

**IPS Academy, Institute of Engineering & Science**  
**(A UGC Autonomous Institute, Affiliated to RGPV, Bhopal)**  
New Scheme & Syllabus Based on AICTE Flexible Curricula **(B. Tech)**  
**Fire Technology & Safety Engineering**

<b>POEC- FT (1)</b>	<b>Fundamentals of Fire and Safety</b>	<b>3L:0T:0P (03 hrs)</b>	<b>03Credits</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 .

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**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>POEC- FT (2)</b>	<b>Occupation Health &amp; First Aid</b>	<b>3L:0T:0P (03 hrs)</b>	<b>03 Credits</b>
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**Course Objective:**

To understand the basics of occupational health with associated hazards and perform first aid techniques in minor injuries at workplace.

**Course Content:**

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

**OCCUPATIONAL HEALTH:** Common occupational diseases such as silicosis, asbestosis, and toxicity related to lead, nickel, chromium, and manganese. Causation of diseases and its effects. Methods of prevention. Compensation of occupational diseases. Occupational dermatitis, occupational cancers, Medical examination of workers, occupational health center, health records, fundamentals of first aid.

**Module 2** **(06 Hrs)**

**CHEMICAL HAZARDS:** Dangerous properties of chemicals, dust, gases, fumes, mists, vapors and smoke. Exposure evaluation and air sampling, There sold limit values. Chlorine Exposure effects. Personal monitoring. Introduction to chemical processes and safety. Storage, Transport and handling of hazardous chemicals. Industrial ventilation. Natural ventilation. Opening in work area.

**Module 3** **(06 Hrs)**

**PHYSICAL HAZARDS:** Improper illumination, Thermal radiation, ultra violet radiation, ionizing and non ionizing radiation. Preventive and control measures. Noise-Measurement, Noise-control techniques – Noise Survey, vibration. Thermal stress, heat balance, heat-stress, heat disorders, control measures.

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

**FIRST AID:** Definition; qualities of duties, tasks, Study of the human body and its various systems: Skeleton system, Digestive system, Respiratory system, Circulatory system, Central Nervous system & their functions, Practical study of this part to include demonstrations of the human body with structural details of its various parts as seen externally and examination of its install functions such as pulse, breathing, movements of the chest and abdomen, movements of various joints of the body with structural changes in the body parts while making three movements.

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

**CASUALTY HANDLING:** Casualty handling including observation, maintenance of observation charts, treatment administered, temperature-pulse-respiration records, application of suction, appropriate positioning of casualties affected by head injuries, chest injuries, abdominal injuries, bleeding, shock, asphyxia etc. Transportation of causalities on stretches, across plain ground, through obstacles, stretcher drill, loading and unloading of causalities in stretches and ambulances, Ambulance installations and their use in causalities during transportation etc

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**Course Outcome:**

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

1. Understand the occupational health and common occupational diseases at workplace.
2. Identify the chemical hazards and their control measures.
3. Familiar the physical hazards and their control measures.
4. Understand the basic human body and its various systems.
5. Demonstrate First Aid techniques concerning to minor injuries at workplace.

**List of Text/Reference Books:**

1. Occupational Health & Safety in manufacturing Industries – M K Potty.
2. Diseases of occupation – D. Hunter.
3. Code of Practice for Hazardous goods by NFPA
4. Dangerous properties of Industrial materials by Irvin Sex.
5. Edward T Dickinson , Fire Service emergency care, , Braddy.
6. L.G Gupta & Abhitabh Gupta , First Aid, Jaypee Brothers.
7. Watson Jones Fractures and Joint Injuries :
8. Cantlie, James, First Aid to injured, St John Ambulance Association

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<b>POEC- FT (3)</b>	<b>Fire Protection in High Rise Buildings</b>	<b>3L:0T:0P (03 hrs)</b>	<b>03 Credits</b>
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**Course Objective:**

To understand types of buildings, services and maintenance management with basic fire fighting installation using different extinguishing medias.

