Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(ONLINE)
SEMESTER II
SESSION 2019/2020

COURSE NAME	:	BUILDING SERVICES 1
COURSE CODE	:	BFB40603
PROGRAMME CODE	:	BFF
EXAMINATION DATE	:	JULY 2020
DURATION	:	6 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **EIGHT (8)** PAGES

Q1 (a) Explain the importance of understanding heat transfer in the building

(4 marks)

(b) An old office building design has been submitted for overall thermal transfer value (OTTV) assessment. Assume that the four elevations of the building are identical with total area of the wall is 1050 m^2. Wall is painted with grey paint where solar absorption factor for the paint is 0.54. Total area of windows is 450 m^2. All windows are 6mm single-glazed glass with shading coefficient of 0.51. U-value of the wall is 2.87 W/m^2K and U-value of the window is 5.7 W/m^2K.

(i) List **THREE (3)** major components of OTTV.

(3 marks)

(ii) Referring to **Table Q1(b)(ii)**, calculate the OTTV of the office building.

(12 marks)

(iii) Compare the OTTV of the office building in question **Q1(b)(ii)** with the standard OTTV in Malaysia.

(2 marks)

(iv) Propose **TWO (2)** strategies to improve OTTV of the office building.

(4 marks)

Q2 A 15-storey office building that has been built 20 years ago using a split unit air conditioning system for ventilation and cooling system (HVAC System) in the building. The building owner decided to review the building HVAC system. Based on the given scenario;

(i) Review the problems or benefits related to the split unit air-conditioning system in the building.

(8 marks)

(ii) Propose whether to maintain or to change air conditioning system for the building.

(4 mark)

(iii) Justify your proposed air-conditionong system in question **Q2(a)(ii)**

(5 marks)

(iv) With the aid of a diagram, explain basic cooling cycle of the proposed air-conditioning system in question **Q2(a)(ii)**

(8 marks)

Q3 (a) A mixed resistors circuit as shown in **Figure Q3(a)** is made from a combination of parallel and series circuits. Determine the:

(i) Current through the circuit (I).

(4 marks)

(ii) Voltage drop (V) across the circuit.

(5 marks)

(b) Explain **THREE (3)** purposes of lift traffic control.

(6 marks)

(c) A 15-storey commercial office block has 10,000 m^2 net floor area. Assume that 18% of the total population are using the lift during 5 min peak time. The population density is one person per 15 m^2 of net floor area. Referring to **Table Q3(c)(i)** to **Table Q3(c)(iv),** estimate the:

(i) Flow rate.

(2 marks)

(ii) Travel distance and speed.

(2 marks)

(iii) Minimum capacity and number of lifts and waiting time.

(2 marks)

(iv) Evaluate the quality of lift service.

(4 marks)

Q4 (a) Explain **TWO (2)** primary objectives of desigining water supply system in the buildings.

(4 marks)

(b) As a consulting engineer, you are required to design a suitable rectangular shape water storage tanks, suction tanks, and supply pipe for discharge of 1.30 litres/sec, based on gravity supply for a hostel. The hostel consists of six (6) blocks of building, each building has 30 rooms and each room can accommodate 4 students. Assume head pressure is 8 m and length of pipe is 30 m (allow 20% for bends) with negligible head loss. Assume for 24 hours interruption of supply, and further 12 hours disruption of supply, will be covered by 95 litres of cold water per person. Determine the total water requirement and design a suitable rectangular water storage tank system to store the water.

(10 marks)

(c) A client requests to install an indoor rainwater harvesting system into a double storey house located in Johor Bahru using gravity fed with automatic top up system. Based on the following information and information given in **Table Q4(c)(i)** and **Table Q4(c)(ii)**, design a rainwater harvesting system for the house.

