First Semester Examination
Academic Session 2020/2021

February 2021

EAF523 – Fire Protection Technology

Duration : 2 hours

Please check that this examination paper consists of **EIGHT (8)** pages of printed material before you begin the examination.

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

Each question **MUST BE** answered on a new page.

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(1). (a). **Figure 1** indicates a warehouse with beams where *D* is 1.5 m, *H* is 5 m and *h* is 0.5 m. Inside the warehouse, there are large boxes which are stacked on top of each other until there is only 0.4 m gap between them and the ceiling. Assume there is no effect of false ceilings. Based on this information, discuss on suitable placement of fire detectors, and justify the reason for your choice of placement and detection type (use diagram to help with your answer).

[15 marks]

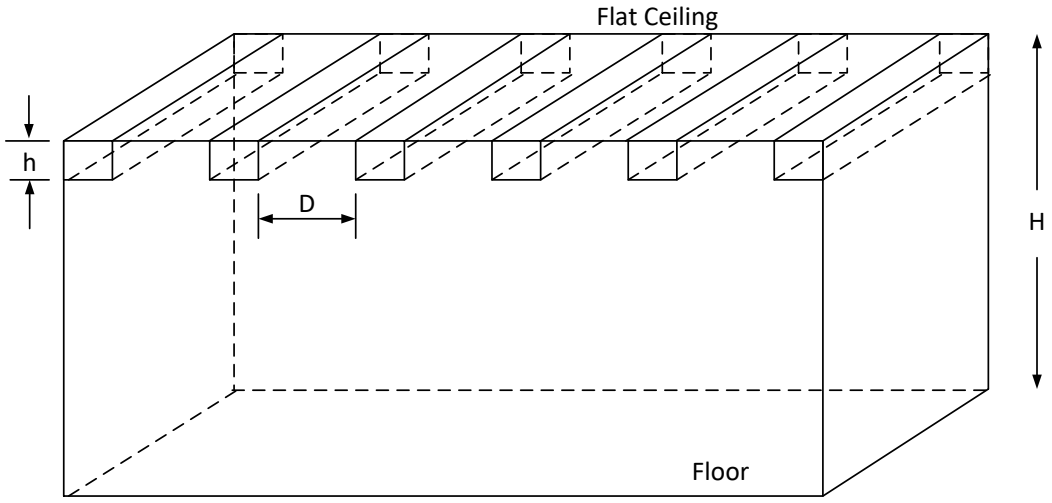

Figure 1: Warehouse with flat beams ceiling

(b). In this Fire Extinguishing System, the related parameters associated with two loads, i.e. standby load and alarm load are listed in **Table 1**. If standby duration is 72 hours and alarm duration is 1 hour with 10 % safety factor, calculate the required battery capacity for this Fire Extinguishing System.

[10 marks]

Table 1

No.	Description	Quantity	Amp (mA)	Total (mA)
1	Master Control	1	75.000	
2	Zone Unit	2	5.000	
3	Smoke Detector	4	0.050	
4	Heat Detector	4	0.055	
5	Flashing Light (G)	3	20.000	
Total Standby Amp.			A	
No.	**Description**	**Quantity**	**Amp (mA)**	**Total (mA)**
1	Master Control	1	140.000	
2	Zone Unit	2	50.000	
3	Flashing Light (R)	3	20.000	
4	Smoke Detector	3	52.000	
5	Heat Detector	3	52.000	
6	Alarm Bell	1	30.000	
7	Tripping (AUX)	1	150.000	
Total Alarm Amp.			B	

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(2). (a). Describe the purpose of a fire alarm system and give an example of the fire alarm system.

[3 marks]

(b). What is manual call point in the fire alarm system and describe in detail when a manual call point will be activated?

[4 marks]

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

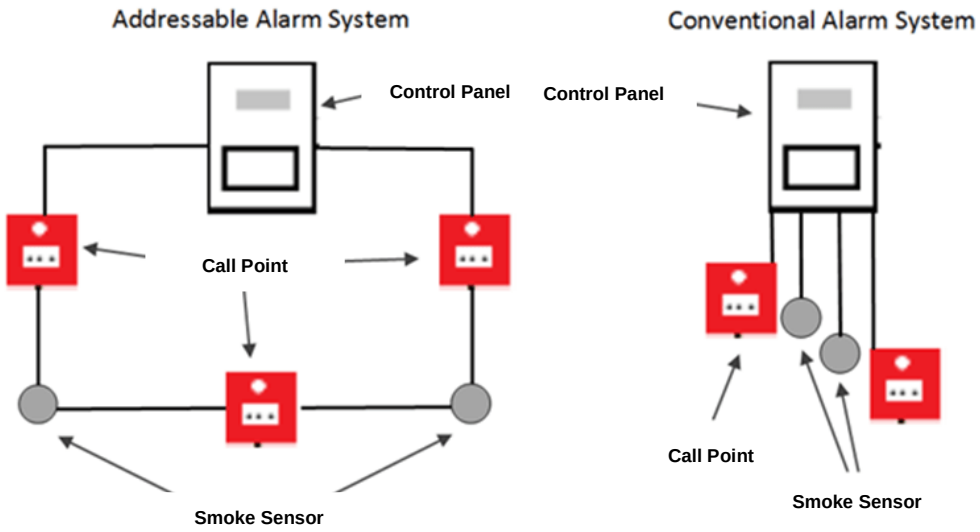

Figure 2: Addressable alarm systems and Conventional Alarm System

[6 marks]

(d). 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, identify **TWO (2)** of the operation requirements. Explain each of the operational requirements.

[4 marks]

(e). Imagine 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-story building.

[8 marks]

(3). (a). Describe the fire protection major goals with respect to design and analysis of fire protection requirements of buildings.

[10 marks]

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

Suggest to the hotel management on how to improve the fire protection systems.

[15 marks]

(4). A ten storey commercial building has two staircase with two elevators. As illustrated in **Figure 3**, each floor has a height of 5 m, width of 7 m and Length of 16 m. It has one double 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 2**. A builder work ducting (masonry shaft) system with leakage factor 25% will be used. Assume no air leakage through building construction and lift shaft vent size is 0.16 m^2. Use **Table 3** to calculate *F* for vent size. Calculate the pressurisation fan capacity.

[25 marks]

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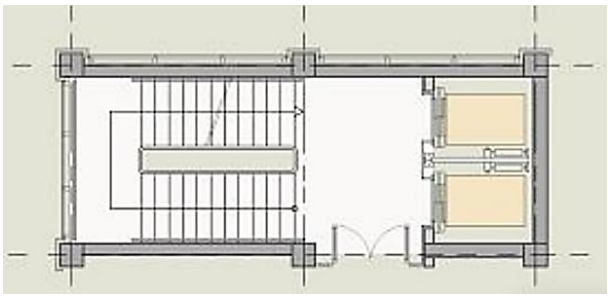

Figure 3: Staircase layout design

Leakage Door Estimation Based 50Pa pressure differential and interpolation data from **Table 2** and **Table 3** (MS1472)

Table 2

	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 3 (MS1472)

No of pressurised 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

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