Syllabus of Chief Officer (Fire) / Add. Chief Officer (Fire) / Dy. Chief Officer (Fire)
PART-1

Marks: 50 **60 Minutes** **Medium: English**

1. **Gujarat Fire Prevention and Life Safety Measures Act, 2013.**

2. **Gujarat Fire Prevention and Life Safety Measures Rules, 2014.**

3. **National Building Code of India (Fire and Life Safety)**

4. **Fire Codes and Standards**
   Specification of Rescue of fire fighting equipment. Technical parameter / specification specific reference to appliances. Code & Standards concerning construction & Design of building. Code and Standard for passive fire protection system and materials. Code, Standard and specification concerning to safety of fire fighting personnel i.e., Breathing Apparatus P.P.E., safety gears and other devices. Code, Standard and byelaws concerning Industrial, Municipal and State life safety & fire protection measures. Code and Practice for construction of temporary structures, pandal, Samiyana and scaffolding.

5. **Fire Service Hydraulics**
   Water Supply Analysis Overview - Define “hydraulics” as it applies to fire protection Engineering, types of water supply. Basic Principles of Hydraulics - Recognize and apply the basic principles of pressure in a non-flowing water system, Recognize and apply the basic principles of water flow in a piping system and through an orifice, explain the concept of friction loss and determine friction loss. Calculating Sprinkler System Demand: Simple Side-Fed Tree, Generally describe the interaction between flow and pressure in an operating sprinkler system and identify mathematical relationships that are the basis of sprinkler system calculations, Demonstrate the relationship between flow and pressure by using pressure balancing in performing head by head calculations for a simple-side-fed tree sprinkler system. Hydraulics of Water Supplies for Automatic Sprinkler Systems. Concepts - Bernoulli’s Theorem and Applications, Pressure Loss at Fittings, Discharge from Nozzles, Discharge Coefficient, Theoretical Discharge.

6. **Fire Protection**
   Engineering approach to industrial fire protection, Statistical overview of industrial fires and explosions, Historic industrial fires and explosions. Plant Siting and layout: Fire protection siting considerations, Plant layout for

fire/explosion protection, Fire Resistant Construction: Construction materials – Steel, Steel Insulation, Concrete Fire resistance calculations Fire resistance tests, Empirical correlations, High intensity fire resistance tests Fire Walls – General criteria for fire walls, Fire wall design, Fire wall loss experience Fire doors – Types of fire doors, Fusible links and detectors, Reliability issues Insulated metal deck roofing – Description, Tests and classifications Water spray protection of exposed structures. Smoke Production & Properties, Particle size of smoke from burning wood and plastics, Smoke Aerosol Properties, Visibility, Smoke isolation and venting, Isolation and suppression within ventilated equipment Isolation within rooms – Building smoke control – Buoyancy pressure differences, Volumetric expansion pressures, Isolation via ventilation exhaust, Upstream smoke propagation, Door and damper smoke leakage Heat and smoke roof venting Heat and smoke venting in sprinkle red buildings. Warehouse Storage: Warehouse fire losses Storage configurations Effect of storage height, flue space and aisle width Commodity effects – Generic commodity classification, Laboratory flammability testing, Small array tests, Large array sprinkle red fire tests Sprinkler flow rate requirements – Ceiling spray sprinklers, In-rack sprinklers, Early suppression fast response (ESFR) sprinklers Sprinkle red warehouse fire modelling – Conceptual model overview, Free burn heat release rates and flame spread rates, Warehouse fire plumes and ceiling jets, Sprinkler actuation model, Spray-plume penetration model, Reduction in heat release due to actual delivered density, Fire control criteria; can wetted commodity be ignited?, Fire suppression criteria Cold storage warehouse fire protection.

Storage of special commodities and bulk materials: Roll Paper – Commodity description, Loss experience, Roll paper fire tests, Roll paper protection requirements Nonwoven roll goods – Commodity description, Loss experience, Fire tests, Sprinkler protection requirements for nonwovens Rubber tire storage Aerosol Products – Product description, Aerosol warehouse fires, Aerosol product formulation effects, Sprinkler protection guidelines Solid oxidizers Bulk storage – General Description, Spontaneous ignition testing, Spontaneous ignition theory, Detection and suppression of bulk storage fires Flammable liquid ignitability and extinguish ability, Incident data, Ignitability temperatures – Flash points and fire points, Auto ignition temperatures, Time to reach fire point Electrostatic ignitability Pool and spill fire heat release rates – Confined pool fires, Unconfined spill fires Spray Fires Water spray extinguishment – High flash point liquids, Water miscible liquids, Low flashpoint liquids, Spray fires Foam extinguishment – Low Expansion Foam, Medium and high expansion foam Dry Chemical and twin agent extinguishment Carbon dioxide suppression Halon replacement suppression agents.