**Course Content:**

**Module 1 (08 Hrs)**

**BUILDING STUDIES:** Basic Terminology, Elements of Structure, Fire Test, Standard time, Temperature relationship, Non combustibility test, Ignitibility test, Fire Propagation test, Performance criteria for fire resistance, Fire resistance rating of structural elements, Type of Building construction, Classification of building based on occupancy, Fire zones.

**Module 2 (08 Hrs)**

**MODEL FIRE AND LIFE SAFETY REQUIREMENT:** Residential buildings, Educational buildings, Institutional buildings, Assembly buildings, Business buildings, Industrial buildings, Storage buildings and Hazardous buildings, Life Safety requirement in Underground structure, Basement protection, Fire Protection in Building under construction, Fire Control Room.

**Module 3 (06 Hrs)**

**FIRE PROPAGATION:** Spread of flames in solids and liquids, linear and three dimensional fire propagation; Smoke, Constituents of smoke, quantity and rate of production of smoke, quality of smoke, smoke density, Visibility in smoke, principles of spreading quantity of smoke, smoke movement; Pressurization modeling of smoke movement; Toxicity of smoke- effect of harmful agents preventing escape and causing injury or death - CO, CO<sub>2</sub>, Nitrogen oxide, Sulphur dioxide.

**Module 4 (08 Hrs)**

**COMPARTMENT FIRE:** Stage of fire development, fire induced flows, compartment flow dynamics, single room fire analysis, Model of enclosures fires, theory & concepts of zone models, Dynamics of enclosure fire: Heat release, fire generated flows, heat transfer & flow through openings. Zone modeling of pre flashover enclosures fire: Flame & burning object, source terms, fire plume source terms. Hot layer source terms, product of combustion source terms one zone modeling of pool flash fire

**Module 5 (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, Co<sub>2</sub> flooding system, Co<sub>2</sub> local application system, Dry Chemical Based Fire Protection System, DCP fixed installation and local application system.

**Course Outcome:**

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

1. Understand types of buildings and classification of occupancy.
2. Explain fire and life safety requirements in each type of building/ occupancy.
3. Have knowledge of fire propagation and spread within the enclosed building.
4. Develop models on compartment fire in different category and scenarios.
5. Have knowledge of fire fighting installation based on extinguishing medias.

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**List of Text/Reference Books:**

1. V.K. Jain. Fire Safety in Buildings. Taylor & Francis
2. D.J. Rasbash. Evaluation of Fire Safety, Willey
3. Gupta R.S., A Hand Book of Fire Technology,
4. T.W.MEVER Building Services Design.
5. LEE Building Maintenance Management

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<b>POEC- FT (4)</b>	<b>Safety in Construction</b>	<b>3L:0T:0P (03 hrs)</b>	<b>03 Credits</b>
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**Course Objectives:**

To learn and understand the modern safety and health regulations and the Indian Standards applicable to the construction industry.

**Course Content:**

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

**BASIC PHILOSOPHY:** Building Bye laws for Residential Area, Cinemas, Theatres, Multiplex, Auditorium etc., Drive-in-Cinemas, Gasoline Filling Station, Basic Philosophy and parameters governing in construction such as site planning and layout, safe access and good housekeeping, safety in use of construction machinery, structural soundness, structural safety, accident causes and its effect.

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

**WORKING AT HEIGHT:** Fall protection in construction, OSHA 3146, Requirement for working at height, Work permit system, Height pass, Salient Features of safety and health in the Building & other Construction Workers (Regulation of employment and conditions of service) Act. 1996 and Central Rules 1998 IS & NB codes)

**Module 3** **(06 Hrs)**

**SAFETY IN DEMOLITION OPERATIONS:** Planning & permit, Precautions prior to demolition, Protection of public, Precautions during demolition. Sequence of demolition operations from safety point of view, Safety measures with respect to building materials including cement, lime, timber, steel, glass, paints, varnishes, and petroleum products

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

**SAFETY IN CONSTRUCTION OPERATIONS I :** Underground works Excavation, drilling & blasting, trenching, strutting, piling & safety in using and operation machinery and equipment relating to above components. Above ground works, Scaffolding, Centering, Frame work, Ladders, Concreting wall and floor openings, staircases and railings. Structural steel work including welding, cutting erection, Safety in use of related machinery equipments,

