Second Semester Examination
2020/2021 Academic Session

July/August 2021

EAF523 – Fire Protection Technology

Duration : 2 hours

Please ensure that this examination paper contains **SEVEN (7)** printed pages before you begin the examination.

Instructions: This paper contains **FOUR (4)** questions. Answer **ALL** questions.

All questions **MUST BE** answered on a new page.

1. (a). Most errors in calculating the required battery sizing occur in determining the required load. There are two types of loads, which are standby, and alarm loads. The following data helps in calculating the required loads for the battery sizing of a fire extinguisher system. The required duration is 24 hours in standby mode and five minutes in alarm mode. There are one main board and two power supplies for the panel equipment, one sounder circuit controller, 30 smoke detectors, 30 beacons, 20 sounders and 10 strobes used, with 5 relays. The standby load for the main board is 0.1370 Amps, and power supply is 0.1 Amps. The alarm load for the panel equipment is double the standby load. The current load for sounder circuit controller is 0.19 Amps (standby load) and 0.0017 Amps (alarm load); smoke detector is 0.0003 Amps; beacon is 0.35 Amps; sounder is 0.22 Amps; strobe is 0.059 Amps and relay is 0.03 Amps. By considering 10% safety factor, determine the battery sizing for the system.

[13 marks]

(b). Based on voltage drop in cables in **Table 1**, determine the voltage drop for the following cases:

(i). 30 beacons, each beacon with current consumption of 30 mA on 200 mA of 1.0 mm cable, and

(ii). 20 sounders, each sounder with current consumption of 35 mA on 200 mA of 1.0 mm cable.

Discuss the effects of the voltage drop for both beacon and sounder if the limiting requirement for the voltage drop for this system is 4 V. Show your calculations.

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Table 1

Cable Size (mm)	Voltage Drop (mV/A/m)
1.5	29
2.5	18
4	11
6	7.3
10	4.4
16	2.8

[12 marks]

2. (a). Based on **Figure 1**, identify **THREE (3)** major differences between **'Addressable alarm systems'** and **'Conventional Alarm System'**.

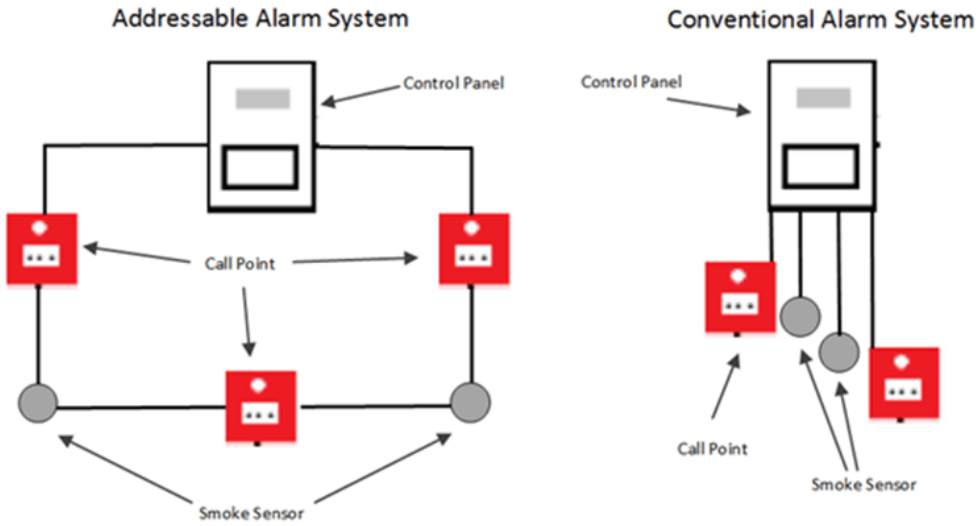

Figure 1: Addressable Alarm System and Conventional Alarm System.

