



# IPS ACADEMY-INSTITUTE OF ENGINEERING & SCIENCE, INDORE

(An Autonomous Institute)

Rajiv Gandhi Proudyogiki Vishwavidyalaya, Bhopal

I Semester Master of Technology (M.Tech.)

**[Industrial Safety Engineering]**

S.No	Subject Code	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per week			Total Credits
			Theory			Practical			L	T	P	
			End Sem.	Mid Sem. Exam.	Quiz/ Assignment	End Sem	Term work Lab Work & Sessional					
1	PSCC-IS101	Industrial Safety Management	70	20	10	-	-	100	3	1	-	4
2	PSCC-IS102	Occupational Health and Hygiene	70	20	10	-	-	100	3	1	-	4
3	PSEC-IS101	Program Specific Elective Course-I	70	20	10	-	-	100	3	-	-	3
4	PSMC-IS101	Probability and Data Analysis	70	20	10	-	-	100	3	-	-	3
5	MLC-1	Program Specific Bridge Course- Fundamentals of Fire and Safety Engineering	70	20	10	-	-	100	3	1	-	2
6	LC- IS101	Occupational Health and Hygiene	-	-	-	60	40	100	-	-	4	2
7	LC- IS102	Fire Engineering	-	-	-	60	40	100	-	-	4	2
8	AUD-1	Disaster Management	-	-	-	-	-	-	2	-	-	0
		Total	350	100	50	120	80	700	17	3	8	20

Program Specific Elective Course (PSEC)-I

PSEC IS-101 (A) Industrial Noise & Vibration Control

PSEC IS-101 (B) Safety in Chemical industries

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<b>PSCC- IS101</b>	<b>Industrial Safety Management</b>	<b>3L:1T:0P (04 hrs)</b>	<b>04Credits</b>
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**Course Objective:**

To impart of knowledge on safety concept, legislation, performance and training in an organization for accident prevention purpose.

**Module 1 (06 Hrs)**

**LEGISLATION:** Objective, Definition, Application & provisions related to safety fire prevention and fire protection in Factories Act 1948, M.P. Factories rules 1962 ,Indian Explosive Act 1884, Gas Cylinder Rules 2004, Petroleum Act 1934 with Rules 2002. Overview of OHSAS 18001.

**Module 2 (08 Hrs)**

**CONCEPTS & TECHNIQUES:** Evolution of modern safety concept- Safety policy - Safety Organization - line and staff functions for safety- Safety Committee- budgeting for safety, incident Recall Technique (IRT), disaster control, Job Safety Analysis (JSA), safety survey, safety inspection, safety sampling, Safety Audit.

**Module 3 (08 Hrs)**

**ACCIDENT INVESTIGATION AND REPORTING:** Concept of an accident, reportable and non reportable accidents, unsafe act and condition –principles of accident prevention, Supervisory role- Role of safety committee – Accident causation models - Cost of accident. Overall accident investigation process - Response to accidents, India reporting requirement, Planning document, Planning matrix, Investigators Kit, functions of investigator, four types of evidences, Records of accidents, accident reports-Class exercise with case study.

**Module 4 (08 Hrs)**

**SAFETY PERFORMANCE MONITORING:** Permanent total disabilities, permanent partial disabilities, temporary total disabilities - Calculation of accident indices, frequency rate, severity rate, frequency severity incidence, incident rate, accident rate, safety “t” score, safety activity rate – problems.

**Module 5 (08 Hrs)**

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

**Course Outcomes:**

At the end of this course student will be able to:

1. Know definition, application & provisions related to safety & fire prevention.
2. Apply the knowledge of safety concept and techniques in conducting plant inspections.
3. Evaluate accident indices used in safety performance monitoring.
4. Contribute in documentation process of accident investigation..
5. Understand the different approaches needed to impart safety education and training.

