

**FT-5001 SALVAGE & EVALUATION OF FIRE SITUATION**

**COURSE OBJECTIVE:**

1. To teach the significance of salvage and smoke movement in fire investigation process.
2. To learn the fundamental of compartment fire and its application in fire investigation process.
3. To calculate the fire loss by different methodology and application of data in identification of fire trends.
4. To understand the evacuation process with different models of evacuation.
5. To learn the role of insurance agency in legal and claim aspect.

**COURSE CONTENT:**

**SALVAGE AND SMOKE CONTROL**

Concept of salvage, salvage operation, equipments, apparatus and methodology used in salvage operations, case studies in different types of occupancies. Mass flow rate, temperature, soot protection. Smoke generation, smoke flow & dispersion, prediction of smoke flow patterns, scaling of smoke proportion, smoke impact in visibility, smoke control system, pressure differences in ventilation system, calculation of discharge rate of air blowers, smoke extraction.

**COMPARTMENT FIRE**

Stage of fire development, fire induced flows, compartment flow dynamics, single room fire analysis, Model of enclosure 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 enclosure 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.

**FIRE LOSS INVESTIGATION**

Fire Risk analysis methods, Quantitative Deterministic methods, Quantitative probabilistic methods, Monte Carlo Technique, Safety Index Method, Ranking method, Fire Risk Index Method, Initial observation and Examination of the Scene, Use of Fire Incident data, Approaches to fire data analysis, top down & topic driven analysis, analysis by fire causes and property type, Analysis of small data sets, application of data trends identification.

**PYROLYSIS**

Importance of Pyrolysis in Fires, Pyrolysis process, Physico Chemical Description of Pyrolysis Process, Pyrolysis of Cellulose, Pyrolysis of Hemicellulose, Pyrolysis of Lignins, Pyrolysis of Wood, Characteristics & location of fire causalities, nature of Injuries, causality rate per fire, Process of emergency evacuation, Evacuation modeling, model-1 EXIT, model-2 EGRESS, model-3 SIMULEX.

**ECONOMICS AND INSURANCE**

Computation of Loss, Fire Insurance Claims, Legal provisions for Fire Loss, Economics of Loss Prevention, Cost of Losses, Cost of Prevention, Level of Loss Prevention Expenditure, Insurance of Process Plant, Damage Insurance, Business Interruption Insurance, Other Insurance Aspects.

## **COURSE OUTCOME**

1. Graduate will able to demonstrate salvage equipments and apparatus with evaluation of smoke control parameter in an occupancy.
2. Graduate will able to design compartment fire zone and formulate the fire dynamics of given problem.
3. Graduate will able to explain fire loss investigation process and prepare fire investigation report.
4. Graduate will able to prepare evacuation plan of a given occupancy.
5. Graduate will able to explain the role of insurance agency in fire loss.

## **EVALUATION**

Evaluation will be continuous an integral part of the class as well through external assessment.

## **REFERENCES**

*V.K. Jain. Fire Safety in Buildings. Taylor & Francis*

*D.J. Rasbash. Evaluation of Fire Safety, Willey.*

*Fire protection handbook volume-I section-III, NFPA.*

*Fire protection handbook volume-II section-IX, NPFA*

*Fundamental of fire fighting skills, NFPA*

*Scand Power. Handbook for Fire calculation and fire risk assessment in the process industry, AS Sintef-NBL.*

**COURSE OBJECTIVE:**

1. To learn about the human body & its various system.
2. To learn about the handling of human casualty, its diagnosis & treatment.
3. To learn about the burn, shock and their types with paramedic care.

**COURSE CONTENT:**

**INTRODUCTION**

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.

**CASUALITY HANDLING-I**

Including history taking, making of a diagnosis based on symptoms as Narrated by the casualty and signs as observed by the paramedic. Checking temperature pulse, respiration, blood pressure, swellings, discoloration of the skin, wounds, deformities etc/to confirm the diagnosis. Study of various types of burns and their complications in the indoor cases in burn ward in the local government hospitals. Study of maintenance of various charts related to such casualties and their importance.

**CASUALITY HANDLING-II**

Study of specific injuries to body parts controlling there functions with external and internal injuries of head chest and abdomen including causes and consequences of external and internal bleeding. Paramedical care of various types of Casualties and their injuries such as wounds, burns, injuries of bones and joints, disturbances in vital function including cardiopulmonary resuscitation, artificial respiration by manual and instrumental methods, bandages, splints, correction of shock, arrest of bleeding, treatment of hyperpyrexia, use of anti/shock fluids and their administration, Observation and maintenance of such causalities.

