydrocarbons.	<b>PO7,PO9</b>

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
HSFS 8004	Hazards & Safety Measures in Process Industry	2	2		2		3	3	3	2

1=Weakly mapped

2= Moderately mapped

3=Strongly mapped

<b>HSFS8005</b>	<b>Concept of Fire Safety in Building Structures &amp; Installation</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Version 1.0</b>		3	0	0	3
<b>Pre-requisites/Exposure</b>	d. Basic Knowledge of Physics, Chemistry and Mathematics e. Basics of fire f. Basic of Civil Engineering g. Fire Risk & Control h. National Building code i. NFPA				
<b>Co-requisites</b>	Fire investigation, Fire safety in building, BIS on fire safety				

### Course Objectives

1. Students can learn various classification of building as per NBC.
2. Learning of general requirements of various types of building.
3. Study of basics of fire classification and its properties.
4. Study the guidelines given in NBC
5. Study about Fire behavior in building and its control measures.
6. To know about fire growth smoke behavior in building.
7. Know the concept of compartmentation and precaution to be taken during designing of compartmentation.
8. Learn mean of methods of enhancing fire resistance of building material or compartmentation.
9. Learning of different types of fire & smoke effects of inside a building.
10. Basics of fire modelling will be learned by students

### Course Outcomes

On completion of this course, the students will be able to

- CO1. Understanding different type of building and know its general guidelines
- CO2. Use of general requirement given by NBC
- CO3. Having knowledge of stairs, exit, corridors and its general requirements
- CO4. Role of Building by laws, Fire zones and its importance would be known to students
- CO5. Students will able to know the purpose of compartmentation and it's all general requirements
- CO6. Factors contributing to compartment would be known to students

## Catalog Description

Building fire safety is major concern today as numbers of fire mishaps are common due to which numbers of deaths 21are resulted due to this. Fire mishaps contributes majority of death due to smoke inhalation and the main reason behind is inadequate emergency procedure, improper planning, designing etc. National building code has recommended specific guidelines on life & fire safety and various consideration are given to implement and minimize those loses occurred due to fire. With the help of this course, students will be learning various control measures and requirements based on different classification of building. Exit ways, staircases, and other routes used during emergency will be promptly inspected and audited by students at work place, which might be highlighting gaps for corrective actions. Codes and standard will be known to students and to enforce the requirements while designing and constructing building. The fire safety requirements (active & passive) would be known and subsequently advised to use in all types of occupancy. The fire behavior will be evaluated with the help of modern software where real time situation will be given for assessment and which helps in preparedness of emergency action plan.

## Course Content

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### Unit I:

**8 lecture hours**

Residential - Educational - Institutional - Assembly - business - Mercantile - Industrial - storage - hazardous. General Requirements.

### Unit II:

**8 lecture hours**

Classification of buildings, Zoning; Building by-laws

Compartments and compartmentation, elements of building contributing to compartment; Standard Time-Temperature curves for building and oil/gas fires and associated standards; concept of fire resistance;

### Unit III:

**8 lecture hours**

Means and methods of enhancing fire resistance of materials; fire doors; fire stops; products of combustion from various materials; health effects of smoke and fire products; burns

### Unit IV:

**12 lecture**

**hours**



Stack effect; smoke vents; pressurization of staircases; evacuation planning; special aspects of fire safety in high-rise and multi-occupancy premises.

Layout, separation, segregation for fire safety in industrial facilities; exposure protection.

**Unit V:**

**4 lecture hours**

Introduction to fire modeling.

**Text Books**

- 7 BIS, NBC Part IV – Fire and Life Safety”, Bureau of Indian Standards, New Delhi, 2016.
- 8 Royetman M Ya – Principles of fire safety standards for building construction
- 9 Jain V K – Fire Safety in Building
- 10 Butcher and Parnell; Designing of Fire Safety;
- 11 BS 5588 : British Standard – Fire precautions in the design, construction and use of buildings
- 12 T. Z Harmathy - Fire Safety Science and engineering

**Reference Books**

6. Fire Insurance Policies of Public Sector insurance companies
7. AIFT (TAC) Regulations
8. BIS, “IS 2189:2008 –Selection, Installation and Maintenance of Automatic Fire Detection and Alarm System – Code of practice” Bureau of Indian Standards, New Delhi, 2008.

**Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination**

**Examination Scheme:**

Components	Internal Assessment	ESE
Weightage (%)	30	70

### Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

<b>Mapping between COs and POs</b>		
	<b>Course Outcomes (COs)</b>	<b>Mapped Programme Outcomes</b>
<b>CO1</b>	Understanding different type of building and know its general guidelines	<b>PO1, PO3,PO9</b>
<b>CO2</b>	Use of general requirement given by NBC	<b>PO7, PO8, PO9</b>
<b>CO3</b>	Having knowledge of stairs, exit, corridors and its general requirements	<b>PO3, PO5</b>
<b>CO4</b>	. Role of Building by laws, Fire zones and its importance would be known to students	<b>PO1, PO9</b>
<b>CO5</b>	Students will able to know the purpose of compartmentation and it's all general requirements	<b>PO1, PO3, PO5, PO7</b>
<b>CO6</b>	Factors contributing to compartment would be known to students	<b>PO1, PO8</b>

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
HSFS8005	Concept of Fire Safety in Building Structures & Installation	3		3		2		3	3	2

1=Weakly mapped

2= Moderately mapped

3=Strongly mapped

<b>HSFS 8009</b>	<b>Global Disaster Scenario and Types of Natural Diasters</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Version 1.0</b>		3	0	0	0
<b>Pre-requisites/Exposure</b>	Fundamentals of safety, health and environment management. Exposure to hazard identification, risk assessment and control.				
<b>Co-requisites</b>					

### Course Objectives

1. Provide a conceptual and methodological framework for the study of natural and manmade disasters and preparedness.
2. To educate students about the underlying natural process that give rise to natural hazards such as earthquakes, volcanic eruptions, tsunamis, floods, and more
3. Expose students to the technological innovations that are allowing an increasing large human population to monitor, predict, and warn society about natural/industrial hazards and impending disasters.
4. To give students a foundation for critically evaluating future approaches to managing hazards, from a technical, personal, and societal point of view.

### Course Outcomes

On completion of this course, the students will be able to

CO1: To understand basic concepts of disaster management cycle.

CO2: Understand and appreciate the institutional framework in India for disaster preparedness and mitigation.

CO3: To characterize and analyzes natural and manmade hazards, to identify their causes, mechanisms and evaluate their significance for the human population

CO4: Explore the scientific principles behind the occurrence of natural disasters.

CO5: Create strategies and implementation plan for Prevention, Responsive mitigation and recovery during industrial or natural disaster.

CO6: To critically examine and evaluate the best practices and gaps from case studies on natural and manmade disasters.

## **Catalog Description**

Many countries in the world and India in particular are vulnerable in varying degrees to a large number of natural as well as man-made disasters. And these disasters seriously threaten country's economy and its sustainable development. The main aim of this course is to provide aspiring disaster management students or those who may have future disaster or emergency management responsibilities, training in a holistic approach towards disaster management to enable them to manage all kinds of disasters by implementing proactive disaster management strategies in terms of relevant legislation, policies and directives, and effectively co-ordinate relief and recovery programs. Students will have an understanding of the principles and practices of disaster management. Critical understanding about the underlying natural process or mechanisms that give rise to natural hazards such as earthquakes, volcanic eruptions, tsunamis, floods, and more. The course will discuss case studies on infamous natural and manmade disasters to critically examine and evaluate the best practices and gaps on disasters preparedness and response.

## **Course Content**

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### **Unit 1**

**10 lecture hours**

Introduction - Disaster Management Cycle, Public administration/policy and emergency management – incident command center – training need analysis and human resource development plan – corporate/public agency coordination and the human element in preparedness planning. Institutional framework in India for disaster preparedness and mitigation

### **Unit 2**

**8 lecture hours**

Earthquake: Introduction – general characteristics – mechanism – causes and effects – prediction - seismic zones and waves – vulnerability – damage potential – magnitude and intensity – geological and geographical analysis – epicenter – characteristics of general motion and attenuation. Landslide and land degradation: Causes – tectonic conditions – erosion – avalanches – rock fall – damage assessment. Fire Urban area fire – building construction and structural fire protection – electric hazard, shock and protection – aircraft fire – actions required for rescue and fire fighting in air crafts and airports forest fires – explosives, fire hazard and protection in special risk areas – coal fire. Biodiversity extinction and deforestation. Biodiversity species at risk – biodiversity loss – management of species diversity – deforestation – causes and adverse effects Epidemics: Health risks – chemicals- diseases – future diseases – medical aid – vulnerability analysis – rehabilitation