**List of Text/Reference Books:**

1. Accident Prevention Manual for Industrial Operations”, N.S.C.Chicago, 1982
2. Heinrich H.W. “Industrial Accident Prevention” McGraw-Hill Company, New York, 1980.
3. Krishnan N.V. “Safety Management in Industry” Jaico Publishing House, Bombay, 1997.
4. John Ridley, “Safety at Work”, Butterworth & Co., London, 1983.
5. Blake R.B., “Industrial Safety” Prentice Hall, Inc., New Jersey, 1973
6. All Relevant Acts & Rules.
7. Fire Services Acts & rules of different states.

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<b>PSCC- IS102</b>	<b>Occupational Health &amp; Hygiene</b>	<b>3L:1T:0P (04 hrs)</b>	<b>04Credits</b>
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**Course Objective:**

To learn and teach on different hazards of industrial hygiene associated with physical, chemical, biological & ergonomically with fundamental study in occupational health and toxicology.

**Module 1 (08 Hrs)**

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

**Module 2 (08 Hrs)**

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

**Module 3 (08 Hrs)**

**BIOLOGICAL AND ERGONOMICAL HAZARDS:** Classification of Bio hazardous agents –bacterial agents, , viral agents, fungal, parasitic agents, infectious diseases - Biohazard control program, employee health program-laboratory safety program-animal care and handling-biological safety cabinets - building design. Work Related Musculoskeletal Disorders –carpal tunnel syndrome CTS- Tendon pain disorders of the neck- back injuries.

**Module 4 (08 Hrs)**

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

**Module 5 (08 Hrs)**

**OCCUPATIONAL PHYSIOLOGY:** Man as a system component, allocation of functions, efficiency, occupational work; capacity – aerobic and anaerobic work – evaluation of physiological requirements of jobs; parameters of measurements – categorization of job heaviness – work organization – stress –strain – fatigue – rest pauses – shift work – personal hygiene.

**Course Outcomes:**

At the end of this course student will be able to:

1. Physical Hazards associated with occupancy.
2. Chemical Hazards related in an organization.
3. Biological And Ergonomical Hazards born in an occupational setting.
4. Understand the basic concepts Occupational Health and Toxicology.
5. Apply the knowledge of Occupational Physiology in conducting plant operations.

**List of Text/Reference Books:**

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

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<b>PSEC- IS101(A)</b>	<b>Industrial Noise &amp; Vibration Control</b>	<b>3L:0T:0P (03 hrs)</b>	<b>03Credits</b>
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**Course Objective:**

To understand and learn the noise and vibration sources commonly available in an occupancy with their impact assessment and preventive measures .

**Module 1 (08 Hrs)**

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

**Module 2 (08 Hrs)**

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

**Module 3 (08 Hrs)**

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

**Module 4 (08 Hrs)**

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

**Module 5 (06 Hrs)**

**ABATEMENT OF NOISE:** Active noise attenuators and scope for abatement of industrial noise.

**Course Outcomes:**

At the end of this course student will be able to:

1. Know basic definitions and terminology used in Vibrations and acoustics.
2. Apply the knowledge instrumentation and auditory in relation between subjective and objective sounds.
3. Evaluate sources of noise and ratings with noise legislations.
4. Contribute in NOISE CONTROL through Acoustic treatment and materials.
5. Understand the active noise attenuators and scope for abatement of industrial noise.

**List of Text/Reference Books:**

1. Irwin, J.D and Graf, E. R, Noise and Vibration Control, Prentice Hall Inc. New Jersey, 1979.
2. Irwing B Crandall, Theory of Vibrating Systems and Sound, D. Van Nostrand Company, New Jersey,
3. Cyril M. Harris, Hand Book of Noise Control, McGraw Hill Book Company, New York, 1971.
4. White R. G. Walker J. G, “Noise and Vibration”, John Wiley and sons New York, 1982.
5. Ambekar AG; Mechanism and Machine Theory; PHI