**CASUALITY HANDLING-III**

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 stretchers, across plain ground, through obstacles, stretcher drill, loading and unloading of causalities in stretchers and ambulances, Ambulance installations and their use in causalities during transportation etc.

**CAUSALITY HANDLING-IV**

Casualties affected by heat and cold, drowning, poisoning, pressure, altitude, inebriations, sound, explosions, nuclear radiations etc. Prevention, protection of effects on human bodies and their paramedical care. Bites of animals such as snakes, dogs and various insects and their paramedical care.

## **COURSE OUTCOME**

1. Graduate will able to explain the various systems of human body.
2. Graduate will able to evaluate various parameter concerning to human causality during emergency.
3. Graduate will able to demonstrate respiratory and non respiratory first aid to human causality.

## **LABORATORY**

1. To measure the bleeding time and clotting time of healthy adult person using vrigid splints.
2. To calculate the victim dressing time using various type of bandage by first aid responder.
3. To calculate the body mass index of an adult person by using surgical height measuring scale with digital weighting machine.
4. To calculate the blood pressure of an adults person using mercury sphygmomanometer and stethoscope apparatus.
5. To calculate the scale of burn.
6. To perform and practice the different methods of handling and transportation of Victim.
7. To perform and practice the first aid treatment of Fractures in different part of human body.
8. To measure the working efficiency of human lungs with lung testing apparatus.

## **EVALUATION**

Evaluation will be continuous an integral part of the class as well through external assessment.

## **REFERENCES**

*Edward T Dickinson , Fire Service emergency care, , Braddy.*  
*L.G Gupta & Abhitabh Gupta , First Aid, Jaypee Brothers.*  
*Watson Jones Fractures and Joint Injuries :*  
*Cantlie, James, First Aid to injured, St John Ambulance Association*  
*First Aid Manual by Indian Red Cross Society.*

**COURSE OBJECTIVE:**

1. To learn about the fundamentals of buildings and their classifications.
2. To teach about the evacuation procedure and means of escape during emergency in tall structures.
3. To learn about automatic fire and gas detection in different types of occupancy.
4. To teach about first aid fire fighting equipments, their working principles and periodic maintenance.
5. To learn about ideal fire and life safety requirement based on different types of buildings.

**COURSE CONTENT:**

**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.

**MEANS OF ESCAPE**

General requirements for evaluation facilities, Principle factors for design consideration, evacuation time, Occupancy load, Occupancy, Travel distance, Design for evacuation routes, evacuation route quantification, requirement of stairs ways, phased evacuation in tall buildings, Life Safety Consideration refuse area, Exit Route, Assibilate of fire fighting approach evacuation facility or disable people, use of lifts & air lifting, safe evacuation time.

**FIRE AND GAS DETECTION**

Fire Alarm system basic, classification of fire alarm system, Basic consideration for instation, Automatic fire detectors, heat detector, Smoke detector, Gas sensing fire detector, Radiant energy sensing fire, detectors, detector installation, maintenance & testing, Inspection, Testing & maintance shuetuting for Fire alarm system & its component gas & vapour fixed detection system, Sensors portable gas mainting instrument.

**FIRE EXTINGUISHMENT**

Basic concept of fire fighting with water, carbon dioxide, dry chemical powder, foam and inert gases, Extinguishing Properties of Water, Droplet size, Smoothening, Heat absorbing capacity, Surface tension and waiting agent additives and its limitations, Properties of inert gases as extinguishing agent, properties of foam, Expansion, Concentration, bubbles size, Extinguishing properties of Dry chemical powder, Composition, Particle size, Radiation shielding, Chain breaking mechanism, Description, working principle and Operation methods of portable Fire Extinguishers, Care inspection and maintenance of portable Fire Extinguisher, Performance criteria of different types of Fire Extinguisher as per relevant Indian Standard.

