

**RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL**

**New Scheme Based On AICTE Flexible Curricula**

**Fire Technology & Safety Engineering, V-Semester**

**FT 501 Fire Fighting & Safety Equipments**

**COURSE OBJECTIVE:**

1. To learn about the fire hose pipes and appliances with different fire stream patterns.
2. To teach about the types, operation, maintenance and fire ratings of portable fire extinguishers.
3. To learn about the principles of water supply and its distribution in fire service.
4. To teach about the fundamentals of pumping and pump hose associated with water line distribution in fire fighting.
5. To learn about the types of fire pump and evaluation of pump power with their efficiency.

**COURSE CONTENT:**

**FIRE HOSE AND FOAM APPLIANCES**

Hose Damage Types and General Care, Fire Hose Couplings and Hose Appliances Tools, Hose Rolls types and Basic Hose Loads, Types of Supply Hose lays, Nozzle Discharge formula, Nozzle Reaction, Fire Stream Patterns and Nozzles- Solid Stream, Fog Stream and Broken Stream, Maintenance of Nozzle, Foam Proportioners, Delivery Devices and Generating Systems, Foam Hazards and Foam Application Techniques.

**FIRE EXTINGUISHER AND RATINGS**

Portable Fire Extinguishers, Types and Means of Agent Expelling, Pump Type, Stored Pressure, Water mist Stored, Wet Chemical Stored and Clean agent type Fire Extinguishers, Fire Extinguisher Rating System for A,B,C, D and K class fire, Multiple marking means, Selection and Method of Application, Maintenance Procedures and filling of different types of Fire Extinguisher.

**WATER SUPPLY AND DISCHARGE MEASUREMENT**

Water Supply Principles in Fire Service, Source and Treatment Process, Water Storage and Distribution, Fire Hydrant Inspection, Maintenance, Fire Hydrant Class with Flow capacity and color code, Discharge Measurement Devices, Pitot Tube, Venturi meter, Quantity Meter, Rota meter and V-Notch.

**RELAY PUMPING AND FIRE PUMPS**

Drafting and Relay Pumping, Basics of Drafting, Drafting Equipments, Water Lift and Altitude, Drafting Procedure, Need for Relay Pumping, Capacity of Pumpers, Types of Fire Pumps, Piston Pumps, Centrifugal Pump, Rotary Pumps, Pump Panel and its Components.

**FIRE SERVICE PUMP HOUSE**

Pump House, Operation of Main, Standby and Jockey Pump, Multistage of Pumps, Pump Power- Water Horsepower (WHP), Brake Horsepower (BHP), Efficiency of the Pump, Prime Movers and Pressure setting of Pumps, Continuity Equation and different forms of Energy, Loss of Head in Pipes.

**COURSE OUTCOME**

1. Student will be able to calculate nozzle reaction, discharge rate and fire stream patterns in fire hose pipe.
2. Student will be able to perform operation and maintenance of portable fire extinguishers.
3. Student will be able to demonstrate fire fighting operation using foam and foam making equipment.
4. Student will be able to design capacity of fire pumps and arrangement of fire pumps in pump house.
5. Student will be able to explain water supply principles its storage and distribution in fire service.

## **LABORATORY**

1. To perform and practice the water based fire fighting operations using different hand held branch pipe with the help of multipurpose fire tender.
2. To perform and practice the foam based fire fighting operations using 5X foam making branch pipe and medium expansion foam generator with the help of multipurpose fire tender.
3. To perform and practice the foam based fire fighting operations using 10X foam making branch pipe, foam proportioners and high expansion foam generator with the help of multipurpose fire tender.
4. To Perform hydrostatic burst pressure test on hose pipes of different material using test procedure in accordance with IS 443.
5. To perform the abrasion resistance test on hose pipes of different material using hose pressure testing machine.
6. To perform and practice the transformer fire extinguishment using water mist store pressure type portable fire extinguisher.
7. To perform and practice the filling and refilling procedure for Gas Cartridge water and foam types Fire Extinguishers.
8. To perform and practice the filling and refilling procedure for Gas Cartridge Dry Chemical Powder type Fire Extinguisher.

## **EVALUATION**

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

## **REFERENCES**

*Paul Spurgeon, Fire Service Hydraulics and Pump Operations, Penn Well Corporation-2012.*  
*Essentials of Fire Fighting International fire Service Training Association.*  
*G.C.Mishra, Concept and Calculation: Fire Service Hydraulics PPA Publications.*  
*N. Sesha Prakash, Manual of Fire Safety CBS Publishers & Distributors Pvt. Ltd.*

**COURSE OBJECTIVE:**

To understand the properties of fluids, statics, kinematic and dynamic behavior through various laws of fluids and familiar the working and performance characteristics of various pumps and hydraulic machines.

