UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2014/2015

COURSE NAME : DESIGN OF WATER SUPPLY

COURSE CODE : BFA 40203

PROGRAMME : BACHELOR IN CIVIL ENGINEERING WITH HONOURS

EXAMINATION DATE : JUNE 2015/JULY 2015

DURATION : 3 HOURS

INSTRUCTION : ANSWER **FOUR (4)** QUESTIONS ONLY

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

Q1 (a) Explain a basic concept of water supply system.

(5 marks)

(b) Flow records of a river **(Table 1)** represent the lowest seven consecutive day average discharge from 1991 to 2012. 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
1991	19.6
1992	28.6
1993	18.1
1994	34.3
1995	29.3
1996	35.7
1997	35.0
1998	27.0
1999	35.0
2000	36.9
2001	90.3
2002	50.6
2003	35.3
2004	59.4
2005	26.3
2006	30.1
2007	29.4
2008	29.7
2009	30.4
2010	49.6
2011	36.6
2012	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. Determine the minimum flow for a 10-year return period.

(20 marks)

Q2 (a) State the global root meansquare velocity gradient according to Camp and Stein (1943)

(4 marks)

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

(6 marks)

(c) Design a cylindrical flash mixing basin by determining the basin volume, tank dimensions, required input power and rotational speed using the following data:

Design flowrate, Q = 11500 m³/day
Rapid mix, t = 5 s
Ratio water depth (H) to Equivalent tank diameter (T) = 2
Diameter impeller = 4 cm
Velocity Gradient, G = 600 s⁻¹
Power number, N_P = 5.7
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) State the advantages and disadvantages of a sedimentation basin.

(4 marks)

(b) Explain the major features to be considered in design of settling basin for water treatment.

(8 marks)

(c) A water treatment plant has a flow rate of 0.6 m³/sec. The settling basin at the plant has an effective settling volume that is 20 m long, 3 m depth and 6 m wide. Determine the percentages of particles will be removed.

(13 marks)

Q4 (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) Determine percentage of hypochlorous acid (HOCl) that is not dissociated, if 15 mg/L of HOCl is added to a potable water for disinfection and the final measured pH is 7.0. Assume the temperature is $25^{\circ}C$.
Given:

$$HOCl \rightleftharpoons H^+ + OCl^-$$

$$pK_a = 7.54$$

(12 marks)

Q5 (a) With the aid of sketches, illustrate the mechanisms of granular filtration.

(5 marks)

(b) Explain the method of classifying filter that will be considered in water treatment.

(8 marks)

(c) A proposed new water treatment plant is going to install rapid sand filters after the sedimentation tanks. The design loading rate to the filter is 200 $m^3/d \cdot m^2$. Determine filter surface area should be provided for the design flow rate of 0.5 m^3/s. Design the filter size if four filters are used.
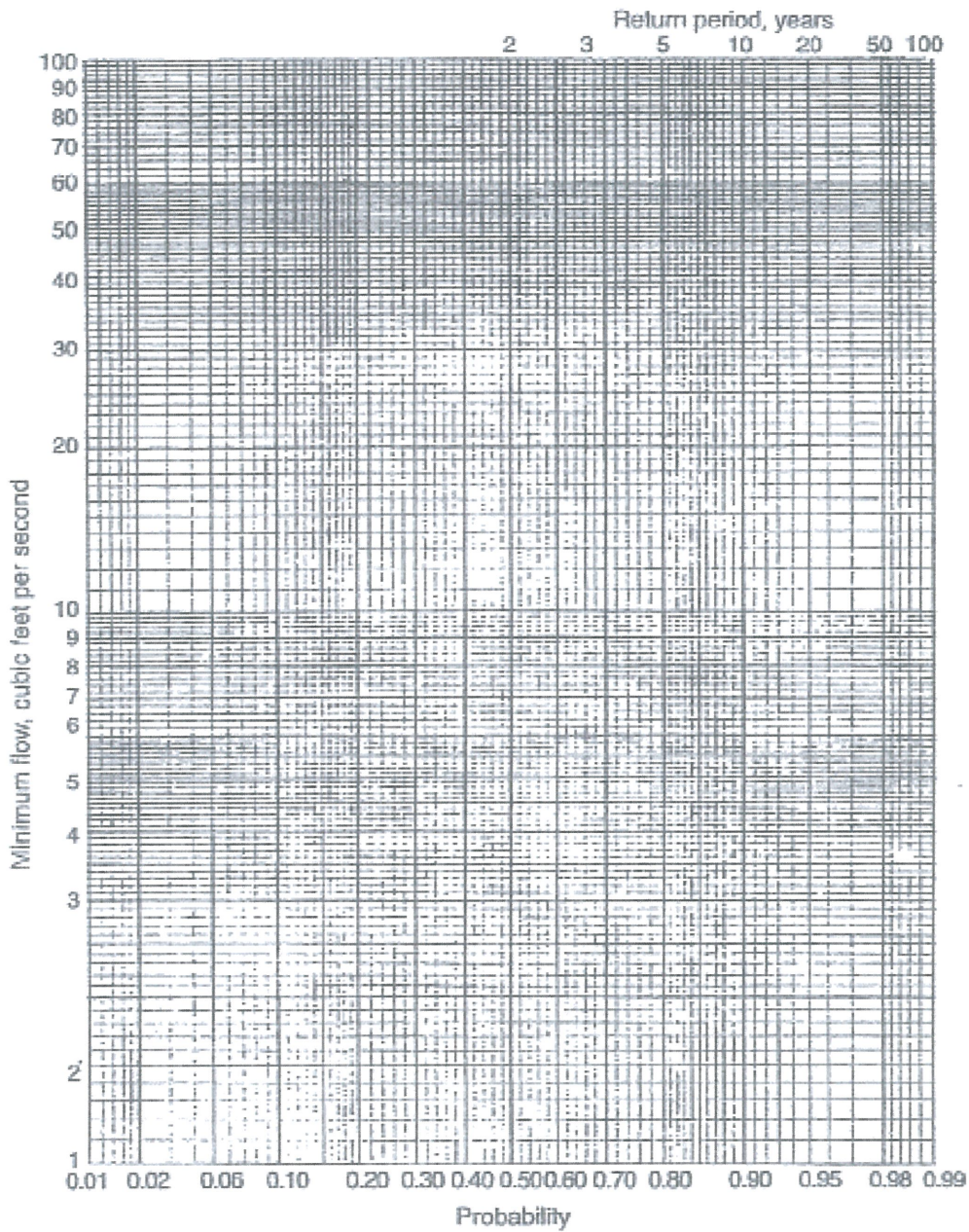
(12 marks)

- **END OF QUESTION –**

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FIGURE 1 : LOGARITHMIC PROBABILITY PAPER