**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 is Building under construction, Fire Control Room.

## **COURSE OUTCOME**

1. Graduate will able to explain fire resistance rating of different structural elements and fire resistance test on building material.
2. Graduate will able to design evacuation routes and performed evacuation in tall buildings.
3. Graduate will able to design fire alarm system with fire and gas detection apparatus in different types of occupancy.
4. Graduate will able to demonstrate first aid fire fighting appliances and performed periodic care and maintenance for the same.
5. Graduate will able to present model fire and life safety requirement in different type of buildings.

## **LABORATORY**

1. To measure the operating performance requirement for effective discharge time, fire rating suitability of water type fire Extinguisher on Class A Fire.
2. To measure the operating performance requirement for effective discharge time, fire rating suitability of Foam type Gas Cartridge fire Extinguisher on Class B Fire
3. To measure the burn back resistance time for different foam concentrates using film formation test apparatus.
4. To assess the effective time of film formation at fire surface for different foam concentrates using film formation test apparatus.
5. To Perform the Caking test on given sample of Dry Chemical Powder using procedures given in IS 4308.
6. To determine the moisture content for regular dry chemical powder using procedures given in IS 4308.
7. Determination of calorific value of diesel, petrol and LPG/Kerosene.
8. To determine the water repellency for regular dry chemical powder using water repellency test apparatus.

## **EVALUATION**

Evaluation will be continuous an integral part of the class as well through external assessment.

## **REFERENCES**

*Barendra Mohan Sen, Fire protection and prevention the essential handbook, UBS publishers.*  
*Dr. Than Singh Sharma, Fundamentals in building design.*  
*Lon H. Ferguson, Fundamentals of Fire Protection for the safety professional, the scarecrow Press, Inc.*  
*National Building code of India part-IV.*  
*Fire protection hand book volume-II section-IX.*

**COURSE OBJECTIVE:**

1. To learn about the basic concept of risk and its management in an organization.
2. To teach about popular risk assessment method used in different types of industry.
3. To learn about application and limitation of hazard and operability study and failure mode effect analysis.
4. To learn about the collection application and types of accident data in different types of industries.
5. To learn about fire growth model and their application in calculating reliability index.

**COURSE CONTENT:**

**INTRODUCTION**

Concept of Risk, Definition, Accepted & impressed risk, Perception & Quantification Risk, Acceptance Criteria, ALARP, Cost benefit analysis, Component of risk, Strategies of risk control, Principles of risk management, Loss control, Degree of hazards, Elementary reliability Theory, Systems & accidents.

**RISK ASSESSMENT**

Introduction, Basic quantitative risk assessment (QRA), Principles of QRA, Probability theory, Set theory and boolean algebra, Use of boolean algebra and cut sets, Combination of frequencies, Logic tree approach, Fault Tree Analysis (FTA), Principles and Symbol and Procedure of FTA, Event Tree Analysis (ETA), Quantification of event tree, Quantitative risk assessment, Criteria of risk acceptance, Types of consequences.

**TECHNIQUES AND APPROACHES**

Introduction to HAZOP, Conducting a HAZOP study, Computerized reporting system, HAZOP of batch process, Extension of HAZOP, Application of HAZOP to human reliability, Failure mode and effect analysis (FMEA), Methodology of FMEA, Critically analysis, Corrective action and follow up.

**ACCIDENT DATA ANALYSIS**

Introduction, Type of accident & incident data, Collection of accident & incident data, Legal requirement to notify accident & incident, Use of accident & incident data, Accident, Incident, Risk assessment data, Use of Computer, Job safety analysis (JSA), Principle and procedure, Summary of risk assessment methods and comparison.

**STOCHASTIC MODEL**

Fire growth model, description assumption, Scenario, Output variables, Stochastic input variables, Response surface for maximum temperature, Calculation of time to untenable conditions, Calculation of COHb value, Fatality caused by heat, logarithm of time untenable condition, Calculation of reliability index.

## **COURSE OUTCOME**

1. Graduate will able to explain basic concept of risk and its management.
2. Graduate will able to apply Boolean algebra and cut sets in different risk assessment methods.
3. Graduate will able to demonstrate HAZOP study for a process industry or its distinguish part.
4. Graduate will able to analyze accident and incident data for risk assessment procedure in an organization.
5. Graduate will able to explain fire growth models and scenario for probable fire scenes.

