Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2022/2023

COURSE NAME	:	WATER RESOURCES ENGINEERING
COURSE CODE	:	BFW 40103
PROGRAMME CODE	:	BFF
EXAMINATION DATE	:	JULY/AUGUST 2023
DURATION	:	3 HOURS
INSTRUCTION	:	1.ANSWER ALL QUESTIONS
		2.THIS FINAL EXAMINATION IS CONDUCTED VIA **CLOSED BOOK.**
		3.STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK.

THIS QUESTION PAPER CONSISTS OF **SEVEN** (7) PAGES

Q1 (a) In nature, a hydrological system plays an important role. Outline **TWO (2)** of its functions.

(4 marks)

(b) Due the climate change, the water cycle varies from year to year. Do you agree? Explain your argument with an example.

(6 marks)

(c) A rectangular weir has a discharge of 21.5 m^3/min, when the head of water is half the length of the weir. Calculate the length of the weir. Assume $C_d = 0.6$.

(4 marks)

(d) The National Water Resources Council (NWRC) is a constitution that was approved by the Cabinet in 2012 and is managed by the National Water Resources Council (NWRC), which is chaired by the Prime Minister. Based on your opinion, review the objective of implementation of legislation in resolving issues related to water resources in Malaysia.

(6 marks)

Q2 (a) The federal government has a proposal to increase the capacity of the Sembrong Dam due to the increasing of water demand in the Batu Pahat and Kluang areas. As an engineer for this project:-

(i) Formulate **THREE (3)** potential risks that need to be considered during the construction period.

(6 marks)

(ii) Based on your answer in **Q2(a)(i)**, recommend **TWO (2)** precautionary actions that need to be performed to minimize the project risks.

(8 marks)

(b) Estimate the runoff depth of 12 hours of rainfall for the Parit Raja catchment with a total area of 1235.524 acres. Refer to **Table Q2 (b)** for the runoff data.

(6 marks)

Q3 (a) You are given the task to conduct a frequency analysis of the daily streamflow data for a river catchment.

(i) Explain **THREE (3)** considerations that should be taken into account when using frequency analysis for water resources planning and management.

(6 marks)

(ii) Identify and justify **TWO (2)** limitation of using frequency analysis in water resources planning and management

(4 marks)

(b) A rectangular channel 1.5 m wide is used to carry 0.2 m^3 of water per second, the rate of flow is measured by placing a 90° V-notch weir. If the maximum depth of water is not to exceed 1.2 m, Estimate the position of the apex of the V-notch from the bed of the channel. Assume $C_d = 0.6$.

(4 marks)

(c) Choose **TWO (2)** types of water structures and explain the differences between these structures and their functions.

(6 marks)

Q4 (a) Computer simulation could be a great tools in design and manage the water distribution. Explain **TWO (2)** functions of the computer models in water distribution system design and management.

(6 marks)

(b) The centrifugal pump was designed to pump the water up to 30 meter with the specific speed, N of 700 rpm and the output power, P_o of 8000 kW. At this rate, the maximum pump efficiency is 82%. Calculate

(i) Inflow Power, P_i

(ii) Volumetric flow rate, m^3/s

(4 marks)

(c) Water pricing policies can be used to manage water demand in urban areas. Conclude the **TWO (2)** roles of water pricing in encouraging water conservation and managing water demand.

(6 marks)

(d) Based on your observation, discuss **TWO (2)** main issues related with water supply and demand in Malaysia

(4 marks)

Q5 (a) You are given the task to design a drainage system for a new residential area located at Lendu, Melaka. The channel will be designed based on 5 years of ARI and 30 minutes of rainfall duration. The proposed channel size is 0.4 m and 1.2 m for channel width and depth respectively. Based on the related information as provided in **Table Q5(a)(i)** and **Table Q5(a)(ii).** Assume that the Horton's Roughness and Manning's Roughness values are 0.035 and 0.050 respectively, Calculate:

(i) Rainfall intensity, i

(ii) Time of concentration, t_c

(iii) Peak flow, Q

(10 marks)

(b) There are several key principles of the ecohydrology approach has been introduced to create better environment. Formulate a strategy on how this principle be applied to address contemporary water management challenges.

(4 marks)

(c) Estimate the preliminary size of a BMPs treatment train using swale, wetlands and WQP shown in **Figure Q5(c)**, to reduce TSS by 80% from a residential subcatchment, with an area of 20 ha. The average contributing impervious of the residential area is 70%.

(6 marks)

-END OF QUESTIONS –

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Table Q2 (b) The runoff data for Parit Raja

Time (hr)	Runoff (m^3/s)	Baseflow (m^3/s)
1	1.98	2.80
2	3.12	2.70
3	7.34	2.65
4	12.34	2.50
5	16.57	2.50
6	21.45	2.50
7	17.22	2.50
8	13.78	2.50
9	8.45	2.50
10	4.89	2.32
11	2.52	1.80
12	1.63	1.43

Table Q5 (a)(i) Value of Constant Fitting for Ladang Lendu Melaka

State	Station ID	Station Name	Constant			
			λ	k	θ	η
Malacca	2321006	Ladang Lendu	72.163	0.184	0.376	0.9

