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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2013/2014

COURSE NAME	:	DESIGN OF WATER SUPPLY
COURSE CODE	:	BFA 40203
PROGRAMME	:	4 BFF
EXAMINATION DATE	:	JUN 2014
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FOUR (4)** QUESTIONS ONLY

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

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

(5 marks)

(b) Flow records of a river (Table 1) represent 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.

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

Tabulate the flows in order of severity using serial number M with values from 1 to n. Tabulate also the probability ranking using the formula M/(n+1). Plot the flows against their probability in the probability paper provided in figure 1. Determine the minimum flow for a 10-year return period.

(20 marks)

Q2 (a) State the objectives of flocculation.

(4 marks)

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

(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	=	3
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		

(15 marks)

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

(5 marks)

(b) Two (2) similar rectangular sedimentation basins are required following chemical flocculation at a water treatment plant receiving an average flow of 6720 m^3/d. Determine the length (L) and width (W) of one 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

(20 marks)

Q4 (a) With the aid of sketches, 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.

(10 marks)

(c) Design a rapid sand filter by determing 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 mrks)

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

(4 marks)

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

(3 marks)

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

(3 marks)

(d) Explain why the use of chlorine gas is not encouraged at a treatment plant.

(3 marks)

(e) Ozone is used for disinfection of bacteria in water. If a kill of 99.9% is required with ozone residual of 0.5 mg/1, determine the contact time (in seconds) needed. Use the following equation to calculate t.

$$t = (1/k)\ \log_{10}(N_0 N_t)$$

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.

(12 marks)

- END OF QUESTION –

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FIGURE 1 : LOGARITHMIC PROBABILITU PAPER