Universiti Tun Hussein Onn Malaysia

FINAL EXAMINATION
(ONLINE)
SEMESTER II
SESSION 2019/2020

COURSE NAME	:	DESIGN OF WATER SUPPLY
COURSE CODE	:	BFA 40203
PROGRAMME	:	BFF
EXAMINATION DATE	:	JULY 2020
DURATION	:	6 HOURS
INSTRUCTION	:	ANSWER **FIVE (5)** QUESTIONS ONLY QUESTION **Q1** IS **COMPULSORY**

THIS QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

Q1 Prepare a design of a water treatment system that is suitable for a proposed development area which consist of 500 units double-story terrace and 30 units bungalow houses.

(20 marks)

Q2 (a) Formulate general equation for water demand.

(4 marks)

(b) A city recorded populations of 220,000 and 250,000 in April 1990 and April 2000 respectively. Estimate the population in January 2025.

(6 marks)

(c) **Table 1 Q2 (c)** represents the lowest seven consecutive day average discharge from 2000 to 2018. The river supply is intended for abstraction to meet an average demand of 7 m3/s of a community.

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

(2 marks)

(ii) Plot the flows against their probability.

(4 marks)

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

(4 marks)

Q3 (a) Propose a suitable water treatment system in a limited space of treatment plant's area

(4 marks)

(b) Estimate the detention times required in completely mixed and plug-flow reactors for an 80 % reduction of reactant concentration. Given;

(i) Influent reactant concentration, C_0 is 250 mg/L
(ii) Effluent reactant concentration, C_t is 50 mg/L
(iii) Rate constant for a chemical coagulation reaction, K is 75 per day.

(6 marks)

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

(i) Flocculation basin is 2 unit
(ii) Design flowrate is 10 m^3/min
(iii) Detention time is 20 min
(iv) Water depth is 4.5 m
(v) Compartment is 2 unit
(vi) Velocity gradient, G in each compartment are 40 s^{-1} and 35 s^{-1}
(vii) Dynamic viscosity at 24°C is 0.000911 Pa.s

(viii) Efficiency of transfer of motor power to water power is 80 %

(10 marks)

Q4 (a) Sketch **FOUR (4)** zones in the sedimentation basin

(3 marks)

(b) Differentiate with an example between Type I Sedimentation and Type II Sedimentation and give an example of where they are applied in water treatment

(7 marks)

(c) Design the horizontal-flow rectangular sedimentation tank(s) for Parit Raja Water Treatment Plant using the maximum day design flow of 0.5 m^3/s by using the following:

(i) The surface overloading rate is 40 $m^3/day.m^2$.
(ii) 4 tanks is prepared and a width of each tank is 4 m.
(iii) Minimum length to width ratio (L: W) is 6:1
(iv) Depth of the tank is 2 m
(v) Minimum length to depth ratio (L: D) is 15:1
(vi) Assess on the turbulence and backmixing if the water temperature is 15°C (kinematic viscosity is 1.14 x 10 -6 m^2/s).
(vii) Minimum horizontal flow ranges between 0.005 – 0.018 m/s
(viii) Reynoulds number < 20,000

(10 marks)

Q5 (a) Explain the basic requirement of pressure and capacity in water distribution system.

(4 marks)

(b) The water level in the service tower (elevated tank) supplying the residential area is 500 m. The elevation of the supply line at the residence is 400 m. Assume the head loss is 1 m. Calculate

(i) Static head
(ii) Static pressure
(iii) Dynamic head
(iv) Dynamic pressure (actual pressure)

(6 marks)

(c) A service reservoir is to be designed for a water supply serving 250.000 people with an average demand of 225 L/day/capita and a fire flow of 37000 L/min. Given the peak demand can be taken as 25% of the maximum daily demand, maximum daily demand factor is 1.8 times the average demand and Fire demand should be maintained at least for 3 hours.

Calculate:

(i) Maximum daily flowrate
(ii) Volume at peak demand
(iii) Volume to supply the fire demand

(iv) Emergency storage
(v) Total volume of the service reservoir

(10 marks)

Q6 (a) Explain Hardy Cross method for pipe network analysis

(4 marks)

(b) Using Hardy Cross Method, calculate the flow rate for each pipe as shown in **Figure Q6 (b).**

(6 marks)

(c) A distribution network is shown in Figure **Figure Q6(c).** Calculate the velocity for each distribution pipe and determine the residual pressure at A and B by using head loss due to conveying water from reservoir R to point A and from Point A to B are 6.04 m and 6.03 m respectively.

