UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2021/2022

COURSE NAME	:	BUILDING SERVICES
COURSE CODE	:	BFB 41003
PROGRAMME CODE	:	BFF
EXAMINATION DATE	:	JANUARY / FEBRUARY 2022
DURATION	:	3 HOURS
INSTRUCTION	:	1. ANSWER **ALL** QUESTIONS.
		2. THIS FINAL EXAMINATION IS AN **ONLINE** ASSESSMENT AND CONDUCTED VIA **CLOSE BOOK**.

THIS QUESTION PAPER CONSISTS OF **SEVEN (7)** PAGES

Q1 (a) Conduction process is one of the potential heat transfer mechanisms in the building, Explain the effect of the conduction process on the building.

(3 marks)

(b) A green office building under construction needs to submit an overall thermal transfer value (OTTV) assessment. Based on the information in **Table Q1**, determine the following:

(i) Evaluate the OTTV of the building compared to MS1525:2019 Clause 5.2.

(13 marks)

(ii) Based on the OTTV calculated in **Q1(b)(i)** justify the importance of considering orientation in designing a building.

(3 marks)

(iii) If a reflective film is adding to the double glazing clear glass of the east and west orientation of the building with a shading coefficient of 0.31 and other conditions remain the same, calculate the new value of solar heat gain through fenestration area and compare with the result calculated in **Q1(b)(i).**

(4 marks)

(iv) Justify the effect of the reflective film on the solar heat gain results as in **Q1(b)(iii)** to the building design.

(2 marks)

Q2 (a) The air conditioning system applying the physics law to treat the internal air thus improve the occupant's indoor environment comfort. Based on your understanding, justify the air treatment process of an air conditioning system as follows:

(i) control temperature

(2 marks)

(ii) control humidity

(2 marks)

(iii) clean the air

(2 marks)

(b) The function of the air-conditioning system is to give comfort to the occupants and to provide the most suitable environment for a space function. Based on this statement, justify **TWO (2)** effects of comfort and space function on the energy consumption of a building.

(8 marks)

(c) Explain what is a psychrometric chart.

(3 marks)

(d) A fully conditioned community hall will be constructed in your area. As an engineer, you need to understand the climate conditions of your area to propose the design and size of the air conditioning system. By selecting any location of the community hall, justify the use of a psychrometric chart in conditioning the community hall to within the comfort zone.

(8 marks)

Q3 (a) Briefly describe the main function and working principles of the following electrical safety devices?

(i) Fuse.

(2 marks)

(ii) Circuit Breaker.

(2 marks)

(b) A combination of parallel and series circuits is shown in **Figure Q3**. The values of **A**, **B** and **C** of the three resistors ($\mathbf{R_2}$, $\mathbf{R_4}$ and $\mathbf{R_6}$) are the last three digits of your matric number (for example AF190**ABC**). If the digit of your number is zero then take 10. Estimate the equivalent resistance (R_{total}) and current (I) through the circuit.

(7 marks)

(c) Lift and escalator are common building transportation systems used in buildings to enable people and goods to move comfortably, quickly, and efficiently. Briefly explain the selection of these two transportation systems based on their benefits.

(4 marks)

(d) You are appointed as building services engineer to design the lift traffic of an office building that will be construct in the town of Kuala Lumpur. The details of the building as following:

Storey	:	15 floors
Floor to floor height	:	4 meters
Net floor area	:	30,000 m^2
population density	:	1 pax/ 30 m^2

Assume that 17% of the total population are using the lift during 5 min peak time. Based on the information in **Table Q3(i)**, **Table Q3(ii)**, **Table Q3(iii)** and **Table Q3(iv)**, estimate the:

(i) Flow rate

(1 mark)

(ii) Minimum handling capacity, waiting time and number of lifts

(2 marks)

(iii) Travel distance

(2 marks)

(iv) Quality of the lift services in terms of intervals and waiting time.

(2 marks)

(v) Briefly discuss what will happen if the total population using the lift during 5 min peak time increases to 30% and suggest what actions should be taken to make the passengers satisfied with the lift traffic system?

(3 marks)

Q4 (a) Water pressure is an important parameter in the water supply system in a building. Briefly explain the **TWO (2)** effects of excessive water pressure in the design of the water supply system.

(2 marks)

(b) Genting Group developer plans to build a five stars rating hotel in the main town of Kluang. The 8-storey hotel is planning to be constructed in 2023 to accommodate customers with different room types as shown in Table 4. Assume that head pressure is 30 meters, the length of pipe is 120 meters (allow 15% for bends) with the discharge of 1.50 liters/second with negligible head loss. As a consultant engineer, you are required to estimate the total water requirement and design a suitable circular shape water storage tanks, suction tanks, and supply pipe for this hotel on 24 hours water required with disruption of 24 hours of water supply.