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

**SAFETY IN CONSTRUCTION OPERATIONS II :** Under water operations, River draining, well sinking, Caissons, under water concreting, Cofferdams & special operation connected with irrigation works, Use of related machinery and equipments, Movement of Materials & personnel, Heavy/Long items, Railway wagons, Motor trucks, Vehicles and Hazardous materials, High rise building, bridges, roads, railways, asphaltting, pneumatic caissons, electrical, installations & lifts, safety in prevention and protection at work site including collapsing of structures

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**Course Outcome:**

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

1. Understand philosophy and parameters governing in construction Industry.
2. Demonstrates the working at height operation and apply applicable rules and act in Indian scenarios.
3. Explain safety in demolition operations involved with construction industry.
4. Understand safety in construction operation specifically underground works excavation.
5. Understand safety in construction operation specifically under water operations.

**List of Text/Reference Books:**

1. Hinze, J.W. (1997) Construction Safety, Prentice Hall
2. Mac Collum, D.V. (1995) Construction Safety Planning, John Wiley & Sons
3. Reese, C.D. & Eidson, J.V. (2006) Handbook of OSHA Construction Safety and Health, Taylor & Francis.
4. Lingard, H. & Rowlinson, S. (2005) Occupational health and Safety in Construction Project Management, Spon Press.
5. Holt, A.S.J. (2005) Principles of Construction Safety, Wiley-Blackwell Publishers
6. MacCollum, D.V. (2007) Construction Safety Engineering Principles, McGraw Hill Publishers
7. Bhattacharjee, S.K. (2011) Safety Management in Construction, Khanna Publishers
8. Li, R.Y.M. & Poon, S.W. (2013) Construction Safety, Springer Publishers Few IS Codes & journal papers
9. Fulman, J.B., 1979 Construction Safety, Security & Loss Prevention, John Wiley and Sons,



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<b>POEC- FT (5)</b>	<b>Explosions and Safety</b>	<b>3L:0T:0P (03 hrs)</b>	<b>03 Credits</b>
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**Course Objectives:**

To understand and learn simple modeling of blast waves derived from energy release in explosions, predictions for the damage caused by explosions and methods of ensuring safety.

**Course Content:**

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

**INTRODUCTION:** Loud Bang and Disruption Blast Wave in an Explosion; Prediction from Dimensional Considerations Typical Examples of Explosions and Classification Theory of Blast Waves Shock Hugoniot and Rayleigh Line Properties behind Constant Velocity Shock Blast waves; Concentration of Mass at Front, Snow Plow Approximation.

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

**BLAST WAVE IMPACT :** Characteristics of Blast Waves Decay of a Blast Wave, Sach's Scaling Overpressure and Impulse in the near and Far Field Missiles, Fragments and Shrapnel, Craters Interaction of Blast with Objects and Structures Reflection and Transmission of Blast Waves, Impedance Amplification of Reflected Blast waves, Spall, Damage to Organs, Mushroom Cloud.

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

**EXPLOSION ENERGY:** Energy Release in an Explosion Energy Release in a Chemical Reaction, Standard Heats of Formation Stoichiometry, Equivalence Ratio and Heat Release in Fuel-rich and Oxidizer-rich Compounds Energy release calculations, Higher and Lower Calorific Values, Internal Energy of Formation Rate of Energy Release Concentration, Activation Energy, Energy Release Profile Thermal Theory of Explosions Application of Thermal Theory and Inferences.

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

**EXPLOSION MODELING:** Modeling of Rate of Energy Release Role of Chain carriers in an explosion Fire and Combustion Combustion and Explosions Case Histories of explosions involving Volatile Liquids Detonations Introduction to Detonations Structure of Detonation Realizable States in a Detonation One Dimensional Model of a Detonation Case Histories of explosions Involving Detonation or Quasi-Detonation.

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

**EXPLOSION TYPES:** Different Types of Explosions Explosions in Confined and Unconfined Geometries Dust Explosion I Dust Explosion II Physical Explosions Rupture of Cryogenic Storage Vessels and Pressure Vessels Condensed Phase Explosions Condensed Phase Explosives based on Hydrocarbons Condensed Phase explosives and their Properties TNT Equivalence and Yield of an Explosion Quantification of damages in an Explosion.