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<b>PSEC- IS101(B)</b>	<b>Safety In Chemical Industries</b>	<b>3L:0T:0P (03 hrs)</b>	<b>03Credits</b>
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**Course Objective:**

To understand the key concepts of chemical safety aspect in process design, plant commissioning and operation with preventive maintenance and emergency planning

**Module 1 (08 Hrs)**

**SAFETY IN PROCESS DESIGN AND PRESSURE SYSTEM DESIGN:** Design process, conceptual design and detail design, assessment, inherently safer design chemical reactor, types, batch reactors, reaction hazard evaluation, assessment, reactor safety, operating conditions, unit operations and equipments, utilities. Pressure system, pressure vessel design, standards and codes- pipe works and valves- heat exchangers- process machinery- over pressure protection, pressure relief devices and design, fire relief, vacuum and thermal relief, special situations, disposal- flare and vent systems failures in pressure system.

**Module 2 (08 Hrs)**

**PLANT COMMISSIONING AND INSPECTION:** Commissioning phases and organization, pre-commissioning documents, process, commissioning, commissioning problems, post commissioning documentation, Plant inspection, pressure vessel, pressure piping system, non destructive testing, pressure, testing, leak testing and monitoring- plant monitoring, performance monitoring, condition, vibration, corrosion, acoustic emission-pipe line inspection.

**Module 3 (08 Hrs)**

**PLANT MAINTENANCE, MODIFICATION AND EMERGENCY PLANNING:** Management of maintenance, hazards- preparation for maintenance, isolation, purging, cleaning, confined spaces, permit system- maintenance equipment- hot works- tank cleaning, repair and demolition- online repairs- maintenance of protective devices- modification of plant, problems- controls of modifications. Emergency planning, disaster planning, onsite emergency- offsite emergency, APELL

**Module 3 (08 Hrs)**

**STORAGES AND TRANSPORTATION:** General consideration, petroleum product storages, storage tanks and vessel- storages layout segregation, separating distance, secondary containment- venting and relief, atmospheric vent, pressure, vacuum valves, flame arrestors, fire relief- fire prevention and protection- LPG storages, pressure storages, layout, instrumentation, vaporizer, refrigerated storages- LNG storages, hydrogen storages, toxic storages, chlorine storages, ammonia storages, other chemical storages- underground storages- loading and unloading facilities- drum and cylinder storage- ware house, storage hazard assessment of LPG and LNG Hazards during transportation – pipeline transport

**Module 4 (08 Hrs)**

**PLANT OPERATIONS:** Operating discipline, operating procedure and inspection, format, emergency procedures and over and permit system- start up and shut down operation, refinery units- operation of, fired heaters, driers, storage- operating activities and hazards- trip systems- exposure of personnel, Specific safety consideration for Cement, paper, pharmaceutical, petroleum, petro- chemical, rubber, fertilizer and distilleries.

**Course Outcomes:**

At the end of this course student will be able to:

1. Evaluate the principles and practices of safety in process design and pressure system design.
2. Know the basic fundamentals in plant commissioning and inspection.
3. Contribute in prevention, mitigation preparedness, response and recovery process in major accidents.
4. Understand the different approaches needed to manage storages and transportation of chemicals with in the plant.
5. Apply the knowledge in conducting plant operations

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**List of Text/Reference Books:**

1. Lees, F.P. "Loss Prevention in Process Industries" Butterworths and Company, 1996.
2. Quantitative Risk Assessment in Chemical Process Industries" American Institute of
3. Chemical Industries, Centre for Chemical Process safety.
4. Fawcett, H.h. and Wood, "Safety and Accident Prevention in Chemical Operations" Wiley
5. Accident Prevention Manual for Industrial Operations NSC, Chicago, 1982.
6. GREEN, A.E., "High Risk Safety Technology", John Wiley and Sons., 1984.
7. Carbide of Calcium Rules, Government of India

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<b>PSMC- IS101</b>	<b>Probability and Data Analysis</b>	<b>3L:0T:0P (03 hrs)</b>	<b>03Credits</b>
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**Course Objective:**

To understand the basic concept of probability and perform the data analysis with suitable Forecasting in research and project phases.