(10 marks)

-END OF QUESTIONS-

FINAL EXAMINATION

SEMESTER/SESSION : SEM II / 2019/2020
PROGRAMME CODE : 4 BFF
COURSE NAME : DESIGN OF WATER SUPPLY
COURSE CODE : BFA40203

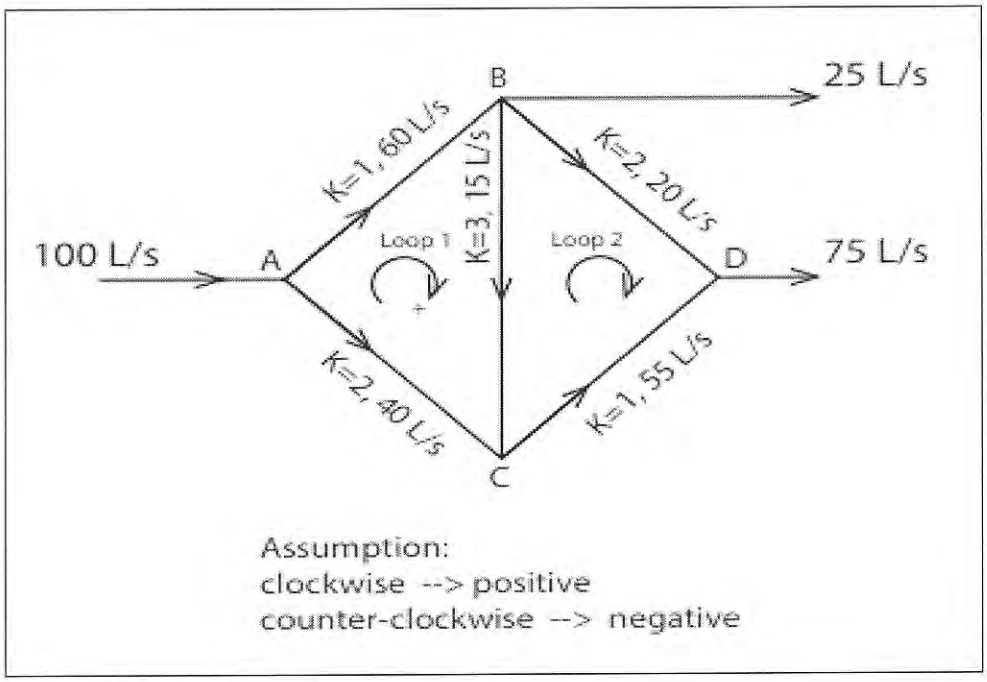
Year	River Discharge, m^3/s
2000	34.3
2001	29.3
2002	35.7
2003	35.0
2004	27.0
2005	35.0
2006	36.9
2007	50.6
2008	35.3
2009	59.4
2010	26.3
2011	30.1
2012	29.4
2013	29.7
2014	90.3
2015	30.4
2016	49.6
2017	36.6
2018	59.1

TABLE Q2(c): The lowest seven consecutive day river discharge

FINAL EXAMINATION

SEMESTER/SESSION	: SEM II / 2019/2020	PROGRAMME CODE	: 4 BFF
COURSE NAME	: DESIGN OF WATER SUPPLY	COURSE CODE	: BFA40203

FIGURE Q6 (B): Proposed flow rate for a pipe distribution



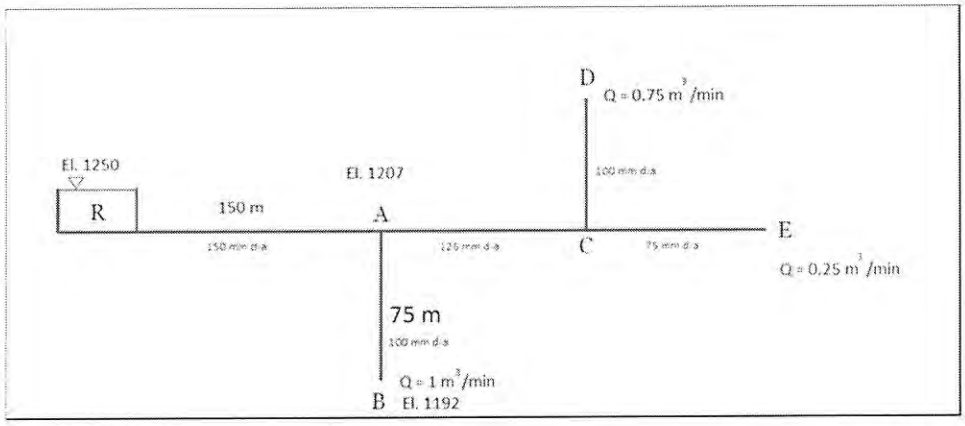


FIGURE Q6 (c): A distribution network