



UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER I
SESSION 2022/2023**

COURSE NAME : MECHANICAL & ELECTRICAL SYSTEM

COURSE CODE : BFC32602

PROGRAMME CODE : BFF

EXAMINATION DATE : FEBRUARY 2023

DURATION : 2 HOURS

INSTRUCTION :

1. ANSWER ALL QUESTIONS.
2. THIS FINAL EXAMINATION IS CONDUCTED VIA **CLOSED BOOK**.
3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA **CLOSED BOOK**.

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THIS QUESTION PAPER CONSISTS OF **FIVE (5) PAGES**

- Q1.** (a) An Integrated Building Management System (IBMS) is an intelligent or smart building system that includes a building automation system (BAS), a fire detection and alarm system, a public address system, and a security system. Using appropriate illustrations, describe in detail the three levels of the IBMS system architecture for commercial buildings.
- (10 marks)
- (b) The wall is one of the essential building envelope components that regulates the passage of energy from a building's interior to exterior or from its exterior to the inside of a building. Materials and construction method of a wall determines the flow of heat when there are differences in temperature between inside and outside. Each building material has a distinct thermal performance that represents its heat resistance.
- (i) Based on the sandwich panel illustrated in **Figure Q1(b)**, calculate the U-value of the wall. Given the inner surface resistivity is $0.12 \text{ m}^2 \text{ K/W}$ and external surface is $0.06 \text{ m}^2 \text{ K/W}$.
- (9 marks)
- (ii) If the air space layer in the sandwich panel is to be removed (between the ALC block and the polyurethane foam) and a layer of plasterboard with $\lambda = 0.16 \text{ W/mK}$ is to be added to the internal wall surface, calculate the minimum thickness of plasterboard to maintain the same U-value of the wall.
- (6 marks)
- Q2.** (a) Fire safety is important and necessary in a building in order to prevent and protect against the destruction caused by fire.
- (i) Fire protection system can be divided into two types. Describe passive and active fire protection systems.
- (4 marks)
- (ii) Explain how a proper building utilization can act as an important passive fire protection aspect.
- (6 marks)

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(b) Due to the rapid population growth and urbanization, tall building has been a norm. This is because the tall building can accommodate a large number of people while having a small building footprint. Mechanical transportation of people and goods is an energy-consuming service that requires the attention of the designer from the beginning of building design.

(i) Choose **ONE (1)** suitable type of building transportation to be installed in a 5-storey residential building, with justification. (9 marks)

(ii) Illustrate **THREE (3)** types of elevators with different number of entrance(s) and location(s). (6 marks)

Q3. (a) Based on the combined circuit (series and parallel) as shown in **FIGURE Q3(a)**, answer the following question.

(i) Calculate the total resistance of the circuit (4 marks)

(ii) Calculate the total current flow through the circuit (2 marks)

(iii) Determine the voltage at the parallel sections of A and B (3 marks)

(iv) Determine the current value at I_1 , I_2 , and I_3 (4 marks)

(b) A room with the dimension of 14 m × 10 m × 4 m with a capacity of 60 occupants is undergoing renovations for its ventilation system, which is a single duct ventilation system. The ventilation system consists of a supply air duct, a return air duct, and an exhaust system. The current supply of fresh air and recirculate air is 2 l/s and 6 l/s, respectively. Meanwhile, the new required minimum ventilation rate is 6 air changes per hour (ACH). It is estimated that 10% of the supply air will leak out of the room.

(i) Determine whether the existing air supply meets the new minimum ventilation rate (5 marks)

(ii) Propose a new fresh air supply and recirculation rate. (2 marks)

(iii) Calculate the amount of exhaust air from the room using your suggestion in **Q3(b)(ii)**. (5 marks)

Q4. (a) A new 10 storeys apartment is expected to be built in a near future. The indirect cold water supply system is needed for the building's water supply system. Furthermore, the water supply system should be capable of delivering sufficient pressure of potable water to all floors of the building. As a consultant engineer, select a suitable water supply system for the building including an appropriate schematic drawing.