**Module 1** **(08 Hrs)**

**DATA COLLECTION:** Primary and secondary sources of data, Survey design, Sources of various data in India, Data presentation: Classification of data, Tabulation of data, Charting of data, Choice of suitable diagrams.

**Module 2** **(08 Hrs)**

**DATA ANALYSIS:** Measures of central tendency: Characteristics of a good average, Arithmetic mean, Median, Mode, Geometric mean and Harmonic mean, Measures of variation: Significance of measuring variation, Methods of studying variation, Average deviation, Standard deviation, Skewness, Moments and kurtosis: Measures of skewness, Moments, Kurtosis.

**Module 3** **(08 Hrs)**

**PROBABILITY AND DATA SAMPLING PROBABILITY:** Types of probability, Random variable, Probability function, Sampling: Purpose and Principle of sampling, Methods of sampling, Size of sample, Merits and Limitations of sampling, Sampling distribution.

**Module 4** **(08 Hrs)**

**STATISTICS:** Correlation analysis: Significance, Correlation & causation, Types of correlation, Methods of studying correlation, Multiple correlation, Regression analysis: Difference between correlation and regression, Bivariate linear regression model, Regression lines and regression coefficients, Index numbers: Use of index numbers, Unweighted index numbers, Weighted index numbers, Quantity index numbers, Volume index numbers, Test for perfections.

**Module 5** **(08 Hrs)**

**FORECASTING AND TIME SERIES ANALYSIS:** Forecasting: Introduction, Steps in forecasting, Methods of forecasting, Time series analysis: Components of time series, Straight line trends, Non-linear trend, Linear programming & hypothesis testing, Linear programming: Methods for maximizing, Methods for minimizing, Input-Output analysis, hypothesis testing: Chi ( $\chi^2$ ) test, z-score test, t-test, Test for proportion.

**Course Outcomes:**

At the end of this course student will be able to:

1. Apply fundamental concepts in exploratory data collection to Fire & Safety engineering problems.
2. Explore the fundamental concepts of data analysis in Fire & Safety engineering problems.
3. Apply the probabilistic technique and sampling technique in Fire & Safety engineering problems.
4. Apply various statistical techniques to Fire & Safety engineering projects.
5. Apply different forecasting analysis & time series analysis on suitable data.

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**List of Text/Reference Books:**

1. Mohammed J. Zaki, Wagner Meira, Data Mining and Analysis, Cambridge, 2012
2. M. K. Jain, Numerical solution of differential equations, John Wiley & Sons, 2010.
3. R. N. Bracewell, Fourier Transform & Its Applications, Tata McGraw Hill, 2014.
4. T. J. Ross, Fuzzy Logic with Engineering Application, Wiley publisher, 2016.
5. S. Ross, A First Course in Probability, Pearson education India, 6<sup>th</sup> edition, 2018.
6. R. J. Beerwends, Fourier and Laplace transform, Cambridge university press, 2003.
7. P. G. Hoel, S. C. Port, C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003.
8. Alberto Leon-Garcia, Probability and Random Processes for Electrical Engineering, Pearson, 2008.
9. N.W. McLachlan, Laplace Transforms and Their Applications to Differential Equations, Dover Publications, 2014.
10. Douglas C. Montgomery, Applied Statistics and Probability for Engineers, 5<sup>th</sup> Edition, Wiley India, 2012



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<b>MLC- 1</b>	<b>Program Specific Bridge Course- Fundamentals of Fire and Safety Engineering</b>	<b>3L:1T:0P (04 hrs)</b>	<b>02Credits</b>
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**Course Objective:**

To understand and learn the basic essentials fundamentals in fire technology & safety engineering discipline.

