NCEES
advancing licensure for engineers and surveyors

## NCEES Principles and Practice of Engineering Examination
# FIRE PROTECTION Exam Specifications

**Effective Beginning with the October 2018 Examinations**

- The exam is an 8-hour open-book exam. It contains 40 multiple-choice questions in the 4-hour morning session, and 40 multiple-choice questions in the 4-hour afternoon session. Examinee works all questions.
- The exam uses both the International System of units (SI) and the U.S. Customary System (USCS).
- The exam is developed with questions that will require a variety of approaches and methodologies, including design, analysis, and application.
- The knowledge areas specified as examples of kinds of knowledge are not exclusive or exhaustive categories.
- Codes and standards applicable to the exam will be those effective December 31 of the year preceding the exam.

| | | Approximate Number of Questions |
|---|---|---|
| **I.** | **Fire Protection Analysis** | **20** |
| A. | Types of Analysis | 8 |
| 1. | Hazard analysis (e.g., hazardous materials, storage, equipment, processes) | |
| 2. | Risk analysis (e.g., likelihood, severity, impact, failure, reliability) | |
| 3. | Limitations of analyses | |
| 4. | Data interpretation | |
| B. | Applying Information for Analysis | 12 |
| 1. | Uncertainty and safety factors | |
| 2. | Facility characteristics (e.g., site, fire department capability, use, building configuration, processes, facility contents) | |
| 3. | Acceptable thresholds (e.g., maximal temperature, heat flux, gas concentration, tenability) | |
| 4. | Codes and standards | |
| 5. | Occupancy, hazard, and commodity classifications | |
| 6. | Fire tests (e.g., classification, product or material characteristics, sources, interpretation) | |
| 7. | Technical drawings, schematics, and plans (e.g., contract documents, shop drawings, riser diagrams) | |
| 8. | Selection of design fire | |
| **II.** | **Fire Dynamics Fundamentals** | **12** |
| A. | Fire and smoke behavior | |
| B. | Fire size and growth | |
| C. | Combustion | |
| D. | Plume entrainment (e.g., axisymmetric, balcony spill, window, corner, wall) | |
| E. | Material properties (e.g., heat of combustion, ignitability, thermal, mechanical, flammable and explosive limits) | |
| F. | Material compatibility (e.g., storage arrangements, water reactives) | |
| G. | Heat transfer from fire and smoke | |

## III. Active and Passive Systems — 36

A. Water-Based Fire Protection Systems — 11

1. Design criteria (e.g., water supply, densities, pressure requirements, design areas, capabilities and limitations)
2. Hydraulic calculations
3. System types (e.g., wet and dry pipe, pre-action, deluge, water mist, standpipes)
4. System components (e.g., sprinkler and nozzle types, valves, flow detection, pipe and fitting material selection, cross-connection control, hanging and bracing, corrosion control)
5. Component placement (e.g., obstructions, ambient conditions)
6. Water supply and distribution (e.g., public, private, storage tanks)
7. Fire pumps and controllers
8. Testing protocol (e.g., hydrostatic, pneumatic, duration, environmental considerations, water supply)

B. Special Hazard Systems — 4

1. Design criteria (e.g., capabilities and limitations of the design)
2. Design method (e.g., total flooding, local application, coverage area)
3. Pipe sizing (calculation input and output)
4. System types (e.g., low-pressure and high-pressure $CO_2$, chemical and inert clean agents, wet and dry chemical, foam, hypoxic air)
5. System components (e.g., valves, nozzles, pipe and fitting selection, hanging and bracing)
6. Agent storage
7. Personnel safety
8. Controls (e.g., actuation, pre-alarm, release, detection)
9. Collateral damage (e.g., toxic or acid byproducts, positive and negative pressure effects, environmental considerations)
10. System interlocks (e.g., damper, process shutdown)
11. Test methods (e.g., enclosure integrity, pipe integrity, foam proportioning)

C. Detection, Alarm, and Signaling Systems — 8

1. Design criteria (e.g., sequence of operation, full versus partial detection, capabilities and limitations of the design, occupancy)
2. System types (e.g., addressable, conventional, emergency communication system, combination, releasing)
3. System components (e.g., control equipment, power supply, initiating devices, notification appliances, wiring, supervising station)
4. Circuit classification, wiring methods, and survivability
5. Building control functions and system interfaces (e.g., elevators, HVAC, smoke control, door releases, security)
6. Test methods
7. Calculations (e.g., voltage drop, battery, sound pressure)
8. Inspection, testing, and maintenance procedures and frequencies

D. Smoke Control Systems — 4

1. Design criteria (e.g., objectives, equipment survivability, pressure limits, air leakage, door opening force, capabilities and limitations of the design)
2. System types (e.g., pressurization systems, zone smoke control, natural venting, mechanical exhaust)
3. System components (e.g., control equipment, fans, dampers, ductwork, initiating mechanisms, power supplies, gravity vents)

4. Calculations (e.g., vent flows, plugholing, makeup air velocity, stack effect, wind, buoyancy)
5. System interfaces (e.g., fire alarm, HVAC, security, suppression)
6. Test methods (e.g., verify sequence of operation, component performance)

E. Explosion Protection and Prevention Systems 2

1. Design criteria (e.g., system interlocks, personnel safety, collateral damage, protected hazard, maximum pressure, oven ventilation and explosion venting, agent considerations, capabilities and limitations of the design)
2. Design method (e.g., suppression, inerting, isolation, venting, containment, damage limiting construction)
3. Prevention methods (e.g., ignition prevention, humidity control, fuel control [dust layers, vapor concentration])

F. Passive Building Systems 7

1. Construction types
2. Construction materials (e.g., roofing, sheathing, insulation)
3. Height and area limits
4. Building separation distance
5. Interior finish (e.g., flame-spread rating, critical radiant flux)
6. Structural fire resistance (e.g., calculation methods, substitution rules, thermal response of structural members and connections)
7. Compartmentalization/barrier (e.g., fire, smoke)
8. Protection of openings, penetrations, and joints

## IV. Egress and Occupant Movement 12

A. Means of Egress 8

1. Occupant load calculations
2. Elements (e.g., exit access, exit, exit discharge)
3. Arrangement and sizing (e.g., remoteness, travel distances, number, capacity)
4. Components (e.g., stairwells, corridors, doors, hardware, elevators, areas of refuge)
5. Emergency lighting and illumination
6. Exit signage and pathway marking

B. Human Behavior 4

1. Evacuation movement (e.g., timed egress analysis, egress width, travel time, travel distance, human performance capabilities, flow rate, emergency planning and training)
2. Occupant pre-evacuation period and human response to fire cues
3. Effects of exposure to smoke, heat, and toxins