**COURSE CONTENT:**

**Pumping Machinery:** Pumps- Reciprocating pump, types, working principle, Centrifugal pump types, working principle, Ejector pump, Air lift pump, Hydraulic Crane, Hydraulic Press, Jet pump, Hydraulic lift. Impact of Jets-force executed by fluid jet on fixed flat plate, curved plate, moving vans, Velocity Diagram, Work done by impact.

**Fluid Static's:** Properties of the fluids. Pressure Measurement -Pressure at a point, Pascal's Law, pressure variation in static fluid, Absolute and gauge pressure, manometers, Hydrostatic forces- Forces on plane and curved surfaces, Buoyancy and Flotation: buoyant force, Stability of floating and submerged bodies, Relative equilibrium.

**Kinematics of Flow :** Types of flow-ideal & real, steady & unsteady, uniform & non-uniform, one, two and three dimensional flow, path lines, streak-lines, streamlines and stream tubes- continuity equation for one and three dimensional flow, rotational & irrotational flow, circulation, stagnation point, separation of flow, sources & sinks, velocity potential, stream function, flow net & its applications, method of drawing flow nets.

**Dynamics of Flow:** Euler's equation. of motion along a streamline and derivation of Bernoulli's equation, application of Bernoulli's equation, energy correction factor, linear momentum equation for steady flow; momentum correction factor. The moment of momentum equation, forces on fixed and moving vans and other applications. Fluid Measurements: Velocity measurement ( Pitot tube, current meters etc.)- flow measurement (orifices, nozzles, mouth pieces, orifice meter, nozzle meter, venturi-meter, weirs and notches).

**Dimensional Analysis :** Dimensional analysis, dimensional homogeneity, use of Buckingham-pi theorem, calculation of dimensionless numbers, Flow through Pipes -Friction losses in pipes losses due to sudden enlargement and contraction, energy gradient lines, siphon, pipes in series and parallel, branching of pipes, water hammer problem, Reynolds experiment & Reynolds number, laminar & turbulent flow, Introduction to Navier Stokes' Equation, relation between shear & pressure gradient.

**COURSE OUTCOME**

1. Student will be able to apply the application of pumping machineries and hydraulic systems.
2. Student will be able to explain the types of fluids & its characteristics.
3. Student will be able to measure the fluid pressure & its velocity.
4. Student will be able to classify the fluid flow and solve problems of flow through pipes.
5. Student will be able to define the properties of the fluids.

**LABORATORY**

1. To determine the meta centric height of a ship model.
2. To determine the Reynolds's number and the type of flow either laminar or turbulent flow.
3. To determine the co-efficient of discharge for orificemeter and venturimeter.
4. To determine the losses due to friction in pipes.
5. To determine the losses in pipe fitting sudden enlargement and sudden contraction.
6. To determine performance of reciprocating pumps and centrifugal pump
7. To verify the Bernoulli's Theorem.
8. To determine the co-efficient of pitot tube.

## EVALUATION

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

## REFERENCES:

1. *Streeter VL, Wylie EB, Bedford KW; Fluid Mechanics; Mc Graw Hills*
2. *FOX , McDonald Pritchard , Fluid Mechanics Wiley students edition*
3. *White ; Fluid Mechanics ; Mc Graw Hills*
4. *Cengal; Fluid Mechanics; Mc Graw Hills*
5. *R Mohanty; Fluid Mechanics; PHI*
6. *K L Kumar Fluid Mechanics*
7. *Fluid Mechanics & hydraulic Machines , Modi & Seth*
8. *CS Jog , Fluid Mechanics Volume II CAMBRIDGE IISc Series , Third Edition*
9. *Dr. D.S. Kumar; Fluid Mechanics and Fluid Power Engineering; S.K. Kataria & Sons*
10. *S. Ramamrutham ;Hydraulics Fluid Mechanics and Fluid Machines;Dhanpat Rai PublishingCompany(P) Ltd.*
11. *Dr. R. K. Bansal; Fluid mechanics and Hydraulic Machines;Laxmi Publication (P)Ltd.*

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**New Scheme Based On AICTE Flexible Curricula**