Table Q5 (a)(ii) Catchment Area Characteristics for Ladang Lendu Melaka

Catchment	Area (ha)	Slope	Overland Length, L_o	Drainage Length, L_d	Slope (m/m)
Lendu	4.6	5.6	104.54	198.25	0.08

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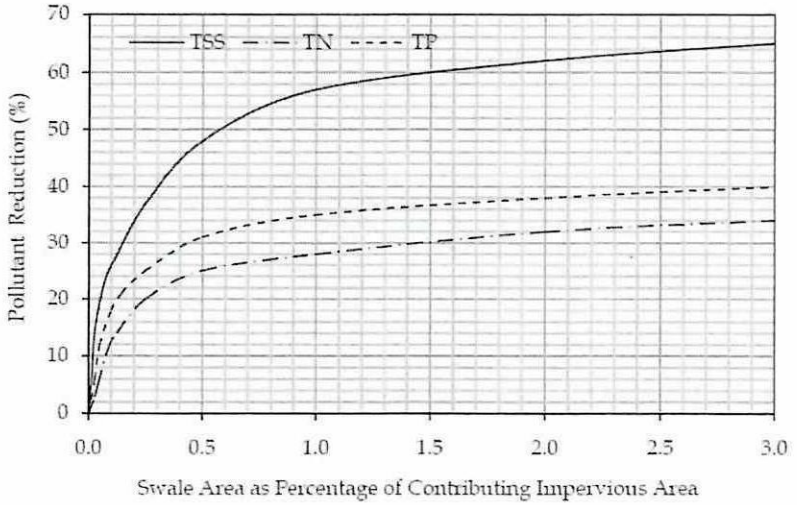

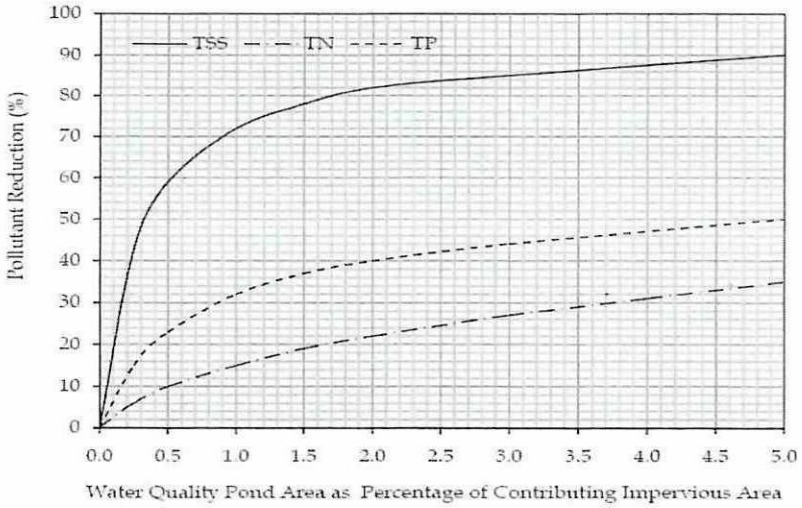

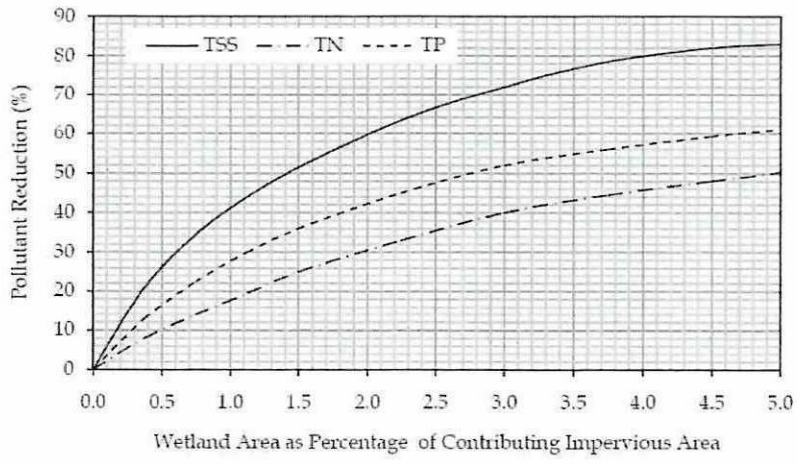

Figure 5 (c) Percentage of Contributing Impervious Area

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LIST OF FORMULA

$$Q = \frac{2}{3} C_d \sqrt{2g}.L.H^{\frac{3}{2}} \qquad \text{Runoff Depth, P} = \frac{V}{A} \qquad P_o = \gamma QH \qquad \gamma = 1000g$$

$$Q = C_d \frac{8}{15} \sqrt{2g}.\tan\frac{\theta}{2}.H^{\frac{5}{2}} \qquad n = \frac{P_o}{P_i} \times 100\%$$

$$i = \frac{\lambda T^k}{(d+\theta)^\eta} \qquad Q = \frac{C.i.A}{360} \qquad t_d = \frac{n.L}{60R^{2/3}S^{1/2}} \qquad t_o = \frac{107.n^*.L^{1/3}}{S^{1/5}}$$

$$Length = \frac{area}{100} \; x \; total \; area \; x \; \frac{impervious \; area}{100} * 10000$$