UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION (ONLINE) SEMESTER II SESSION 2020/2021

COURSE NAME	:	WATER SUPPLY ENGINEERING
COURSE CODE	:	MFE10203
PROGRAMME CODE	:	MFA
EXAMINATION DATE	:	JULY 2021
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS **CLOSE BOOK EXAMINATION**

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

Q1   (a)   Discuss the type of water demand and the factor that affect the consumption

                                           (5 marks)

     (b)   The upper and lower limit of growth rate at Batu Pahat district are 3.65% and 2.23%. Identify P design (Pn) for Batu Pahat district for year 2021 by using design period of 7, 12 , 17 , 22 , 27, 32 and 37 year.

                                           (10 marks)

     (c)   Design the horizontal-flow rectangular sedimentation tank(s) for Kluang Water Treatment Plant using the maximum day design flow of 0.65 m3/s by using the following:

         i.   The surface overloading rate is $23 m^3/day.m^2$.

         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^oC (kinematic viscosity is 1.14×10^{-6} m^2/s).

         vii.   Minimum horizontal flow ranges between 0.005 – 0.018 m/s

         viii.   Reynoulds number < 20,000

                                           (10 marks)

Q2   (a)   Discuss in detail type of intake structure.

                                           (6 marks)

     (b)   Rectangular intake tower is built to transfer the water from Sembrong reservoir to water treatment plant. Toward prevent impurities from entering the water treatment plant, the coarse and fine screen need to design. The length and width of the coarse screen are 4 m and 3 m respectively. The maximum of flow is 103,500 m3/day. The space between each bars at approximately 8 cm on center and used size 12 mm square edge bar.

         i)   Design the coarse screening. The velocity through the rack should be less than 0.08 m/s.

                                           (10 marks)

         ii)   Design the fine screen. The velocity through the fine screen shall be less than 0.2 m/s and screen efficiency factor is 0.50. The depth of flow at the screen chamber is 8.3 m at the minimum water level of reservoir

                                           (4 marks)

         iii)   Calculate the total head loss through coarse and fine screens

                                           (5 marks)

Q3   (a)   Determine the difference level between 2 reservoirs which is connected by single pipe of cast iron for 1 km. Discharge and diameter is given as 0.05 m^3/s and 100 mm respectively. Assume the viscocity value is 1.14×10^{-6} m^2/s.

(7 marks)

(b)   Alum is a non-toxic liquid that usually used to treat water. Explain in detail the reaction of alum after it is added to the water to be treated.

(6 marks)

(c)   The formation of aluminium hydroxide floats is the result of a reaction between acidic coagulants and the natural alkalinity of water when alum chemicals are incorporated into the water. If 2.5 mg/l alum was used to treat the water, calculate the amount of alum sludge produced and the alkalinity (HCO_3^-) of the water. Given the molecules weights as Al= 27, S=32, O=16, H=1, Ca=40 and C=12.

(12 marks)

Q4   (a)   Briefly explain the characteristics of discharge Q and head loss h_f of flow in series and parallel pipes

(6 marks)

(b)   Discuss an overview of the problems caused by hydraulic transients and methods of eliminating water hammers.

(6 marks)

(c)   **Figure Q4** shows a reticulation system. Estimate the flow rate in each pipeline using Hardy-Cross Method. Use initial flow rate of 110 liters per second (L/s).