(13 marks)

(b) The owner of a residential house discovered that his house's water supply has a very slow flow of water. He is also aware that there was no notification of a water shortage from the water provider for that day. He decided to hire a plumber to investigate the problem. Based on this scenario, predict **FOUR (4)** possible causes of slow water flow that the plumber may discover in the house's water supply system.

(12 marks)

-END OF QUESTIONS-

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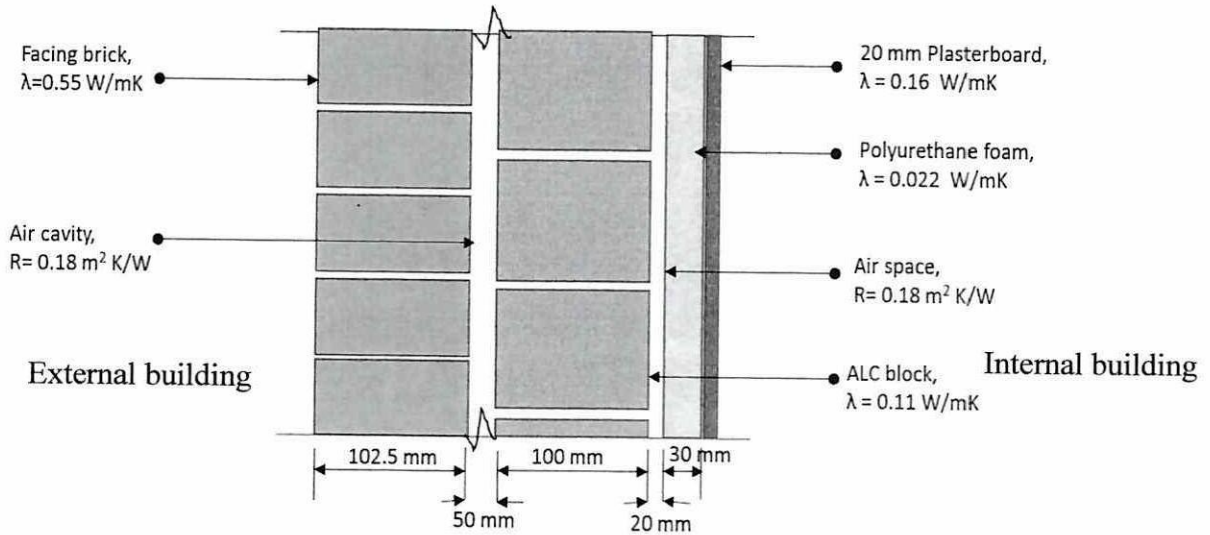


Figure Q1(b)

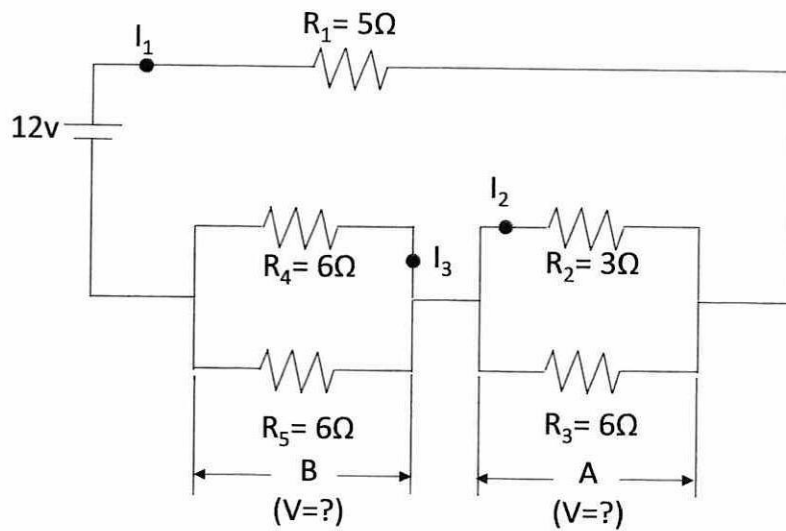


Figure Q3(a)

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