[6 marks]

(b). Control and Indicative Equipment will comprise equipment for the reception, indication, control and relaying of signals originating from detectors or manual call points connected to it, and for activation of alarm sounders and alarm signaling devices. In the design requirement of the alarm system, **discuss THREE (3)** of the operation requirements. Explain each of the operational requirements.

[9 marks]

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(c). A scenario like a multi-story building or a sprawling hospital campus with hundreds of independent smoke detectors and fire alarms, when a fire starts to spread, a single alarm goes off. Soon the smoke spreads, a second alarm is activated, and more alarms are sounding. By the time the firefighting units arrived, there were many alarms, and the emergency crew had no idea where the problem had started or the source of the problem. This can lead to a prolonged event, excessive property damage and possibly unnecessary injury and loss of life. Based on this scenario, propose a fire alarm system solution to improve the system's effectiveness in the multi-storey building.

[10 marks]

(3). In the early morning on Monday, 1 July 2019, a fire occurred in the 8-storey hotel with 40 rooms. The fire was considered to have broken out in a room on the 6th floor caused by a short circuit of electric wiring when no one was in the room. Based on the walkthrough inspection after the fire, the building was equipped with the hose reel system but only for the ground floor and 1st floor. It was observed that all of the hose reels were not in good shape and the hoses were without nozzles. Portable fire extinguishers Class A were installed at one end of the building for each floor. It was observed that the travel distance was 100 feet.

The building was installed with the smoke detectors and fire alarms. Although the detectors and alarms worked when the fire broke out, the security team reportedly failed to respond immediately because the detectors and sensors had repeated errors before the day of the fire. The firefighters experienced difficulties to get water source from the nearby fire hydrants due to no water supply.

The fire from the fire source floor (6th floor) spreaded to upper and lower floors (5th and 7th floor) primarily through the floor, ducts, gaps between the floor and wall and openings on outside wall. It was found that a great number of wooden panels were used as interior finishing which is said to be the cause to accelerate the spread of fire.

Based on your expert opinion, codes and standards (Uniform Building by Law, Malaysian Standard and National Fire Protection Association) propose to the management on how to improve the fire protection systems for the hotel.

[25 marks]

(4). An 8-storey commercial building has 3 staircases with 3 elevators, as shown in **Figure 2**. As illustrated in **Figure 3**, each staircase unit has 2 units of double-leaf openings into a pressurised space, and 1 unit of single leaf opening into pressured space door, and one lift landing door. The height (H) and width (W) of the double-leaf opening into pressured space door, are given in **Table 3**. A builder work ducting (masonry shaft) system with a leakage factor of 25% will be used. Assume no air leakage through building construction and lift shaft vent size is 0.16m^2. Calculate the pressurization fan capacity.