(20 marks)

(c) In Malaysia, rainfall is abundant throughout the year. The use of the Rain Water Harvesting System (RWHS) should be optimised thus the use of treated water can be reduced. As a building services engineer, recommend **TWO (2)** approaches that can be used to encourage Malaysian to implement RWHS in their household.

(4 marks)

– END OF QUESTIONS –

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Table Q1

No.	Description	Elevation 1	Elevation 2	Elevation 3	Elevation 4
1	Solar Absorptivity (W/m².K) of the wall	0.45	0.45	0.45	0.45
2	Thermal Transmittance (W/m².K) of the wall	2.25	2.25	2.25	2.25
3	Thermal Transmittance (W/m².K) of the fenestration	3.1	3.1	3.2	3.3
4	Shading Coefficient of the Clear double glazing glass	0.85	0.85	0.85	0.85
5	Total area of exterior wall (m²)	560	560	560	560
6	Total area of window (m²)	93	68	68	53
7	Orientation	West	South	East	North

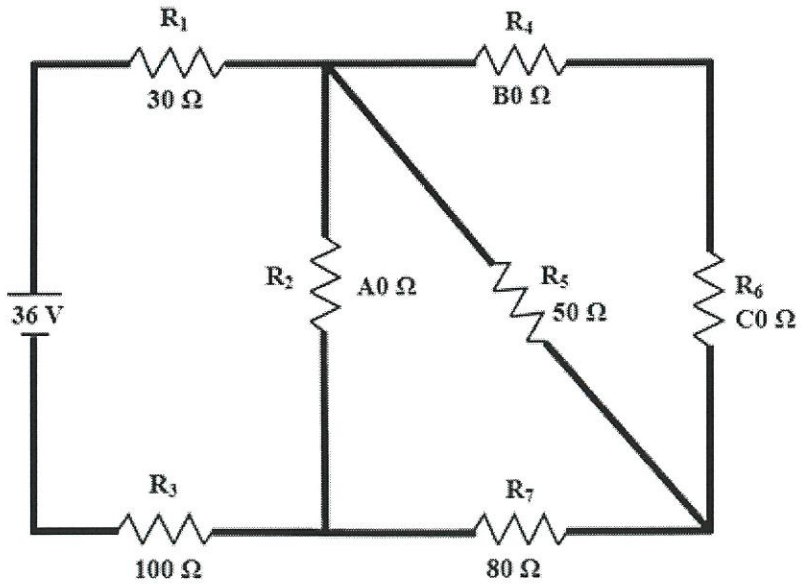

FIGURE Q3

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TABLE Q3 (i)

Passenger lift performance (based on 3.3 m floor to floor height) and lifts serving all of 15 floors		Intervals (s)			Handling capacity (persons)
Number of cars	Speed (m/s)	12 Passengers	16 Passengers	20 Passengers	24 Passengers
		29	32	37	41
4	2.50	103	112	127	137
			31	36	40
4	3.50		116	132	142
			25	29	32
5	3.50		146	165	178
				24	27
6	3.50			198	213

TABLE Q3 (ii)

Speed (m/s)	Lift travel in metres			
	Municipal Flats	Luxury flats	Offices	Bed lifts
0.25 – 0.375	-	-	-	5
0.50	30	15	10	10
0.75	45	20	15	-
1.00	55	25	20	20
1.50	-	-	30	45
2.50	-	-	45	100
3.50	-	-	60	-
5.00	-	-	125	-

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TABLE Q3 (iii)

Interval (s)	Quality of services
25 – 35	Excellent
35 – 45	Acceptable for offices
60	Acceptable for hotels
90	Acceptable for flats

TABLE Q3 (iv)

Interval (s)	Quality of services
25 – 35	Excellent
35 – 45	Acceptable for offices
60	Acceptable for hotels
90	Acceptable for flats

TABLE Q4

No. of storey	Rooms / Facilities	Fittings	Quantity / floor	Storage (liter)/ unit
Ground floor	Lobby and washrooms	WC	10	180
		Wash Basin	6	90
1st - 3rd floor	Twin Suite	WC	30	180
		Wash Basin	30	90
		Shower	30	130
4th – 6th floor	Deluxe Suite	WC	20	180
		Wash Basin	20	100
		Shower	20	140
		Bath tub	20	140
7th – 8th floor	Premier Suite	WC	10	200
		Wash Basin	10	120
		Shower	10	150
		Jacuzzi	10	180