**Unit 3****6 lecture hours**

Floods: General characteristics – causes – geomorphology and floods – flood forecasting – river and coastal flood – flash flood – lake outburst – risks, environmental planning – flood control and management. Cyclone and Tsunami: Structure and nature of cyclones and Tsunamis – characteristics hazard donation – factors-hazard potential – impact assessment. Coastal and marine environment pollution and control – marine environment degradation – land use changes in coastal zones – wave – tidal storms – erosion habitat pollution – sediment discharge and control. Droughts Causes – vulnerability – tides – famines – desert and desertification.

**Unit 4****6 lecture hours**

Manmade hazards: Toxic chemicals – noise pollution – environment ground water pollution and management – solid waste management. Terrorist disaster/War: Hazardous wastes – reactivity – toxicity – nuclear war – biological weapons – armed conflicts – land mines etc.

**Unit 5****6 lecture hours**

National & World Wide Scenario: History of disasters - various disasters in various countries - Disasters in India Relief and rehabilitation in disasters at local, national and global levels, Gaps in disaster management identified on analysis, Worldwide Aid and Agencies, Study of different case studies on natural disaster & man-made disaster

**Text Books and Reference Books**

1. Donald Hyndman, David Hyndman “Natural Hazards and Disasters” Third Edition
2. Coppola P Damon, 2007. Introduction to International Disaster Management, Carter, Nick 1991.
3. Disaster Management: A Disaster Manager's Handbook. Asian Development Bank, Manila
4. Government of India, Ministry of Home Affairs, National Disaster Management Division, 2004, Disaster Management in India – A Status Report
5. National Policy on Disaster Management 2009, NDMA, Government of India.

**Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination****Examination Scheme:**

Components	Internal Assessment	ESE
Weightage (%)	30	70

**Relationship between the Course Outcomes (COs) and Program Outcomes (POs)**

<b>Mapping between COs and POs</b>		
	<b>Course Outcomes (COs)</b>	<b>Mapped Programme Outcomes</b>
<b>CO1</b>	Understand basic concepts of disaster management cycle.	<b>PO1, PO2,</b>
<b>CO2</b>	Understand and appreciate the institutional framework in India for disaster preparedness and mitigation.	<b>PO1, PO2, PO6, PO7</b>
<b>CO3</b>	To characterize and analyzes natural and manmade hazards, to identify their causes, mechanisms and evaluate their significance for the human population	<b>PO1, PO3</b>
<b>CO4</b>	Explore the scientific principles behind the occurrence of natural disasters	<b>PO1,PO3,</b>
<b>CO5</b>	Create strategies and implementation plan for Prevention, Responsive mitigation and recovery during industrial or natural disaster.	<b>PO1, PO2, PO8</b>
<b>CO6</b>	To critically examine and evaluate the best practices and gaps from case studies on natural and manmade disasters.	<b>PO1, PO2, PO3,</b>

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
HSFS 8009	Global Disaster Scenario and Types of Natural Disasters	3	2	2			2	2	3	

1=Weakly mapped

2= Moderately mapped

3=Strongly mapped

<b>HSFS 8010</b>	<b>Water supply, Refugee Health and Sanitation in Emergency</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Version 1.0</b>		3	0	0	3
<b>Pre-requisites/ Exposure</b>	a. Basic Knowledge of water supply Engineering b. Basic knowledge of waste water treatment c. Basic knowledge of Global disaster and their causes				
<b>Co-requisites</b>	--				

### **Course Objectives**

1. To explain the relationship between the environment and water, sanitation and hygiene related diseases;
2. To present standards and key indicators related water supply, sanitation and hygiene in emergencies;
3. To provide basic information about control measures for improving environmental conditions;
4. Discuss the importance of addressing long term needs of the community at the onset of the emergency and throughout its duration

### **Course Outcomes**

On completion of this course, the students will be able to

CO1 - To explain the relationship between the environment and water, sanitation and hygiene related diseases;

CO2- To follow standards and key indicators related water supply, sanitation and hygiene in emergencies;

CO3 - To design Soak pit, Infiltration trench, Evaporation pan for Waste water management

CO4- To discuss the importance of addressing long term needs of the community at the onset of the emergency and throughout its duration.

