UNIVERSITI KUALA LUMPUR
INSTITUTE OF MEDICAL SCIENCE TECHNOLOGY

FINAL EXAMINATION

OCTOBER 2025 SEMESTER

COURSE CODE	:	HRB30303
COURSE TITLE	:	FIRE SAFETY
PROGRAMME NAME	:	BACHELOR OF OCCUPATIONAL SAFETY & HEALTH (HONOURS)
DATE	:	03 FEBRUARY 2026
TIME	:	9:00AM - 12:00PM
DURATION	:	3 HOURS

INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper CAREFULLY.
2. This question paper is printed on both sides of the paper.
3. This question paper consist of TWO sections.
4. Answer ALL questions for Section A.
5. Section B consist of four questions. Answer THREE (3) questions only.
6. Please write your answer on the answer booklet provided.
7. Please answer all questions in English only.
8. Please answer MCQ/EMQ questions using OMR sheet. ☐ *Tick if applicable*
9. Refer to the attached Formula/ Appendies. ☐ *Tick if applicable*

THERE ARE 7 PAGES OF QUESTIONS INCLUDING THIS PAGE

SECTION A (Total: 40 marks)

Answer ALL questions.

Please use the answer booklet provided.

Question 1

When lighting a gas stove, there is a narrow window between the Lower Explosive Limit (LEL) and the Upper Explosive Limit (UEL). The LEL for methane is 5% and its UEL is 15%. By using the information given, explain the UEL, LEL and Fire Triangle Concept with the help of the vapor concentration vs temperature graph.

(10 marks)

Question 2

A safety audit at a chemical processing plant has identified two immediate mechanical threats:

Failure A: A rupture in a high-pressure pipeline is releasing a heavy, low-lying propane mist into a densely packed area of steel structures and machinery.
Failure B: A large primary storage tank holding liquefied propane under high pressure has developed a significant structural fracture that could lead to a sudden loss of containment.

Examine the potential catastrophic consequences of these failures by providing a detailed technical explanation of a Vapor Cloud Explosion (VCE) and a Boiling Liquid Expanding Vapor Explosion (BLEVE). In your analysis, you must differentiate the specific physical mechanisms (pressure changes and phase transitions) that lead to each event based on the scenario above.

(10 marks)

Question 3

You have been appointed as the Safety Supervisor for a high-risk maintenance project. The task involves replacing a corroded section of a high-pressure chemical pipeline located inside a confined space. The work requires welding (hot work) and will take place during a night shift with a team of four technicians.

Apply **FIVE (5)** principles of a Standard Safety Work Procedure (SWP) to this project.

(10 marks)

Question 4

During the post-fire analysis of a chemical storage facility, investigators discovered a localized pour pattern on a charred substrate alongside a partially compromised plastic vessel, both of which are suspected to contain volatile hydrocarbon residues.

(a) Assess the situation by selecting the appropriate airtight containers.

(4 marks)

(b) Choose **TWO (2)** tests that can identify the chemical signature of the suspected accelerant.

(6 marks)

SECTION B (Total: 60 marks)

Answer THREE (3) questions only.

Please use the answer booklet provided.

Question 1

At 2:00 PM, a fire broke out in a 10th-floor server room of a modern office building. The room was equipped with high-density server racks and a failing Uninterruptible Power Supply (UPS) battery. Initial sparks from the battery ignited nearby plastic casing. Within minutes, the heat became intense enough that the fire began to spread through the ventilation shafts and heat the steel structural beams. Despite the room being sealed, the fire continued to grow until a window shattered, introducing a fresh gust of oxygen, leading to a sudden intensification of flames.

(a) Analyze the differences between the application of the Fire Triangle and the Fire Tetrahedron in the context of this incident.

(8 marks)

(b) Determine the mechanism of fire spread that will make the situation worst.

(12 marks)

Question 2

A 20-year-old industrial warehouse recently converted into a data server hub. A minor electrical fault occurred in a server rack, which rapidly escalated into a full-scale building fire. Despite the building having "modern" upgrades, the fire resulted in total property loss.

(a) Point out **THREE (3)** differences between the fundamental purposes of 'Grounding' and 'Bonding' in a commercial electrical. Use diagram to illustrate your explanation.

(10 marks)

(b) Distinguish **FIVE (5)** differences between the operational roles of Active Fire Protection (AFP) and Passive Fire Protection (PFP) within a high-rise building's safety strategy.

(10 marks)

Question 3

The Bhopal Gas Tragedy, widely considered the world's most devastating industrial disaster, occurred on the night of December 2–3, 1984, when 40 tons of toxic methyl isocyanate (MIC) leaked from the Union Carbide plant due to a runaway chemical reaction triggered by "water washing" pipes without properly isolating storage tanks. The disaster at the Bhopal Union Carbide plant was the result of a systemic collapse of defense-in-depth safety layers, where cost-cutting measures and maintenance negligence transformed a series of manageable mechanical failures into a catastrophic chemical reaction. By bypassing "slip blind" isolation and deactivating the refrigeration system, the plant removed the primary barriers preventing water contamination and thermal instability. When the resulting runaway reaction occurred, the final lines of defense—the undersized scrubber and the disconnected flare tower—were physically incapable of neutralizing or burning the gas, while the overfilled storage tank provided no margin for pressure expansion, effectively turning the facility into an uncontainable pressure cooker.

(a) Analyze how **FIVE (5)** structural failure transformed a localized chemical leak into a mass-casualty event.

(10 marks)

(b) Identify **FIVE (5)** control measures to prevent such catastrophe.

(10 marks)

Question 4

The 1911 Triangle Shirtwaist Factory fire remains one of the most significant industrial tragedies in U.S. history, claiming the lives of 146 garment workers—mostly young immigrant women—in New York City. The high death toll was a direct result of neglected safety measures, including locked exit doors intended to prevent theft, a single inadequate fire escape that collapsed under the weight of those fleeing, and fire department ladders that could not reach the upper floors of the building. This disaster served as a definitive turning point for labor rights, sparking massive public outcry that led to the creation of the Factory Investigating Commission and the subsequent passage of landmark workplace safety legislation, including mandatory fire drills, functional sprinkler systems and improved building egress laws.

(a) Analyze **FIVE (5)** critical components of a comprehensive Fire Prevention Program for a high-occupancy industrial facility.

(10 marks)

(b) Identify **FIVE (5)** technical elements to consider in an Emergency Response Plan (ERP) with regards to the incident.

(10 marks)

END OF EXAMINATION PAPER