UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2018/2019

COURSE NAME	:	BUILDING SERVICES 1
COURSE CODE	:	BFB40603
PROGRAMME CODE	:	BFF
EXAMINATION DATE	:	DECEMBER 2018 / JANUARY 2019
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

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THIS QUESTION PAPER CONSISTS OF **NINE (9)** PAGES

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

(5 marks)

(b)   An office building as shown in **FIGURE Q1** needs to undergo a major renovation to improve overall thermal transfer value (OTTV) of the building. Assume that the four elevations of the building are identical, and the wall is painted with grey paint. Solar absorption factor for the paint is 0.54. The windows are using 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. Referring to **TABLE 1,** determine the followings:

(i)   OTTV of the office building before the renovation

(12 marks)

(ii)   compare the OTTV of the office building in **Q1(b)(i)** with the standard OTTV in Malaysia

(2 marks)

(iii)   propose **THREE (3)** strategies to improve OTTV of the office building

(6 marks)

Q2   (a)   With the aid of a diagram, demonstrate the basic cooling cycle of an air conditioning system in a building.

(8 marks)

(b)   An air conditioning system of a 15 storey office building needs to be redesigned to improve its efficiency. The office building currently using **Packaged Air Conditioners with Air Cooled system.** Based on the given information answer the followings:

(i)   with the aid of a diagram, propose a new air conditioning system suitable for the building.

(8 marks)

(ii)   evaluate and justify the proposed air-conditioning system in **Q1(b)(ii).**

(5 marks)

(c)   An office size 10x10x4m high is to be ventilated at the rate of 3 air changes per hour. If the flow at the rate is limited to 4m/s in the supply duct, calculate the followings:

(i)   volume flow rate

(2 marks)

(ii)   dimensions of a square duct for supply

(2 marks)

Q3 (a) A mixed resistors circuit as shown in **FIGURE Q3** is made from a combination of parallel and series circuits. The values of the resistances mentioned in the circuit are in Ohm (Ω) and the supply voltage is in Volt (V). Determine the equivalent resistance (R_{eq}) and the current (I) in the circuit.

(9 marks)

(b) List the purposes of lift traffic control

(6 marks)

(c) A 15 storey commercial office block has a net floor area above ground level of 15,000m². Assume 19% of the total population are using the lift during 5 min peak time and a population density of one person per 15m² of net floor area. From **TABLE 2** to **TABLE 5**, estimate the:

(i) flow rate

(2.5 marks)

(ii) travel distance and speed

(2.5 marks)

(iii) minimum capacity and number of lifts and waiting time

(2.5 marks)

(iv) evaluate the quality of lift service

(2.5 marks)

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

(4 marks)

(b) As a consulting engineer, you are required to design suitable square shape water storage tanks, suction tanks, and supply pipe for discharge of 1.30litres/sec, based on gravity supply for a hostel. The hostel consists of four (4) blocks of building, each building has 80 rooms and each room can accommodate 4 students. Assume head loss is negligible and length of pipe is 30m (allow 20% for bends). Assume for 24 hours interruption of supply, and 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 water storage tank system to store the water.

(10 marks)

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(c)   A client requests to install an indoor rainwater harvesting system into a double storey house located in Shah Alam using gravity fed with automatic top up system. Based on the data outlined in **TABLE 6** and **TABLE 7**, design a rainwater harvesting system for the house.

Typical features of a double storey house in Shah Alam:

- 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 100m² roof size and less than 40° roof pitch
- rainfal intensity is assumed to be 150mm/h
- rectangular gutter with 1:600 gradient with no bending
- 1.0mm of rainfall is used as first flush depth

(11 marks)