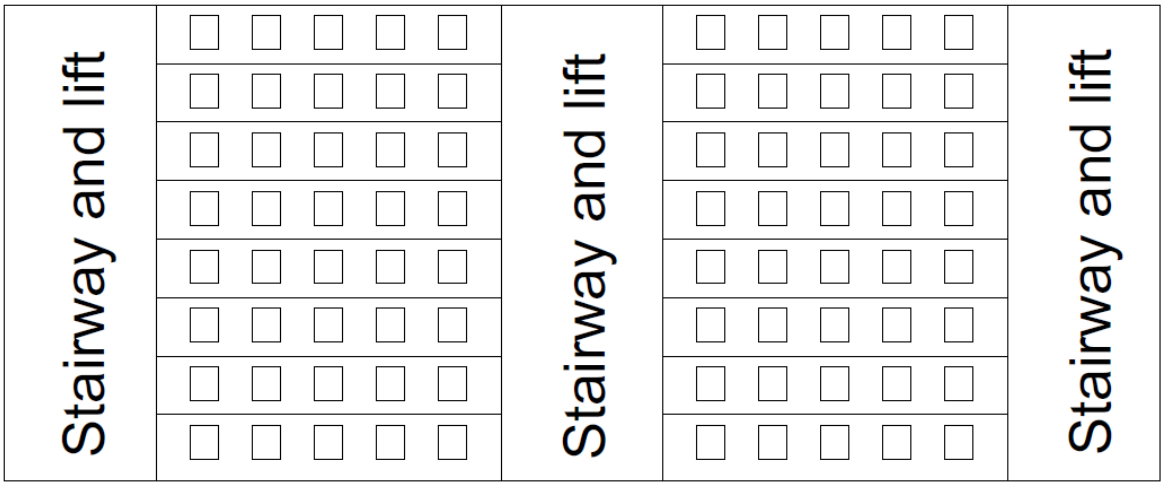

Figure 2: Schematic drawing of 8 storeys commercial building

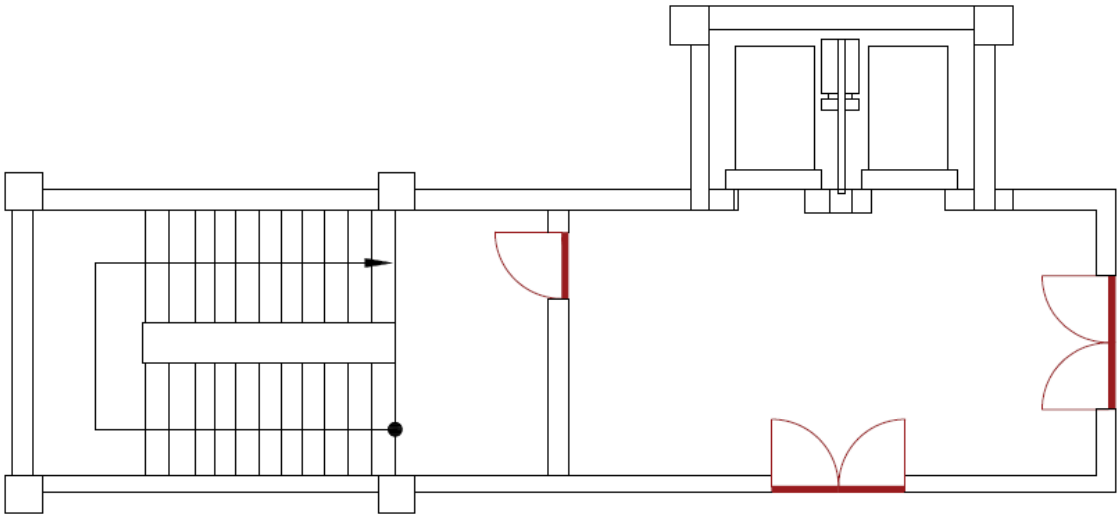

Figure 3: Layout of the staircase

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For leakage door estimation, it is based on 50 Pa pressure differential and interpolation data from **Table 3** and **Table 4** (MS1472).

Table 3.

	Type of Door	Size		Leakage Per Door (CMH)
		Height (H) (m)	Width (W) (m)	
Case A	Single leaf opening into a pressurised space	2	0.8	210
Case B	Single leaf opening outwards from a pressurised space	2	0.8	420
Case C	Double leaf opening into a pressurised space	2	1.6	630

Table 4 (MS1472).

No of pressurized lobbies opening into the lift shaft (=n)	Value of F for vent size		
	$0.1m^2$	$0.16m^2$	$0.22m^2$
1	0.860	0.94	0.96
2	1.280	1.60	1.76
3	1.460	1.99	2.32
4	1.540	2.22	2.70
5	1.580	2.35	2.96
6	1.610	2.44	3.13
7	1.620	2.49	3.25
8	1.630	2.53	3.33
9	1.640	2.56	3.40
10	1.645	2.58	3.44
12	1.659	2.60	3.51
14	1.655	2.62	3.55
16	1.66	2.63	3.57
Above 16	1.66	2.66	3.66

[25 marks]

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