

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

POEC- FT (1)	Fundamentals of Fire and Safety	3L:0T:0P (03 hrs)	03Credits
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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, 2nd 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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POEC- FT (2)	Occupation Health & First Aid	3L:0T:0P (03 hrs)	03 Credits
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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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POEC- FT (3)	Fire Protection in High Rise Buildings	3L:0T:0P (03 hrs)	03 Credits
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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, CO₂, 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, Co₂ flooding system, Co₂ 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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POEC- FT (4)	Safety in Construction	3L:0T:0P (03 hrs)	03 Credits
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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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POEC- FT (5)	Explosions and Safety	3L:0T:0P (03 hrs)	03 Credits
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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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POEC- FT (6)	Disaster Preparedness & Planning	3L:0T:0P (03 hrs)	03 Credits
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Course Objective:

To understand and learn the basic essentials act and standards in disaster management preparedness and national capacity building.

Module 1 (08 Hrs)

INTRODUCTION TO DISASTER AND DISASTER MANAGEMENT: Disaster definition, types, their variation, causal factors, disaster management concept, Disaster Management cycle and developmental considerations.

Module 2 (08 Hrs)

DISASTER PREVENTION AND MITIGATION: Primary and secondary prevention, objectives, means of emerging management actions, mitigation, objectives and various mitigation measures.

Module 3 (08 Hrs)

PLANNING FOR DISASTER PREPAREDNESS: For Community; for people with special needs, with respect to infrastructure, housing and live stock; with respect to contingency health care services, control of outbreak of communicable diseases.

Module 4 (08 Hrs)

ROLES AND RESPONSIBILITIES IN DISASTER PREPAREDNESS : Central, State, District and Local Administration; Armed Forces, Paramilitary Forces, National Service and Scouts; Non Governmental Organisations, community based organizations; International Agencies; Community; family and individuals; Media..

Module 5 (08 Hrs)

DISASTER MITIGATION: Principles, approaches, techniques; education and training; community participation, disaster mitigation strategies Role of Technology in Disaster preparedness, Information technology; Geographical information system; communication technology; emerging technologies.

Course Outcomes:

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

1. Know about the different types of disasters and their cycles.
2. Understand the fundamentals of disaster prevention and mitigation.
3. Plan various types of disaster preparedness strategies with different resources.
4. Develop roles and responsibilities of various agencies involve in disaster management
5. Understand principles, approaches and techniques involved in disaster mitigation process.

List of Text/Reference Books:

1. Disaster Management : Text and Case Studies - DBN Murthy, Deep and Deep Publication, New Delhi.
2. National Policy on Disaster Management-2009
3. Hyogo Framework for Action 2005-15
4. International Humanitarian Law Hans Peter Gasser-1993
5. International Humanitarian Law, Larry May Bee, Benarjii Chakka

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POEC- FT (7)	Disaster Mgt, Laws, Policies & Regulation	3l:0T:0P (03 Hrs)	03 Credits
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Course Objective:

To understand and learn the basic essentials act and standards in disaster management preparedness and capacity building.

Module 1 (08 Hrs)
DISASTER MANAGEMENT LAWS & REGULATION: Disaster Management Act 2005, Environmental protection act 1986, Hyogo Framework for Action 2005-2015, Biosafety Categena protocol, Kyoto protocol, Montreal protocol, Yokohoma strategies, U.N.O's International decade for Natural Disaster Reduction.

Module 2 (08 Hrs)
BUSINESS LAWS: Indian Contract Act 1872, The company's act 1956, Law of Intellectual Property, I (D & R) Act : Regulation of scheduled industries, powers of IDRA, industrial licensing.

Module 3 (08 Hrs)
DISASTER POLICIES AND FRAMEWORK: Disaster Management Policy: Concept, principles, constitutional elements, Disaster Management Policies of Different States (eg. MP, Gujrat, Orissa, Uttranchal, Delhi etc.), Countries (Japan, South Asian Countries, USA etc.)

Module 4 (08 Hrs)
MEANING, NEED AND PROCESS OF STRATEGIC MANAGEMENT: Business Policy, Corporate Planning and Strategic Management: Single and Multiple SBU organisations: Strategic Decision Making Processes Rational Analytical Intuitive-Emotional. Political Bhavioural, Universality of strategic Management, Strategists at corporate level and at SBU level; Interpersonal informational and decision roles of a manager.

Module 5 (08 Hrs)
STRATEGY IMPLEMENTATION: Implementation process; resource allocation; organizational implementation plan and policy implementation; Leadership Implementation; Implementing strategy in International setting.