## **LABORATORY**

1. Calculation of individual risk and fatal accident rate as theoretical risk factor
2. Preparing the risk matrix for an organization.
3. Application of Hazard study methods to a raw gas holder.
4. Application of Hazop study on an oil vaporizer.
5. Application of Hazop study on ethylene oxide sterilizer.
6. Application of Fault tree analysis to a chemical reactor.
7. Determination of Safety Integrity level by using risk parameter chart for a given sample.
8. Determination of safety integrity level by using SIL class software with risk parameter chart.
9. Evaluation of preliminary safety instrumented system (SIS) design using SILclass software tool.

## **REFERENCES**

*Process Safety Analysis- An introduction, Bob Skelton, Gulf Publishing Company Houston, Texas.*  
*Safety Analysis- Principles and Practices in Occupational Safety, Second Edition, Lar Harms-Ringadahl, CRC Press*  
*Safety at work, John Channing , 8<sup>th</sup> Edition, Routledge Taylor & Fracis Group Landon & New York.*  
*Risk Analysis in Building Fire Safety Enginneering, A M Hasofer, V R Beck, ID Bennetts, Elsevier.*  
*Practical Hazops, Trips and Alarms, David Macdonald, Elsevier*



**COURSE OBJECTIVE:**

1. To learn the characteristics of crude oil and classification of petroleum products.
2. To learn about the refining process and its significance in safety.
3. To learn about petrochemical fire and emergency planning in potential fire hazard areas.
4. To teach the statutory provisions pertaining to refineries petrochemical plants and gas terminals.

**COURSE CONTENT:**

**INTRODUCTION**

Crude oil, its properties & Characteristics, Classification of petroleum & its products, MSDS of crude oil, diesel, gasoline, kerosene, LPG, Natural Gas, naphtha, Ammonia, Benzene, toluene, Acetylene.

**REFINING PROCESSES**

Primary Distillation, catalytic cracker, polymerization, reforming, steam cracking, sulphur recovery, Lubricating oil treating. Process units such as desalter, ADU, VDU, FCC, hydrocracker, catalytic reformer etc. Storage tanks & its types. Layout of Refineries - simplified flow diagram of a typical refinery.

**FIRE PROTECTION & EMERGENCY PLANNING**

Major fire risks, design criteria for selection of fire water network, fire fighting installations such as hydrant, mobile water monitors, foam pourer, DCP fixed, subsurface injection & steam snuffing systems. Storage tanks protection. Use of various media in petroleum & gas fires such as water, foam, DCP.

**FIGHTING REFINERY & PETROCHEMICAL FIRES**

Potential fire hazards, precautionary measures in case of non-ignited releases, oil & gas leaks. Fire fighting facilities for depots, terminals, onshore, off-shore drilling platforms, and pipelines for transportation of petroleum products & Gas. Fighting Gas terminal fires: - Fire fighting & procedures in case of BLEVE, LPG hazards, spillage, vehicles using LPG & CNG as a fuel. Fire fighting facilities at LPG bottling plants. Water Injection into LPG vessel (water bottoming)

**STATUTORY PROVISIONS**

Pertaining to refineries, petrochemical plants & gas terminals, Oil Industry Safety Directorate (OISD), Petroleum Act 1934, Petroleum Rules 2002, Petroleum & Natural Gas Regulatory Board (PNGRB) drafts, Explosive Act 1884, Explosive Rules 1983 and Gas cylinders Rules 2004. Application of advance technologies used in refineries & petrochemical plants such as SCADA, SAP and various simulation modeling.

**COURSE OUTCOME**

1. Graduate will be able to explain hazardous Characteristics of petroleum product and refining process.
2. Graduate will be able to apply fire protection systems in potential fire hazards area in oil and gas industry.
3. Graduate will be able to present statutory provisions pertaining to refineries, petrochemical plants and gas terminals.

**EVALUATION**

Evaluation will be continuous an integral part of the class as well through external assessment.

**REFERENCES**

*Fire Service Manual (Volume 2) Fire Service Operations - Petrochemical Incidents*

*Manual of Firemanship, Part 6-A by H.M.S.O.*

*Oil Industry Safety Directorate (OISD) Norms & Rules*

*Petroleum & Natural Gas Regulatory Board (PNGRB) drafts*

*Loss prevention in Process of Industries, Vol 1,2, & 3, Frank P. Lees.*

*Relevant NFPA Codes and Indian Acts.*

**COURSE OBJECTIVE:**

1. To learn the fundamental of work study and safety.
2. To learn about principles of ergonomics.
3. To learn about personal protective equipments and their contribution in accident prevention.
4. To teach main machine systems and in-build safety within the devices.

