

PGDFLP12: Syllabus: Principles of Fire Services & Safety

Course Objective

To equip students with an advanced understanding of fire safety principles, fire service management, and the integration of fire safety measures in engineering and architectural projects, with a specific focus on Indian regulations and standards.

Module 1: Fundamentals of Fire and Safety Engineering

- Definition and chemistry of fire.
 - Fire triangle and tetrahedron: Heat, fuel, oxygen, and chain reaction.
 - Fire classification: Class A, B, C, D, K.
 - Mechanisms of combustion, flame propagation, and ignition.
 - Heat transfer in fires: Conduction, convection, radiation.
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Module 2: Fire Codes, Standards, and Regulatory Framework

- Indian fire safety standards: National Building Code (NBC 2016), IS 1646.
 - International fire codes: NFPA, ISO standards.
 - Legal framework in India: Factories Act, Explosives Act, Petroleum Act, and Fire Services Act.
 - Role of statutory bodies: Local fire authorities, disaster management agencies.
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Module 3: Fire Dynamics and Behaviour

- Fire development in enclosed spaces: Flashover, backdraft, and smoke movement.
 - Effects of ventilation and structural features on fire spread.
 - Fire load calculations and building compartmentation.
 - Smoke toxicity and hazards.
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Module 4: Active and Passive Fire Protection Systems

A. Passive Fire Protection

- Fire-resistant materials and construction methods.
- Compartmentalization and fire barriers.
- Fire doors, dampers, and glazing.

B. Active Fire Protection

- Fire detection systems: Smoke detectors, heat detectors, flame detectors.
 - Alarm systems: Manual and automatic alarms, public address systems.
 - Fire suppression systems: Sprinklers, gaseous suppression, foam systems.
 - Fire hydrants, pumps, and standpipes.
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Module 5: Fire Safety in Building Design and Engineering

- Principles of fire safety in architecture and engineering.
 - Integration of fire safety systems in design: HVAC, electrical, structural considerations.
 - Fire safety in high-rise buildings, hospitals, and industrial structures.
 - Design of fire escape routes, staircases, and refuge areas.
 - Case studies of fire-safe building designs.
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Module 6: Industrial and Electrical Fire Safety

- Fire hazards in industrial setups: Petrochemical, manufacturing, and power plants.
 - Explosion prevention: ATEX zones, dust, vapor, and BLEVE.
 - Electrical fire safety: Circuit protection, grounding, and insulation.
 - Battery and renewable energy system fire safety (e.g., solar, EV batteries).
 - Specialized suppression systems for industrial applications.
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Module 7: Fire Service Operations and Management

- Structure and organization of fire services in India.
 - Roles and responsibilities of firefighters and first responders.
 - Use of firefighting equipment: Hoses, ladders, breathing apparatus.
 - Incident command system and firefighting strategies.
 - Fire station design and resource planning.
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Module 8: Disaster Management and Emergency Response

- Fire risk assessment and hazard identification.
- Emergency evacuation planning and drills.
- Firefighting in urban vs. rural environments.
- Coordination with disaster management teams.
- Post-fire investigations and reporting.

Module 9: Modern Technologies in Fire Safety

- Smart fire detection and suppression systems.
 - IoT and AI applications in fire safety.
 - Robotics and drones in firefighting.
 - Fire simulation software for planning and training.
 - Sustainable firefighting practices: Eco-friendly agents and equipment.
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Module 10: Practical Applications and Field Exposure

- **Workshops and Lab Sessions:**
 - Hands-on training with fire extinguishers, alarms, and suppression systems.
 - Smoke and fire simulation exercises.
- **Site Visits:**
 - Visits to fire stations, industrial plants, or high-rise buildings.
 - Observation of fire drills and safety audits.
- **Project Work:**
 - Design and analysis of fire safety systems for a specific building or industrial setup.