**Course Outcome:**

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

1. Know concept of blast wave belongs to different types of explosions.
2. Calculate the impact of blast wave on objects and building structure.
3. Understand the fundamentals of explosion energy and rate of energy release.
4. Develop one dimensional model of a detonation involving volatile liquids.
5. Have knowledge of explosion types and their properties.

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**List of Text/Reference Books:**

1. Baker, W.E., Explosions in Air, University of Texas Press, Austin, 1973
2. Ramamurthi, K. Explosions and Explosion Safety, McGraw Hill, New Delhi, 2011
3. Crowl, D. A. and Louvar, J.F., Chemical Process safety, Prentice Hall, NJ, 2002
4. Stull, D.R., Fundamentals of Fire and Explosion, AIChE Monograph Series, Vol. 73, No. 10,1977
5. Kinney G. F. and Graham K. J., Explosive Shocks in Air, Springer, Berlin, 1985
6. Cooper P. W. and Kurowski S.R., Introduction to the Technology of Explosives, Wiley-VCH, New York, 1966

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<b>POEC- FT (6)</b>	<b>Disaster Preparedness &amp; Planning</b>	<b>3L:0T:0P (03 hrs)</b>	<b>03 Credits</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. What went wrong-Trevor Kletz.
8. Chemical process safety □ Daniel . A. Crawl, Joseph F Louver.
9. Madhya Pradesh Control of Industrial Major Accident Hazards rules 1999.

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<b>POEC- FT (7)</b>	<b>Insurance &amp; Risk Management</b>	<b>31:0T:0P (03 Hrs)</b>	<b>03 Credits</b>
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**Course Objective:**

The objectives of this course are to explain to the student operations of upcoming insurance and banking sector, statutory requirements and understanding of financial environment and market in which they operate.

**Course Content:**

**Module 1** **(08 hrs)**

**Insurance and Risk Management:** Introduction to risk, Nature & types of risks, Risk Management Process, Risk and its relation with Insurance, General principles of Insurance, Insurance Terminology, Insurance Application and Acceptance Procedure.

**Module 2** **(08 hrs)**

**Life Insurance:** Principles, Products Term Insurance, Endowment Insurance, Pensions, Annuities. Claim Management, Premium payment lapse and Revival, Premium Calculations, Concept of Mortality tables, Assignment, Nomination, Loans, Surrenders, Foreclosure, Reinsurance, Bank assurance, Underwriting Actuarial Profession.

**Module 3** **(06 hrs)**

**General Insurance:** Principles, Products Fire, Marine, Motor Vehicles, Public Liability, Commercial, Medi-claim and Health Policies, Group Insurance, Crop Insurance etc.

**Module 4** **(08 hrs)**

**Life Insurance Policies:** Applications in different situations; Important life insurance policies; Life insurance annuities; Important legal provisions and judicial pronouncements 20% in India.

**Module 5** **(06 hrs)**

**Insurance Regulatory and Development Authority (IRDA):** Functions & importance of IRDA, Legislation on Advisors, Brokers, Corporate Agents, Agents, TPA, Recent developments.

**Course Outcome:**

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

1. Understand the principles of Insurance and their applications.
2. Describe fundamental theories on life insurance.
3. Demonstrate the basic concepts of general insurance.
4. Understand the life insurance policies and judicial pronouncements in India.
5. Describe function and importance of IRDA

**List of Text/Reference Books:**

1. M. N. Mishra; Insurance Principles & Practice; S. Chand & Co. New Delhi
2. R. M. Shrivastava; Management Of Indian Financial Institutions; Himalaya Publications, New Delhi
3. Arondekar; Principles Of Banking; Iibf; Macmillan India Ltd.
4. Ajay Kumar; Risk Management; Iibf; Macmillan India Ltd.
5. Timothy Koch And S. Mac Donald "Bank Management" New York, Dryden Press
7. Mishra M. N. Life Insurance Corporation Of India- I, II & III Vol. Raj Book & Subscription, Jaipur