

# CHENNAI PORT AUTHORITY

## FIRE OFFICER & ASSISTANT SAFETY OFFICER

### EXAMINATION SYLLABUS

## 1. FIRE AND SAFETY ENGINEERING

### A. Fire Science Fundamentals

#### Fire Chemistry

- Fire Triangle: Fuel, Oxygen, Heat
- Fire Tetrahedron: Fuel, Oxygen, Heat, Chemical Chain Reaction
- Types of Combustion: Rapid, Spontaneous, Smoldering
- Products of Combustion: Smoke, Heat, Toxic Gases (CO, CO<sub>2</sub>, HCN)
- Flash Point, Fire Point, Auto-ignition Temperature
- Flammability Limits: Lower Explosive Limit (LEL), Upper Explosive Limit (UEL)

#### Heat Transfer Mechanisms

- Conduction, Convection, Radiation
- Fire Spread Patterns and Control

#### Fire Classification

- Class A: Ordinary Combustibles (Wood, Paper, Cloth)
- Class B: Flammable Liquids (Petrol, Oil, Solvents)
- Class C: Flammable Gases (LPG, Hydrogen, Methane)
- Class D: Combustible Metals (Magnesium, Sodium, Potassium)
- Class E: Electrical Fires
- Class F: Cooking Oil Fires

## B. Fire Prevention and Protection Systems

### Fire Detection Systems

- Smoke Detectors: Ionization, Photoelectric
- Heat Detectors: Fixed Temperature, Rate-of-Rise
- Flame Detectors: UV, IR, UV/IR Combination
- Gas Detectors: Combustible Gas, Toxic Gas
- Fire Alarm Control Panel (FACP): Conventional vs. Addressable

### Water-Based Fire Suppression

- Fire Hydrant Systems: Components, Layout, Pressure Requirements
- Sprinkler Systems: Wet Pipe, Dry Pipe, Pre-action, Deluge
- Water Spray Systems: Medium and High Velocity
- Foam Systems: Low, Medium, High Expansion
- Foam Concentrates: AFFF, FFFP, Protein, Synthetic

### Gaseous Fire Suppression

- CO<sub>2</sub> Systems: Total Flooding, Local Application
- Clean Agents: FM-200, Novec 1230, Inert Gases (IG-541)

### Portable Fire Extinguishers

- Types: Water, Foam, CO<sub>2</sub>, Dry Chemical Powder (DCP), Clean Agent
- PASS Technique: Pull, Aim, Squeeze, Sweep
- Inspection, Maintenance, Refilling Schedule

## C. Fire Pumps and Hydraulics

- Centrifugal Fire Pumps: Construction, Operation, Performance Curves
- Pump Drivers: Electric Motor, Diesel Engine, Steam Turbine
- Jockey Pump: Purpose and Operation
- Pressure Calculations: Static, Residual, Normal Working
- Flow Rate Calculations:  $Q = AV$  formula
- Friction Loss in Pipes

## **D. Building Fire Safety**

- Fire-Resistant Construction: Ratings (1-hour, 2-hour, 4-hour)
- Fire Compartmentation and Fire Doors
- Means of Egress: Exit Routes, Travel Distance, Exit Width
- Emergency Lighting and Exit Signage
- Smoke Control Systems: Natural and Mechanical Ventilation
- Fire Lift (Firefighting Elevator)

## **E. Industrial Fire Hazards**

- Oil Storage Tanks: Fixed Roof, Floating Roof, Bund Wall Requirements
- Flammable Liquid Handling and Storage
- LPG/LNG Storage and Safety
- Dust Explosion Prevention
- Electrical Equipment in Hazardous Areas: Zone Classification
- Static Electricity Hazards and Bonding/Grounding

## **F. Fire Safety Codes and Standards**

### **National Fire Protection Association (NFPA)**

- NFPA 10: Portable Fire Extinguishers
- NFPA 13: Sprinkler Systems
- NFPA 20: Fire Pumps
- NFPA 30: Flammable and Combustible Liquids
- NFPA 72: Fire Alarm Systems
- NFPA 101: Life Safety Code

### **Indian Standards (BIS)**

- IS 2190: Fire Extinguishers
- IS 9668: Sprinkler Systems
- IS 15105: Fire Detection and Alarm Systems

### **Oil Industry Safety Directorate (OISD)**

- OISD-STD-116: Fire Protection
- OISD-STD-117: Fire Fighting Facilities

### **National Building Code (NBC) of India**

- Fire and Life Safety Requirements
- Means of Egress, Fire Resistance

## **G. Firefighting Operations**

- Size-up: Initial Assessment of Fire Scene
- Incident Command System (ICS)
- Search and Rescue Operations
- Ventilation: Vertical, Horizontal, Positive Pressure
- Forcible Entry Techniques
- Fire Attack: Offensive vs. Defensive
- Hose Operations: Direct, Indirect, Combination Attack
- Ladder Operations and Roof Work

## **H. Firefighting Equipment**

- Fire Hoses: Delivery, Suction

- Nozzles: Fog, Jet, Branch Pipe
- Fire Tenders: Types and Components
- Breathing Apparatus: Self-Contained (SCBA), Airline
- Personal Protective Equipment (PPE): Helmet, Turnout Gear, Gloves, Boots
- Thermal Imaging Camera
- Rescue Tools: Hydraulic Spreaders, Cutters

## **I. Emergency Response Planning**

- Emergency Action Plan (EAP)
- Fire Emergency Evacuation Plan (FEPP)
- On-Site Emergency Plan (OSEP)
- Off-Site Emergency Plan
- Mock Drills: Planning, Execution, Evaluation
- Emergency Response Team Formation and Training
- Mutual Aid Agreements
- Crisis Communication Plan