Course Outcomes:

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

1. Know about the disaster management laws in the country with applicable regulations.
2. Familiar with business laws and their application.
3. Understand the disaster policies framework in our country.
4. Develop strategies management against familiar disaster.
5. Implement different strategies in disaster management.

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List of Text/Reference Books:

1. Lawrence R Jauch and William F. Glueck, "Business Policy and Strategic Management" McGraw Hill Book Co. New York.
2. Glen Boseman and Arvind Phatak, "Strategic Management : Text and Cases" John Wiley and Sons, Singapore.
3. Daniel J. Mearthy, Robert J. Minichicillo, and Joseph R. Curran "Business Policy and Strategy" Richard D. Irwin, AITBS, New Delhi.
4. Disaster Management Act-2005
5. National Policy on Disaster Management-2009
6. Hyogo Framework for Action 2005-15
7. International Humanitarian Law Hans Peter Gasser-1993
8. International Humanitarian Law, Larry May Bee, Benarjii Chakka

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POEC- FT (8)	Insurance & Risk Management	31:0T:0P (03 Hrs)	03 Credits
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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
6. Mishra M. N. Life Insurance Corporation Of India- I, II & III Vol. Raj Book & Subscription, Jaipur

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POEC- FT (9)	Chemical Process Safety	31:0T:0P (03 Hrs)	03 Credits
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Course Objective:

To understand and learn the important technical fundamentals of chemical process safety with basics of safety.

Course Content:

Module 1

(06 Hrs)

INTRODUCTION : Safety, Hazards and Risk, Elements of process safety management, Features and characteristics of a management system for process safety, Process Safety, Inherent Safety, Hazard Identification ,Risk Assessment, Safety and Accident Loss Statistics, OSHA incidence rate, Fatal accident rate(FAR),Fatality rate.

Module 2

(08 Hrs)

RISK MANAGEMENT AND CONTROL MEASURES: Hazardous substance rules 1986, Factories Act 1948, EPA rules, Class Label Nature of Accident, Introduction of Four significant disasters of world Flixborough, Seveso, Bhopal, Jaipur Accident Types of Chemical Plant Causes of over pressurization Heat of Reaction Adiabatic Temperature Rise Arrhenius relationship Thermal runaway Phi factor Heat loss (changes with scale) Reagent accumulation Onset temperature (exothermic events)Safety factors (for thermal hazards data) Safety factors and Consideration

Module-3

(08 Hrs)

TOXICOLOGICAL STUDIES: Toxic, Toxicant and Toxin, Routes and Effects of Exposure Types of Toxic Effect, Entry Routes for Toxicants and Methods for Control, Dose-Response Relationships Dose Versus Response Dose Limit Values Measures of Toxicity: Median Lethal Dose LD50, Median Lethal Concentration LC50, Targeted Organ, Excretion, Metabolism, Biotransformation, Toxicological Disease Process, Modeling Concepts, Selection of Models, Toxic Load response relation ,Dose-infection models Hit-Theory Models.

Module 4

(08 Hrs)

SAFETY IN THE STORAGE AND HANDLING OF CHEMICALS AND GASES: Types of storage-general considerations for storage layouts- atmospheric venting, pressure and temperature relief- relief valve sizing calculations- storage and handling of hazardous chemicals and industrial gases, safe disposal methods, reaction with other chemicals, hazards during transportation- pipe line transport- safety in chemical laboratories. Safety provisions like level and flow indicators- alarms, trips- protection and stills, columns and towers from lightening- colour coding for pipe lines and cylinders.

Module-5

(08 Hrs)

SAFETY IN THE OPERATION OF CHEMICAL PROCESS PLANTS : Properties of Chemicals MSDS Material Safety data Sheet, Operational Activities and Hazards Standard operating procedures, Effects of pressure, temperature, flow rate and humidity on operations Condition monitoring- control valves- safety valves- pressure reducing valves, drains, bypass valves, inert gases. Chemical splashes, eye irrigation and automatic showers.

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Course Outcomes:

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

6. Know about elements of process safety management.
7. Understand the risk management and control measures through past accidents.
8. Explain the chemical toxicology with different Disease Process, Modeling.
9. Demonstrates the safety measures in STORAGE and handling of chemicals and gases capacity
10. Explain operational safety in chemical process plant.

List of Text/Reference Books:

1. Crowl D.A. and Louvar J.F., Chemical Process Safety: Fundamentals With Applications.
2. Lees F.P. Lee's Loss Prevention in Process industries: Hazard Identification, Assessment and control
3. Kletz T, What Went Wrong - Case Histories of Process Plant Disasters: How They Could Have Been Avoided