CO5- To identify and control problems in the environment, water, sanitation and hygiene situation during an emergency.

CO6- To apply standards to water supply, sanitation and hygiene in emergencies.

### **Catalog Description**

This subject deals with water supply, excreta disposal, control of disease transmitting vectors, hygiene promotion, solid-waste disposal, drainage, and selection and planning of settlements in emergency situations. It aims to provide an understanding of these programme elements, together with information and ideas for management and decision making in complex situations where both speed and good judgement are essential. The major focus of the subject

is water supply and sanitation, as this reflects current priorities in emergency-response work. Site selection and planning are included to reflect their links with water supply and sanitation.

## **Course Content**

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### **Unit 1**

#### **Hazards Monitoring and Emergency Management 6 Hrs**

Tracking and modeling – early warning systems – warning protocols – India disaster resource network – environmental hazards – public health aspects of disaster management – emergency services systems - urban hazards and disasters – an introduction to disaster planning. Introduction to emergency management planning - organization and structure for emergency management- emergency management research – methods/analysis – public information for emergency management – principles and practice for disaster relief and recovery – logistics, support system – computer applications in emergency management

### **Unit 2**

#### **Humanitarian Laws & Humanitarian Interventions 6 Hrs**

Human rights, international humanitarian law and refugee conventions, guidelines on internally displaced persons, public health surveillance, control of communicable and non-communicable Partnerships and roles in different stages of emergencies, e.g. humanitarian reform, role of national governmental and non-governmental actors, community participation, prevention/recovery strategies, diseases, mental health, reproductive health, violence and injuries, water and sanitation, nutrition, refugee camp planning.

### **Unit 3**

#### **Environmental Health Risks, Site Selection & Planning 6 Hrs**

Introduction – environmental health risks in emergencies – needs and standards – public health approach to water supply and sanitation in emergencies – partners in the humanitarian response – working with disaster affected people – social diversity – local context Emergency settlements, site selection and planning – introduction – physical planning of emergency settlement – settlement location and physical layout: implications for water supply and sanitation.

### **Unit 4**

#### **Water Supply & Drainage 6 Hrs**



Water supply – planning and implementation – water sources – treatment – pumping – tinkering – storage – distribution – collection and use – testing. Waste water – storm water – community involvement.

#### **Unit 4**

##### **Excreta Disposal**

**6 Hours**

Phased response – organizational options – staffing needs – monitoring latrine programmers – technical options – options for problem sites

#### **Unit 5**

##### **Solid Waste**

**6 Hours**

Health risk of solid waste from health centers – dead bodies

#### **Text books and Reference Books**

1. Harvey, P.A., Baghri, S. and Reed, R.A. (2002) Emergency Sanitation: Assessment and programme design, WEDC, Loughborough University, UK.
2. Adams, John Managing Water Supply and Sanitation in Emergencies. Oxfam: Oxford.
3. Assar, M. Guide to sanitation in Natural disasters.
4. House, Sarah and Reed, Bob Emergency Water Sources: Guidelines for selection and treatment. WEDC, Loughborough University: Loughborough.

#### **Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination Examination Scheme:**

Components	Internal Assessment	ESE
Weightage (%)	30	70

#### **Relationship between the Course Outcomes (COs) and Program Outcomes (POs)**

<b>Course Outcomes (COs)</b>	<b>Mapped Programme Outcomes</b>
CO1 - To explain the relationship between the environment and water, sanitation ,hygiene and excreta related diseases;	<b>PO9</b>
CO2- To follow standards and key indicators related water supply, sanitation and hygiene in emergencies;	<b>PO9</b>
CO3 - To design Soak pit, Infiltration trench, Evaporation pan for Waste water management	<b>PO9</b>
CO4- To discuss the importance of addressing long term needs of the community at the onset of the emergency and throughout its duration.	<b>PO8</b>
CO5- To identify and control problems in the environment, water, sanitation and hygiene situation during an emergencies;	<b>PO8,PO9</b>
CO6- To apply standards to water supply, sanitation and hygiene in emergencies;	<b>PO8,PO9</b>

<b>Course Code</b>	<b>Course Title</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>
<b>HSFS8010</b>	<b>Water supply, Refugee Health and Sanitation in Emergency</b>								<b>3</b>	<b>3</b>

1=Weakly mapped

2= Moderately mapped

3=Strongly mapped