**Module 1 (08 Hrs)**

**BASICS OF FIRE AND FIRE SCIENCE:** Chemistry and Physics of Fire, Theory of Fire Extinguishment, combustion process, extinguishment with water, extinguishment with aqueous foams, extinguishment with water mist, extinguishment with inert gases, extinguishment with halogenated agents,

**Module 2 (08 Hrs)**

**FUNDAMENTALS OF FIRE DETECTION-** simplified fire development, fire signatures, characteristics of fire signatures, aerosol signatures, energy release signatures, gas signatures, other fire signatures, basics of passive fire protection, stages of fire development, flame spread, Smoke and Toxicity.

**Module 3 (08 Hrs)**

**FIRE FIGHTING INSTALLATION-** Water Based Fire Protection, Hydrant system, Automatic Sprinkler System, High Velocity Water spray system, Foam Based Fire Protection, Gas Based Fire Protection, Co2 flooding system, Co2 local application system, Dry Chemical Based Fire Protection System, DCP fixed installation and local application system.

**Module 4 (08 Hrs)**

**INDUSTRIAL LABOUR LEGISLATION:** Labour Legislations in India-Principles Of Labour Legislation- Social Justice, Social Equity, National Economy. Classification Of Labour Laws- Purpose, Legislature, Period Of Enactment. The Factories Act, 1948-Main Provisions Of The Act, Health And Hygiene (Sec11-20), Safety Provisions (Sec 21- 41)

**Module 5 (08 Hrs)**

**ACCIDENT INVESTIGATION AND REPORTING-** Concept of an accident, Reportable and non reportable accidents, Reporting to statutory authorities, Principles of accident prevention, Accident investigation and analysis, Records for accidents, Departmental accident reports, Documentation of accidents, Unsafe act and condition, Domino sequence, Supervisory role, Role of safety committee, Cost of accident.

**Course Outcomes:**

At the end of this course student will be able to:

1. Apply fundamental concepts of fire and its extinguishment.
2. Understand the fundamentals of fire detection & interpret in fire detection system design.
3. Understand various types of fire fighting installation.
4. Know about industrial labour legislation.
5. Understand accident investigation and reporting process .

**List of Text/Reference Books:**

1. Heinrich H.W. Industrial Accident Prevention McGraw - Hill Company, New York,1980.
2. Krishnan N.V. Safety Management in Industry Jaico Publishing House, Bombay,1997.
3. Lees, F.P., Loss Prevention in Process Industries Butterworth publications, London, 2<sup>nd</sup> edition, 1990.
4. John Ridley, Safety at Work, Butterworth and Co., London, 1983.
5. Fred Stowell, Principles of Foam Fire Fighting International Fire Service Training Association.
6. Robert M Gagnon, Designer's Guide to Automatic Sprinkler Systems, NFPA-2005.
7. Operation of Fire Protection System NFPA Special Edition.
8. Tariff Advisory committee, Fire Protection Manual- Hydrant System.

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<b>LC- IS101</b>	<b>Occupational Health and Hygiene</b>	<b>0L:0T:4P (04 hrs)</b>	<b>02Credits</b>
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Practical /lab work / case studies related occupational health and hygiene, student is required to submit a journal/report for the same.

**List of Experiment:**

1. To carry out survey of noise level by Integrated Sound Level Meter.
2. To evaluate the lung function capacity of human body by Spirometer.
3. To monitor the presence of Ammonia and its control measures.
4. To diagnose the personal hearing capability and hearing loss by the use of pure tone audiometer (Arphi 500 series)
5. To detect the presence of flammable gas by the use of flammable gas detection monitor.
6. To carry out the air sampling survey and dust monitoring using air sampling pump.
7. To evaluate noise dose for a personnel working in noisy area with the help of noise dosimeter.
8. To carry out survey of illumination levels by use of Lux meter.
9. To study the basic anatomy, Physiology & pathology of Human Systems.
10. To study, the Industrial toxicology with the help of common toxicants inside the industry.
11. To study the industrial hygiene related Government regulation & their Impact on Environment.
12. To study the Industrial Hygiene control methods.
13. Study the overview of Industrial Hygiene.