Flammable liquid storage: Storage Tanks, Drum Storage, Flammable liquids in small containers, Electrical cables and equipment: Electrical cables: Generic description Cable fire incidents Cable flammability testing and classifications Vertical cable tray fire test data Horizontal cable tray fire test

data Cable fire suppression tests – Sprinkler and water spray suppression tests, Gaseous suppression system tests Passive protection: coatings and wraps Protection guidelines and practices. Electronic equipment flammability and vulnerability – Electronic component flammability, Electronic cabinet flammability, Electronic equipment vulnerability, Detection and suppression of electronic equipment fires Transformer fire protection – Transformer generic description, Transformer fire scenarios, Transformer fire incidents, Installation and fire protection guidelines, Water spray protection of transformers. Blast Waves: Ideal blast waves, Pressure vessel ruptures, Vapour cloud explosions, vented gas and dust explosions.

7. Fire and Smoke Dynamics

Fire Science and Combustion, Heat Transfer and Aerodynamics, Limits of Flammability and Premixed Flames, Diffusion Flames and Fire Plumes, Steady Burning of Liquid and Solid Fuels, Ignition: The Initiation of Flaming Combustion, Spread of Flame, Spontaneous Ignition within Solids and Smouldering Combustion. The Pre-Flashover Compartment Fire, the Post-Flashover Compartment Fire, the Production and Movement of Smoke.

8. Design and Installation of detection and Fire Fighting System

Provisions & applicable standards of detection and alarm system, Introduction of detection devices, alarm and detection system, Type of detectors, Method of selection. Installation,testing and commissioning of alarm and detection system.

Provisions & applicable standards of water based systems: Hydrants, Monitors, Risers, Sprinklers, Spray systems, Earthing, NDT and Cathodic protection for underground piping, etc.

Hydraulic Calculation, Design of hydrants, wet riser and dry riser system. Design of Sprinkler system: types of Sprinkler Systems, Density-based sprinkler demand, Pressure requirement of the most remote sprinkler, C value for pipes, Pressure losses through piping, fittings and valves, Use of velocity pressure, Elevation losses, Loops and grids.

Design, Calculation of Spray systems based on hazards, Hydraulic calculation based on standard norms and procedure.

Design, Calculation and installation of fire pumping system based on standard norms and procedure.

Installation, Testing and Commissioning of water based fixed fire fighting system.

Provisions & applicable standards of detection and alarm system, Introduction of detection devices, alarm and detection system, Type of detectors, Method of selection. Design, installation, testing and commissioning of alarm and detection system. Provisions & applicable standards of foam, gases and dry chemical powder based systems.

Classification and property of foam, gases and dry chemical powder.

Identification, Hydraulic Calculation and Design of foam system: Installation identification, Hazard classification, Type of protection, Hazard description, Flammable or combustible liquids area to be protected, Flammable or combustible liquids identification, foam application method, Description, number and placement of foam application devices, Selection of foam agent, Rate of application of foam solution, Rate of foam concentrate, Rate of water application, Duration of discharge, Quantity of foam and water required.

Identification and Design of clean agent based system: Determine the design concentration, Determine the total agent quantity, Establish the maximum discharge time, Selection of piping material and thickness consistent with pressure rating requirement, Piping design network and selection of nozzle to deliver required concentration at required discharge time to ensure mixing, Evaluation of compartment over / under pressurization and provide venting if required.

Design of dry and wet chemical extinguishing agent based system: Physical property, Extinguishing properties, Method of application, System design, Storage of chemical and expellant, System actuation, distribution system, Quantity and rate of application, Limitations of the system, Inspection, testing and maintenance procedure.

9. Special Hazards and Fire Protection

Constructional features of an Air Crafts and Helicopters, Basic Fire-Hazards, Nature of Air Crashes, Emergency landings including belly leading etc. Access to Fire Service Personnel and Escape of trapped persons problems, Types of Safety Belts, Ejection-Seats etc. and their methods of release. Tactical management during emergency, Problems of rescue and fire-fighting in Aircraft & helicopter carrying ammunition, bombs, nuclear weapons etc.