Typical features of a double storey house in Johor Bahru:

- Dual flush toilet
- Assumed water usage 4.8 l/flush, 5 flushes per occupant per day and 4 occupants in the house
- Metal roof with total of 100 m^2 roof size and less than 40° roof pitch
- Rainfal intensity is assumed to be 150 mm/h
- Rectangular gutter with 1:600 gradient with no bending
- 1.0 mm of rainfall is used as first flush depth

(11 marks)

– END OF QUESTIONS –

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TABLE Q1(b)(ii)

Solar Correction Factors

Orientation	CF
North	0.90
North-East	1.09
East	1.23
South East	1.13
South	0.92
South-West	0.90
West	0.94
North-West	0.90

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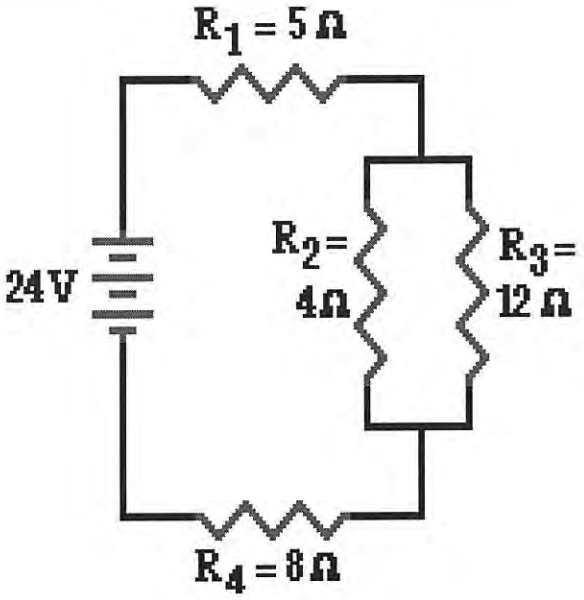

FIGURE Q3(a)

TABLE Q3(c)(i)

Passenger lift performance (based on 3.3 m floor to floor heights) and lifts serving all of 15 floors		Interval (s)				Handling capacity (persons)
Number of cars	Speed (m/s)	12 Passengers	16 Passengers	20 Passengers	24 Passengers	
4	2.50	29 103	32 112	37 127	41 137	
4	3.50		31 116	36 132	40 142	
5	3.50		25 146	29 169	32 178	
6	3.50			24 198	27 213	

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TABLE Q3(c)(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	—

TABLE Q3(c)(iii)

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

TABLE Q3(c)(iv)

Minimum number of lifts for offices

Installation	Quality of service
One lift for every three floors	Excellent
One lift for every four floors	Average
One lift for every five floors	Below average

Note: A lower standard than the above would be acceptable for hotels and blocks of flats. Where large numbers of people have to be moved, cars smaller than twelve-person capacity are not satisfactory.

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TABLE Q4(c)(i)

Roof Area (m^2)	Roof Runoff Rate (L/s)	Rectangular/ Eave Gutters (mm)				Rectangular Downpipe * (mm)			
		Cal. Size		Ava. Size		Cal. Size		Ava. Size	
		width	depth	width	depth	width	depth	width	depth
50	1.98	115	57.5	190	150	75.9	38	100	50
60	2.38	120	60	190	150	79.2	40	100	50
70	2.77	130	65	190	150	85.8	43	100	50
80	3.17	135	67.5	190	150	89.1	45	100	50
100	3.96	150	75	190	150	99	50	100	50
120	4.75	160	80	190	150	105.6	53	120	80
150	5.94	175	87.5	190	150	115.5	58	120	80
200	7.92	195	97.5	250	178	128.7	64	150	75

**Downpipe size is 66% of gutter width*

TABLE Q4(c)(ii)

Demand (liter/day)	Optimum Rainwater Storage Tank Cistern Capacity (m^3) Roof Catchment Area (m^2)					
	50	100	200	300	400	500
50	0.5	0.5	0.5	0.5	0.5	0.5
100	0.5	0.5	0.5	0.5	0.5	0.5
200	1.8	1.0	0.8	0.8	0.8	0.7
300	-	1.9	1.3	1.3	1.3	1.3
400	-	3.6	2.0	1.6	1.6	1.6
500	-	7.4	2.7	2.1	2.1	2.1