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<b>LC- IS102</b>	<b>Fire Engineering</b>	<b>0L:0T:4P (04 hrs)</b>	<b>02Credits</b>
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**Course Objective:**

Practical /lab work / case studies related fire engineering, student is required to submit a journal/report for the same.

**List of Experiment:**

1. To study the operation, maintenance & Installation criteria for portable fire extinguishers.
2. To study the different periodic check's for maintenance of Hydrant Systems & Sprinkler Systems.
3. To study the mechanism of combustion for Gas/Vapour & air mixtures.
4. To study the mechanism of fire extinguishment with relevant extinguishing media based on combustible materials.
5. To study the passive fire protection system inside the Industrial Occupancies.
6. To perform the abrasion resistance test on hose pipes of different material using hose pressure testing machine.
7. To perform and practice the transformer fire extinguishment using water mist store pressure type portable fire extinguisher.
8. To perform and practice the filling and refilling procedure for Gas Cartridge water and foam types Fire Extinguishers.
9. To perform and practice the water based fire fighting operations using different hand held branch pipe

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<b>AUD- 1</b>	<b>Disaster Management</b>	<b>2L:0T:0P (02 hrs)</b>	<b>0Credits</b>
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**Course Objective:**

To understand the fundamentals approaches of disaster risk reduction & relationship between vulnerability, disaster, disaster prevention and risk reduction.

**Module 1 (08 Hrs)**

Types and consequence of major accident hazards, Role of management, Local authorities and public, Disaster Management rehabilitation Cycle - Prevention, Mitigation, Preparedness, Disaster impact, Response, Restoration, Reconstruction, Onsite & offsite emergency planning; Emergency preparedness, rehearsal & exercises.

**Module 2 (06 Hrs)**

Role of Insurance in Disaster Management, Role of International co-operation (i.e. NGO & UN Agencies), Effect on environment due to disaster. Need for National Capacity Building and Disaster Knowledge Network

**Module 3 (06 Hrs)**

The Disaster Management Act:: Need for technological input in disaster mitigation, community based disaster preparedness program; Preparation of Disaster Management; Plan Early Warning System; Role of Information Technology (IT)

**Module 4 (06 Hrs)**

Natural Disaster like Earthquake, Mine fire, flood etc, Dangerous properties of some highly hazardous chemicals, Industrial Disaster due to toxic gas release, Fire or Explosion, Case - Studies.

**Module 5 (08 Hrs)**

Accident related Disasters (Forest fires, Air, road, & Rail Accidents, Rural & Urban Fires, Oil Spills, Major building collapse etc, Case Studies.

**Course Outcomes:**

At the end of this course student will be able to:

1. Evaluate the principles and practices of disaster risk reduction and management.
2. Know the basic role of public, national/international organizations in disaster management.
3. Prevention, mitigation preparedness, response and recovery process in disaster management.
4. Understand distinguish between the different approaches needed to manage pre-during and post disaster periods.
5. Apply the knowledge in conducting independent DM study including data search and analysis from disaster case study.

**List of Text/Reference Books:**

1. Disaster Management Act 2005
2. Industrial Security Management S.C. Dey
3. Dangerous Properties of Industrial Material □ Irvin Sex.
4. Encyclopedia of occupational Health & Safety (OSHA) IV edition.
5. Safe Handling of Hazardous Chemicals by Rohatgi.
6. Industrial Fire Hazards Hand Book (NFPA)
7. Major Hazard Control I.L.O. Geneva.
8. What went wrong-Trevor Kletz.
9. Chemical process safety □ Daniel . A. Crawl, Joseph F Louver.
10. Madhya Pradesh Control of Industrial Major Accident Hazards rules 1999.