**COURSE CONTENT:**

**WORK STUDY**

Study of operations, work content, work procedure, breakdown, human factors, safety and method study, methods and movements at the workplace, substitution with latest devices, robotic concepts, applications in hazardous workplaces, productivity,.

**ERGONOMICS**

Definition, applications of ergonomic principles in the shop floor, work benches, seating arrangements, layout of electrical panels, with gear, principles of motion economy, location of controls, display location, machine foundations, work platforms, fatigue, physical and mental strain, incidents of accident, physiology of workers.

**PERSONAL PROTECTION**

Concepts of personal protective equipment, types, selection of PPE, invisible protective barriers, procurement, storage, inspection and testing, quality, standards, ergonomic considerations in personal protective equipment design.

**PROCESS AND EQUIPMENT DESIGN**

Process design, equipment, instrument, selection, concept modules, various machine tools, in-built safety, machine layout-machine guarding-safety devices and methods, selection, inspection, maintenance and safe usage, statutory provisions, operator training and supervision, hazards and prevention.

**MAN MACHINE SYSTEMS**

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.

**COURSE OUTCOME**

1. Graduate will able to explain the work procedure and movements at work places.
2. Graduate will able to apply principles of ergonomics to release physical and mental strain at work places.
3. Graduate will able to demonstrate personal protective equipment and their contribution in accidents prevention.
4. Graduate will able to design equipment safety devices and explain their statutory provisions.
5. Graduate will able to present main machine interface control.

## **EVALUATION**

Evaluation will be continuous an integral part of the class as well through external assessment.

## **REFERENCES**

*Introduction to work study, ILO, 3<sup>rd</sup> edition, Oxford & IBH publication.*

*Martin Helander, A Guide to hyuman factors and Ergonomicsw, Taylor and Franceis,*

*Barnes, R.M. Motion and Time study, John Wiley.*

*E.J.Mc Cromick and M.S. Sanders “Human Factors in Engineering and Design” TMH, New Delhi.*

**COURSE OBJECTIVE:**

1. To learn about the applications of operations research.
2. To Understand the OR specialist and manager relationship.
3. To understand the role of Supply Chain Management in Manufacturing and Service Organisations

**COURSE CONTENT:**

**LINEAR SYSTEM AND DISTRIBUTION MODELS**

Mathematical formulation of linear systems by LP, solution of LP for two variables only, special cases of transportation and assignment and its solution, Vogel's forward looking penalty method, cell evaluation degeneracy, use of SW Lindo, Tora, Excell.

**SUPPLY CHAIN (SCM)**

Definition, importance, expenditure and opportunities in SCM; integration of inbound, outbound logistics and manufacturing to SCM, flow of material money and information, difficulties in SCM due to local v/s system wide (global) optimization and uncertainties in demand and transportation; Bull-whip effect; customer value; IT, info-sharing and strategic partnerships; plant and warehouse-network configuration; supply contracts and revenue sharing; outsourcing; transportation, cross docking and distribution, forecasting models in SCM; coordination and leadership issues; change of purchasing role and vendor rating, variability from multiple suppliers.

**INVENTORY MODELS**

Necessity of inventory in process and safety stock, problem of excess inventory and cycle time (=WIP/Throughput), JIT/ lean mfg; basic EOQ/ EPQ models for constant review Q-system(S,s); periodic review, base stock P-system; service level, lead time variance and safety stock;; ABC, VED and other analysis based on shelf life, movement, size, MRP technique and calculations, lot sizing in MRP, linking MRP with JIT; evolution of MRP to ERP to SCM and e-business.

**WAITING LINE MODELS**

Introduction, Input process, service mechanism, Queue discipline, single server (M/M/1) average length and times by Little's formula, optimum service rate; basic multiple server models (M/M/s),Competitive strategy, concept and terminology, assumptions, pure and mixed strategies, zero sum games, saddle point, dominance, graphical, algebraic and LP methods for solving game theory problems.

**DECISION ANALYSIS**

Decision under certainty, risk probability and uncertainty; Hurwicz criteria; AHP- assigning weight and consistency test of AHP, Meta-heuristics Definition of heuristic and meta-heuristic algorithms; introduction to Tabu search, Simulated Annealing and Genetic algorithms and solution of traveling salesman and non linear optimization problems.