**Fire Technology & Safety Engineering, V-Semester**

**Departmental Elective FT- 503 (A) Safety in Petrochemical Industry**

**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. Student will be able to explain hazardous characteristics of petroleum product and refining process.
2. Student will be able to apply fire protection systems in potential fire hazards area in oil and gas industry.
3. Student will be able to present statutory provisions pertaining to refineries, petrochemical plants and gas terminals.
4. Student will be able to explain various fire fighting strategies in case of BLEVE, LPG hazards and spillage.
5. Student will be able to demonstrate the knowledge about statutory provision 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.*

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**Fire Technology & Safety Engineering, V-Semester**

**Departmental Elective FT- 503 (B) Operation Research and Supply Chain**

**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. Student will be able to apply tools of operations research in the project.
2. Student will be able to explain operation research and manager relationship.
3. Student will be 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 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-built 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. Student will be able to explain the work procedure and movements at work places.
2. Student will be able to apply principles of ergonomics to release physical and mental strain at work places.
3. Student will be able to demonstrate personal protective equipment and their contribution in accidents prevention.
4. Student will be able to design equipment safety devices and explain their statutory provisions.
5. Student will be 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 human 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.*



**Open Elective FT- 504 (B) Entrepreneurship and Management Concept**

**COURSE OBJECTIVE:**

1. To learn the fundamental of systems.
2. To learn about principles and function of management and its theory.
3. To learn about the marketing and its fundamental concepts.
4. To teach the productivity and operations.
5. To learn the fundamental concept of entrepreneurship and opportunity analysis.

**COURSE CONTENT:**

**SYSTEM CONCEPTS**

Types, definition & characteristics; supra & subsystems, key component; boundary & interface complexity; feedback (pull) & feed forward (push) controls, open flexible-adaptive system, computer as closed system, law of requisite variety; system coupling, stresses and entropy; functional & cross functional system; Steven Alter's nine element work system model and its comparison with IPO (input-processing-output) model, structure and performance of work systems leading to customer delight.

**MANAGEMENT**

Importance, definition and functions; schools of theories, knowledge driven learning organization and e-business; environment, uncertainty and adaptability; corporate culture, difficulties and levels of planning, BCG matrix, SWOT analysis, steps in decision making, structured and unstructured decision; dimensions of organizations, size/specialization, behavior formalization, authority centralization, departmentalization, span and line of control, technology and Minzberg organization typology, line, staff & matrix organization, coordination by task force, business process reengineering and process of change management, HR planning placement and training, MIS; attitudes and personality trait, overlap and differences between leader & manager, leadership grid, motivation, Maslow's need hierarchy and Herzberg two factor theory, expectation theory, learning process, team work and stress management.

**MARKETING**

Importance, definition, core concepts of need want and demand, exchange & relationships, product value, cost and satisfaction (goods and services ) marketing environment; selling, marketing and societal marketing concepts; four P's, product, price, placement, promotion; consumer, business and industrial market, market targeting, advertising, publicity, CRM and market research. Finance: Nature and scope, forms of business ownerships, balance sheet, profit and loss account, fund flow and cash flow statements, breakeven point (BEP) and financial ratio analysis, pay-back period, NPV and capital budgeting.

**PRODUCTIVITY AND OPERATIONS**

Productivity and standard of living, types of productivity, operations (goods and services) Vs project management, production processes and layouts, steps in method improvement, time measurement, rating and various allowances; standard time and its utility, predetermined motion and time method, concepts of product and process specification, TQM, cost of quality, introduction to lean manufacturing (JIT), QFD, TPM & six sigma quality.

**ENTREPRENEURSHIP**

Definition and concepts, characteristics, comparison with manager, classification, theories of entrepreneur, socio, economic, cultural and psychological; entrepreneur traits and behavior, roles in economic growth, employment, social stability, export promotion and indigenization, creating a venture, opportunity analysis competitive and technical factors, sources of funds, entrepreneur development program.

**COURSE OUTCOME**

1. Student will be able to explain different types and characteristics of systems.
2. Student will be able to apply principles of management and its theory at work place.
- 3 Student will be able to explain marketing skills for the selling of goods and services.
4. Student will be able to explain productivity and operations in an organization.
5. Student will be able to present concept and characteristics of entrepreneurship.

**EVALUATION**

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

**REFERENCES**

*Daft R; The new era of management; Cengage.*

*Bhat Anil, Arya kumar; Management: Principles ,Processes Practices; Oxford higher edu.*

*Davis & Olson; Management Information System; TMH.*

*Steven Alter; Information systems, Pearson, [www.stevenalter.com](http://www.stevenalter.com)*

*Kotler P; Marketing management;*

*Khan, Jain; Financial Management;*

*ILO; Work study; ILO.*

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**Fire Technology & Safety Engineering, V-Semester**

**FT 505 Fire Fighting Practices**

**COURSE OBJECTIVE:**

To learn and teach about the standard practices associated with management, hydrant, hose, pumps and techniques as per foundation training of fire service manual.