Hazards in Airport, Protection of Hangers, Refuelling and defiling in Air Cargo. Crash Tender: Provision of Crash – Fire – tenders including Rapid Intervening appliances, Categorisation of Air-Port, their extinguishing media and determination of the appliances for each category as per International Standard.

Constructional features of Passenger and goods train, yard, tunnels and railway station. Hazards, preventive measures and tactical management. Construction features of Passenger Vehicles, Commercial Vehicles, Transport System Including Tunnels and their Hazards & Management.

Type of natural disaster, hazards, preventive measures and tactical management.

10. Fire And Arson Investigation

The nature and behaviour of fire: Elements of Combustion, Flaming and Glowing Fire, Explosive Combustion, Heat Transfer, Sequence of Room Fire, Effects of Environmental Conditions, Combustion Properties of Liquid & Gaseous Fuels.

Combustion Properties of Solid Fuels: Pyrolysis, Papers, Plastics, Paints, Metals, Coals, Flame Colour & Smoke production. Source of Ignition: Primary Igniter, the role of services and appliances in starting fire (Gas lines, Gas Appliances, L.P. Gas, Electricity).The role of hot & burning fragments in kindling fire, lightening, spontaneous combustion, electric light bulb.

Structure fire & their investigation: Elements of building construction, General Principals of fire behaviour, Investigative information during suppression, Examination of structure fire scene, documenting the fire scene.

Grass and Wild Fires, Automobile Motor Vehicle and Ship Fires. Electrical causes of Fire: Basic Electricity, Wiring systems, Ignition by ElectricalMeans.Investigation of Electrical-related fire: Post – Fire Indicator, LaboratoryExamination.Clothing & Fabric Fire, Explosion & Explosive Combustion, Chemical Fire &Hazardous Material.

Laboratory Services: Availability of Laboratory Services: General FireEvidence, Miscellaneous Laboratory Test Identification of Volatile Accelerants: Gas Chromatography, Sample Handling,Extraction of Volatile Accelerants, Identification of Volatiles.Chemical Incendiaries Non-Fire-Related Criminal Evidence: Fingerprints, Blood, Impression Evidence, Trace Evidence.

Fire Related Deaths: Pathological and Toxicological examination: Destruction of the body, effect of fire, other pathological findings, carbon monoxide asphyxiations, other toxic cases. Arson as a Crime: The crime of arson motive, the arson set, deductions from the interpretation of evidence (Analytical reasoning, Elimination of Accidental and Natural Causes).Other Investigative Topics: Arson Law, Elements of Proof, Sources of Information, Chain of evidence, Report writing, Courtroom Testimony.

11. Piping Design

Definition, Application Codes and Standards. Pipe Fittings, Pipe Flanges, Valves. Piping Special Items, Process Mechanical Equipments– Staticequipment's& Rotaryequipments. Layouts, Piping Isometric Drawings& Material Take off, Pipe Support, Typical Unit Conversion, Materials, Stress Analysis.

12. Fire Risk Calculation

Application of fire risk analysis, Probability Concept, Statistics, Extreme Value Theory, Reliability, Probability Models in Fire Protection Engineering, Utility Theory, Value of Human Life, Computer Simulation for Fire Protection, Fire Risk Assessment Schedules.

13. Fire Services and Disaster Management, Fire and Disaster Tactica.

14. Fire Service Technology and Media.

15. Fire Service Equipment.

16. **Fire Service Operations and Communication.**

17. **Safety Management, Environment and Health.**

18. **The Petroleum Act of 1934, Calcium Carbide Rules, Cinematograph Act, 1938, Factories Act of 1938, Explosive Rules of 1940, Factories Act and Civil Right Act. General Principles of Compensation Laws and Fire Insurance Assessment and Case Studies, Occupational Safety and Health Act (OSHA), Disaster management Act of India.**

19. **Forest Hazards:** Hazard within the forest, exposure hazard due to forest fire, environmental pollution. Fire risk analysis of rural, forest and industrial development.

20. **Current Trends and recent advancements in the field of Fire Safety.**

PART -2		
Descriptive Questions		**(20 Marks) (30 Minutes)**
➢ **For Both Questions Maximum 200 words each** ➢ **Writing option in Gujarati / English**		
1. Case Study		
2. Precis Writing		

Part 1	**MCQ TEST**	**50 Marks**	**Minimum Qualifying Marks 35**
Part 2	**Descriptive Test**	**20 Marks**	
	Interview	**30 Marks**	
	TOTAL	**100 Marks**	