Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2019/2020

COURSE NAME	:	DESIGN OF WATER SUPPLY
COURSE CODE	:	BFA40203
PROGRAMME CODE	:	BFF
EXAMINATION DATE	:	DECEMBER 2019/ JANUARY 2020
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

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

Q1 (a) State **FIVE (5)** types of primary drinking water standards criteria.

(5 marks)

(b) **TABLE 1** represents the lowest seven consecutive day average discharge from 1981 to 2002. The river supply is intended for abstraction to meet an average demand of 15 ft^3/s of a community.

i) Tabulate the flows in order of severity using serial number M with values from 1 to n. (5 marks)

ii) Plot the flows against their probability.

(5 marks)

iii) Determine the minimum flow for a 10-year return period.

(5 marks)

Q2 (a) List **TWO (2)** objectives of flocculation process.

(4 marks)

(b) Explain the design criteria for a flocculation basin with a baffle.

(6 marks)

(c) Design a flocculation basin by determining the basin volume, tank dimensions, required input power, and impeller location using the following data:

Flocculation basin	= 2 unit
Design flowrate	= 12 m^3/min
Detention time	= 30 min
Water depth	= 4 m
Compartment	= 2 unit
Velocity gradient, G in each compartment	= 70, 50 and 30 s^{-1}
Dynamic viscosity at 24°C	= 0.000911 Pa.s
Efficiency of transfer of motor power to water power	= 80%

Impeller placement at one-third of water depth

(10 marks)

Q3 (a) Illustrate with the aid of sketch, the movement of water and solids in a rectangular sedimentation tank for water treatment.

(4 marks)

(b) Discuss the function of settling basin in the water treatment system

(6 marks)

(c) Two similar rectangular sedimentation basins are required following chemical flocculation at a water treatment plant receiving an average flow of 6720 m^3/d. Analyse the dimension of basin to satisfy the following conditions at the average flow conditions:

Detention time = 4 h
Basin depth D = 3 m
Maximum weir loading = 250 $m^3/d/m$
Surface overflow rate = 25 $m^3/d/m^2$
Maximum horizontal velocity=2.5mm/s.

(10 marks)

Q4 (a) Illustrate the mechanisms of granular filtration.

(5 marks)

(b) Discuss the design requirements for direct filtration to treat raw river water with low turbidity and colour.

(5 marks)

(c) Design a rapid sand filter by determine the area, length, and width of each filter using the following data:

Design flows	=	20,000 m^3/day
Filtration rate	=	250 m3/day.m^2
Number of filter	=	4 unit
Area increment for each filter	=	1/3
Width (W) of filter with two (2) cells	=	5 m
Length-width ratio	=	3:1

(10 marks)

Q5 (a) Compare the differences between sterilization and disinfection as used in water treatment.

(4 marks)

(b) Sketch a graph of residual chlorine versus chlorine dose.

(4 marks)

(c) Explain the breakpoint chlorination in water treatment process.

(4 marks)

(d) Ozone is used for disinfection of bacteria in water. If a kill of 99.9% is required with ozone residual of 0.5 mg/l, determine the contact time (in seconds) needed. Use the following equation to calculate t.

$$t = \frac{1}{k} \log_{10} N_0 N_t$$

Where, t = contact time (seconds)
N_0 = Initial number of bacteria (number or percent)
N_t = Number of organisms remaining (not killed) after time t
k = Disinfection constant for ozone = 2.5 x 10~2 per second.

(8 marks)

– END OF QUESTIONS –

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Table 1: Average River Discharge for 22 years

Year	River Discharge, ft^3/s
1981	19.6
1982	28.6
1983	18.1
1984	34.3
1985	29.3
1986	35.7
1987	35.0
1988	27.0
1989	35.0
1990	36.9
1991	90.3
1992	50.6
1993	35.3
1994	59.4
1995	26.3
1996	30.1
1997	29.4
1998	29.7
1999	30.4
2000	49.6
2001	36.6
2002	59.1