**COURSE CONTENT:**

**MANAGEMENT OF STANDARD PRACTICES**

PSP1- To mount the appliance with a crew of four.

PSP2 - To mount the appliance with a crew of five.

**FOAM STANDARD PRACTICES**

F1- To get a foam making branch to work with a crew of four.

F2- To get an Inline foam Generator to work with a crew of five (one delivery)

F3- To get an In line foam generator to work with a crew of five (two deliveries)

F4- To get an in line variable Inductor to work with a crew of five (one delivery)

**HYDRANT/HOSE STANDARD PRACTICES**

H1- To replace a burst length of hose with a crew of four.

H2- To divide a length of hose in to two using dividing breeching with a crew of five.

H3- To remove a dividing breeching from a line of hose with a crew of five.

**PUMP STANDARD PRACTICES**

P1- To get a pump to work from a hydrant using soft suction with a crew of five (two deliveries)

P2- To get a ground monitor to work with a crew of five.

P3- To get a portable pump to work from open water with a crew of five (two deliveries).

**TECHNIQUES**

T1- To effect a rescue using rope and associated equipments with a crew of three.

T2- To effect a rescue using five personnel, an extension ladder, rope and associated equipment.

T3- To define and implement the nine main protocols required to ensure the safe extrication of casualty from an entrapment situation.

T-4 To define and operate the one meter and two meter safe working area around a motor vehicle involved in a road traffic accident.

**COURSE OUTCOME**

1. Student will be able to perform and operates standard practices associated with management, hydrant, hose, pumps and techniques as per foundation training of fire service manual.
2. Student will be able to apply hose drill performance and practice in fire fighting operation.
3. Student will be able to apply hydrant drill performance and practice in fire fighting operation.
4. Student will be able to apply trailer pump drill performance and practice in fire fighting operation.
5. Student will be able to foam standard practices drill performance and practice in fire fighting operation.

**EVALUATION**

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

**REFERENCES**

*Fire and Rescue Service Manual Volume-4, Foundation Training and Development, HM Fire Service Inspectorate Publications Section.*

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**Fire Technology & Safety Engineering, V-Semester**

**FT 506 Computer Programming (AutoCAD)**

**COURSE OBJECTIVE:**

1. To understand how to use AutoCAD as a draughting tool to produce 2D & 3D working drawings.
2. To perform how to create a new drawing, edit an existing drawing.
3. To perform how to plot a drawing to a suitable printer or plotter.
4. To understand how to draw Isometric drawing and setup drawing environment and customize screen layout to suit their own preferences.

**COURSE CONTENT:**

**STARTING A NEW DRAWING/OPENING AN EXISTING DRAWING:** Setting up a drawing starting from scratch, Setting up a drawing using a Wizard, Using and creating a template file, Opening an existing drawing, Screen layout, Pull-down menus, Screen icons, Command line, status bar, Dialogue boxes.

**DRAWING COMMANDS:** Lines, Ray, Construction Line, Multiline and polylines, Rectangles, Arc, Circle and Ellipse, Polygon, Spline, Co-ordinate input methods, (directive, and absolute, relative and polar)

**MODIFY COMMANDS:** Erase, Trim, Move, Copy, Mirror, Offset, Fillet and Chamfer, Array, Extend, Stretch, Rotate, Break, Scale and Explode.

**CONSTRUCTION OF PLANE AND COMPLEX GEOMETRICAL FIGURES:** Angles, Triangles, Rhombus, Quadrilaterals, Polygons, Angle Bisectors, Line divided in equal parts, Construction of Curves and Helix, Principles of Projections, Projections of Straight Lines and Solids, Section of Solids

**DRAWING SETTINGS AND AIDS:** Layers, Load Line types, Match properties, World UCS and User-defined, UCS, Drawing limits and units, Blocks, Attributes, individual project drawings of Hydrant post, Sprinkler head, Branch pipe, water monitor, fire extinguisher, hose fittings and Breathing Apparatus.

**COURSE OUTCOME**

1. Student will be able to use Auto CAD Software in designing the fire protection system.
2. Student will be able to create new and edit existing drawing.
3. Student will be able to plot a drawing to a suitable printer or plotter.
4. Student will be able to draw Isometric drawing and setup drawing environment and customize screen layout to suit their own preferences.

**REFERENCES**

*Auto CAD Manual*