## **J. Fire Investigation**

- Origin and Cause Determination
- Fire Pattern Analysis
- Evidence Collection and Preservation
- Electrical Fire Investigation
- Report Writing and Documentation

## **K. First Aid and Medical Emergencies**

- Primary Survey: DRABC (Danger, Response, Airway, Breathing, Circulation)
- CPR (Cardiopulmonary Resuscitation)
- Burn Treatment: Thermal, Chemical, Electrical

- Smoke Inhalation Treatment
- Trauma Management: Fractures, Bleeding Control
- Heat Stress and Heat Stroke

## **L. Legislation and Regulations**

### **Factories Act, 1948**

- Chapter IV: Safety Provisions (Sections 21-41)
- Precautions Against Fire (Section 38)

### **Petroleum Act, 1934 and Rules, 2002**

- Licensing Requirements for Petroleum Storage
- Safety Distance Criteria

### **Explosives Act, 1884 and Rules, 2008**

- Licensing and Storage of Explosives

### **Gas Cylinder Rules, 2016**

- Manufacturing, Storage, and Handling of Gas Cylinders

### **Static and Mobile Pressure Vessels (Unfired) Rules, 2016**

- Design, Fabrication, and Inspection Requirements

### **Environment Protection Act, 1986**

- Hazardous Waste Management Rules

## **M. Construction Site Safety**

- Working at Height: Scaffolding, Fall Protection
- Excavation Safety and Trenching
- Electrical Safety and Permit-to-Work
- Lifting Operations: Cranes and Rigging
- Confined Space Entry

## **N. Safety Engineering and Industrial Safety**

### **Safety Indices and Statistics**

- Frequency Rate =  $(LTI \times 1,000,000) / \text{Total Man-hours}$
- Severity Rate =  $(\text{Days Lost} \times 1,000,000) / \text{Total Man-hours}$
- Incidence Rate =  $(\text{Injuries} \times 1,000) / \text{Average Employees}$

### **Job Safety Analysis (JSA)**

- Job Selection and Task Breakdown
- Hazard Identification
- Control Measures

### **Work Permit System**

- Hot Work, Cold Work, Confined Space, Height Work, Electrical Work Permits
- Lockout/Tagout (LOTO) Procedures

### **Dock Worker Safety Act, 1986**

- Safety Provisions for Port Operations
- Cargo Handling Safety
- Lifting Equipment Certification

## **2. REASONING ABILITY**

- Logical and Analytical Reasoning
- Statement and Conclusions/Assumptions/Arguments
- Seating Arrangements: Linear, Circular, Rectangular
- Blood Relations and Coding-Decoding
- Direction Sense and Distance Calculations
- Data Sufficiency and Analysis
- Puzzles: 5-10 variables
- Syllogisms and Critical Reasoning

- Series: Number, Letter, Alpha-numeric

## **3. QUANTITATIVE APTITUDE**

### **Number Systems and Arithmetic**

- Simplification, HCF, LCM, Percentages, Ratio
- Averages, Profit & Loss, Simple & Compound Interest

### **Time and Work**

- Work Efficiency, Pipes and Cisterns

### **Time, Speed and Distance**

- Response Time Calculations, Relative Speed

### **Mensuration**

- Area, Volume, Perimeter: 2D and 3D Figures

### **Algebra**

- Linear Equations, Quadratic Equations

### **Data Interpretation**

- Tables, Bar Graphs, Line Graphs, Pie Charts

### **Probability and Permutations**

- Risk Assessment, Team Formation

## **4. GENERAL AWARENESS**

### **Current Affairs (Last 6-12 Months)**

- Major Fire Incidents in India and Abroad
- Industrial Accidents and Safety Developments
- Government Safety Initiatives

## **Indian Polity and Governance**

- Ministry of Labour and Employment
- DGFASLI and NDMA

## **Port and Maritime Sector**

- 12 Major Ports of India: Deendayal, Mumbai, JNPT, Chennai, Visakhapatnam, etc.
- Chennai Port Authority: History, Facilities, Officials, Cargo Statistics
- Sagarmala Project and Maritime India Vision 2030/2047
- IMDG Code and ISPS Code

## **Safety Organizations**

- National Safety Council (NSC)
- Institution of Fire Engineers (India)
- NDRF, Tamil Nadu Fire and Rescue Services

## **Geography**

- Major Ports Location, Industrial Zones in India
- Fire-Prone Regions, Earthquake and Cyclone Zones

## **Science and Technology**

- Combustion Chemistry and Physics
- Fire Detection Technology, IoT and AI in Fire Safety

## **Tamil Nadu Specific**

- Industries in Tamil Nadu: Chennai, Coimbatore, Hosur
- Tamil Nadu Pollution Control Board
- Petrochemical Complexes: Manali, Ennore

- Passages (400-700 words): Technical, Fire Safety, Emergency Scenarios
- Vocabulary, Inference, Main Idea, Tone

## **Grammar**

- Error Detection and Sentence Correction
- Fill in the Blanks
- Active/Passive Voice, Tenses
- Subject-Verb Agreement, Articles, Prepositions

## **Vocabulary**

- Synonyms, Antonyms, One-word Substitution
- Idioms and Phrases
- Technical Fire Safety Terminology

## **Sentence Organization**

- Para Jumbles (4-6 sentences)
- Coherence and Logical Flow

## **Cloze Test**

- Fill Blanks in Passages (5-10 blanks)

## **Technical Communication**

- Safety Instructions and SOP Language
- Incident Report Writing

# **5. ENGLISH LANGUAGE**

## **Reading Comprehension**