(13 marks)

– END OF QUESTIONS –

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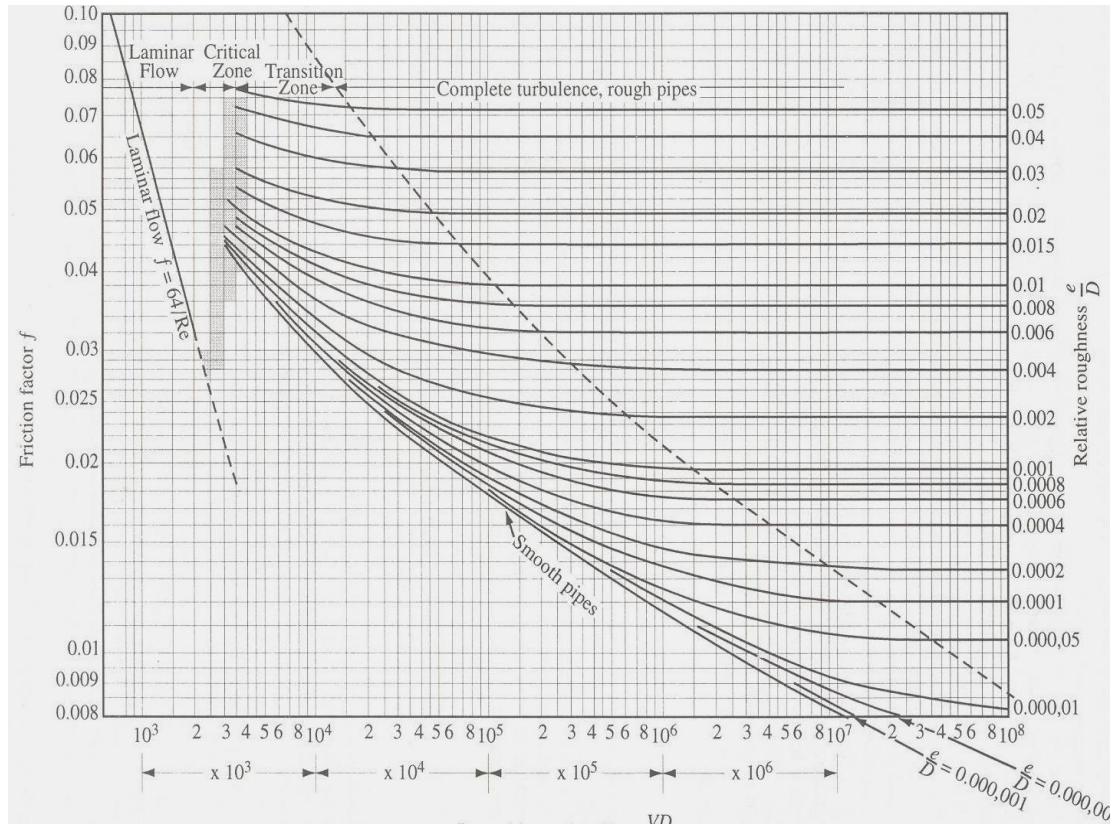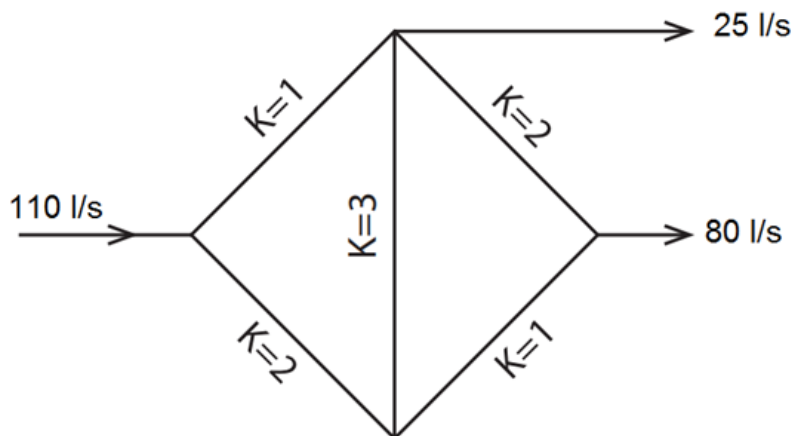COURSE NAME   : WATER SUPPLY ENGINEERING   COURSE CODE   : MFE 10203

Figure Q3: Moody diagram

Figure Q4: Reticulation system