– END OF QUESTIONS –

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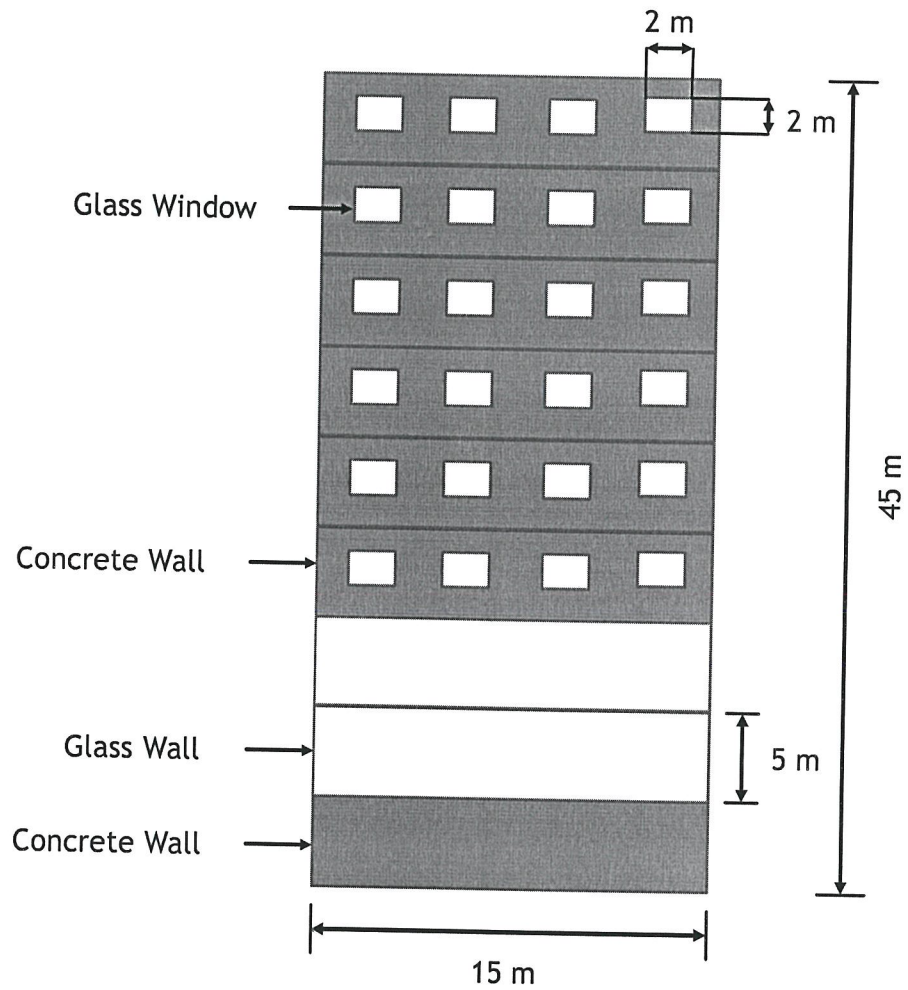
FIGURE Q1

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TABLE 1

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
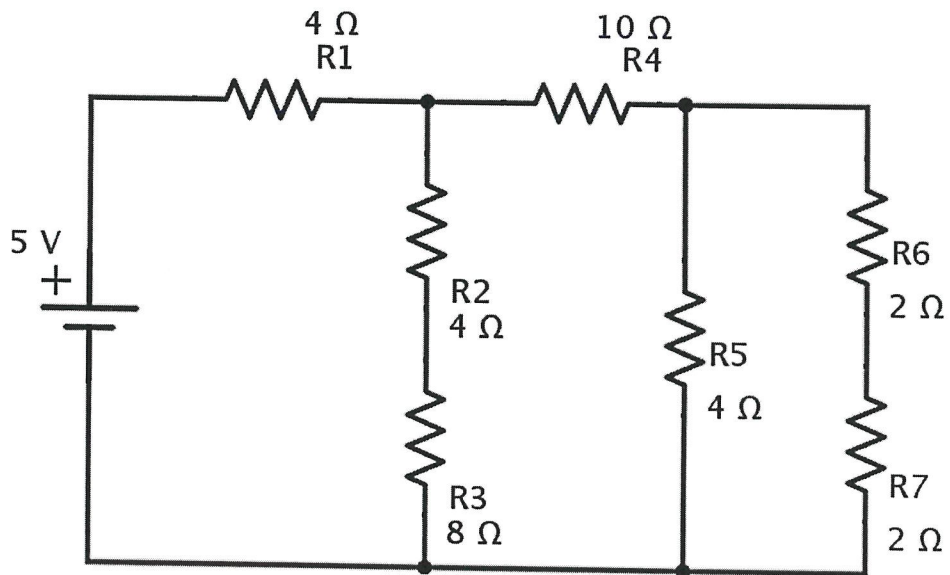
FIGURE Q3

TABLE 2

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 / 165	32 / 178
6	3.50			24 / 198	27 / 213

TABLE 3

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 4

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

TABLE 5

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 6

Roof Area (m²)	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 7

Demand (liter/day)	Optimum Rainwater Storage Tank Cistern Capacity (m³) Roof Catchment Area (m²)					
	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

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