## **COURSE OUTCOME**

1. Graduate will able to apply tools of operations research in the project.
2. Graduate will able to explain operation research and manager relationship.
3. Graduate will able to develop decision making ability at work places.

## **EVALUATION**

Evaluation will be continuous an integral part of the class as well through external assessment.

## **REFERENCES**

*Hillier FS and Liberman GJ; Introduction to Operations Research concept and cases; TMH*  
*Simchi-Levi, Keminsky; Designing and managing the supply chain; TMH.*  
*Srinivasan G; Quantitative Models In Operations and SCM; PHI Learning*  
*Mohanty RP and Deshmukh SG; Supply Chain Management; Wiley India*  
*Taha H; Operations research; PHI*  
*Sen RP; Operations Research-Algorithms and Applications; PHI Learning*  
*Ravindran , Philips and Solberg; Operations research; Wiley India*  
*Vollman, Berry et al; Manufacturing planning and control for SCM; TMH.*  
*Bowersox DJ, Closs DJ, Cooper MB; Supply Chain Logisti Mgt; TMH*  
*Burt DN, Dobler DW, StarlingSL; World Class SCM; TMH*  
*Bronson R ;Theory and problems of OR; Schaum Series; TMH*

**COURSE OBJECTIVE:**

1. To learn about the different instruction of fire fighting appliance drill.
2. To learn about lifting, carrying, rolling and unrolling of fire fighting hose.
3. To learn about three men and four men hydrant drill.
4. To learn about four men and six men trailer pump drill.
5. To learn about the application and different ladder drill.

**COURSE CONTENT:**

**APPLIANCE DRILLS**

Instructions for officer incharge, Duty of drill incharge, Command and action meaning - crew number, Fall in, Fall out, Mount, Dismount, Get to work, Water ON, Knock-off, Make up, Carry ON, Stand from under, still, slip, Counter Balance, Step In, Step out, Extend, Lower, Pitch.

**HOUSE DRILLS**

Lifting a roll of delivery hose, Carrying of a roll delivery hose, Connecting a delivery hose, Unrolling a delivery hose, disconnecting a delivery hose, under- running delivery hose, Rolling up a delivery hose.

**HYDRANT DRILL (THREE MEN)**

Requirement, Position of three crew members, Add one length of hose, Remove one length of hose, Replacing burst length of hose, Getting a branch to work, Dividing a line in to two line of hose, Collecting two hose line to make one line, Knock off and make off.

**HYDRANT DRILL (FOUR MEN)**

Requirement, Position of four crew member, Function of individual crew member, Add one length of hose, Removing one length of hose, Replacing a burst length of hose use of dividing breeching, Use of collecting Breeching, Getting a branch to work, knock off and make up.

**TRAILER PUMP DRILL (FOUR MEN AND SIX MEN)**

Requirement, Single delivery, Single suction, Double suction, Double delivery, Position of six crew members in trailer pump, Change round, Mount, Dismount, Close up position, Fall in position, Towing Tender, Ladder drill, Extension ladder, Position of four crew members, Position at Pitching, Fire Escape ladder drill requirement, close up position, Pitching.

**COURSE OUTCOME**

1. Graduate will able to demonstrate different world of command used in appliance drill.
2. Graduate will able to apply hose drill performance and practice in fire fighting operation.
3. Graduate will able to apply hydrant drill performance and practice in fire fighting operation.
4. Graduate will able to apply trailer pump drill performance and practice in fire fighting operation.
5. Graduate will able to apply ladder drill performance and practice in fire fighting operation.

## **LABORATORY**

1. To performed and practice different world of command used in appliance drill.
2. To performed and practice hose drill in a crew.
3. To performed and practice three men hydrant drill with hydrant post and hose pipe.
4. To performed and practice four men hydrant drill with hydrant post and hose pipe.
5. To performed and practice four men trailer pump drill with trailer pump, Suction pipe, hose pipe and hose fittings.
6. To performed and practice six men trailer pump drill with trailer pump, Suction pipe, hose pipe and hose fittings.
7. To performed and practice ladder drill and its application.

## **EVALUATION**

Evaluation will be continuous an integral part of the class as well through external assessment.

## **REFERENCES**

*Drill manual for Fire Services of India by Govt. of India.*

*Fire Fighters Skill drill manual by NFPA.*