Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2023/2024

COURSE NAME	:	WATER, DRAINAGE & PLUMBING SYSTEM
COURSE CODE	:	BNB 31703
PROGRAMME CODE	:	BNB
EXAMINATION DATE	:	JULY 2024
DURATION	:	3 HOURS
INSTRUCTIONS	:	1. ANSWER **ALL** QUESTIONS 2. THIS FINAL EXAMINATION IS CONDUCTED VIA ☐ Open book ☒ 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 **SIX (6)** PAGES

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Q1 Demand analysis of water in a water supply system involves studying various factors that influence the quantity of water required by users within a specific area or community.

(a) List out **TWO (2)** critical components to consider before designing a project.

(2 marks)

(b) Differentiate between continuous and intermittent types of water demand and provide examples of each.

(4 marks)

(c) A new residential area located near Harmoni Permai, Pagoh consists of 4,200 units, 15,000 m^2 commercial buildings, 700 students, 180 beds for private hospital and 300 people for mosque. Based on **Table Q1.1**, calculate:

(i) The average daily flow of sewage.

(3 marks)

(ii) The peak flow rate from the residential area.

(6 marks)

Table Q1.1 Recommended Population Equivalent by Malaysian Standard 1228

Type of Premise	Population Equivalent (PE)
Residential	5 per house
Commercial	3 per 100 m^2 of floor area
Schools: - Day school / Institutions - Fully residential - Partial residential	 0.2 per student 1 per student 0.2 per student non-residential student 1 per residential student
Hospital	4 per bed
Mosque/ Church/ Temple	0.2 per person

(d) Explain the following factors that influence the water demand in capita in urban areas.

(i) Population growth

(2 marks)

(ii) Water pricing

(2 marks)

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(e) Non-revenue water has become one of the major issues in sustainability water management. Based on your understanding, explain the incidence of non-revenue water in Malaysia and **TWO (2)** suitable measures to overcome it.

(4 marks)

Q2 In any pumping system, the role of the pump is to provide sufficient pressure to overcome the operating pressure of the system to move fluid at a required flow rate.

(a) State **THREE (3)** main types of pumps commonly used in fluid systems.

(3 marks)

(b) Differentiate between water pumping and gravity water supply.

(6 marks)

(c) **Table 2.1** shows a range of specific speed, *Ns* where a pump is needed to operate at 1,500 rpm (i.e. 50 Hz) with a head of 7 m and a discharge of 250 $L.s^{-1}$.

Table Q2.1 Ranges of *Ns* (Hamill, 2011)

Type	***Ns***
Radial (centrifugal)	10 – 70
Mixed flow	70 – 170
Axial	> 110

Based on the information given in **Table Q2.1**, compute:

(i) Specific speed, *Ns*

(4 marks)

(ii) Choose the best pump to install.

(2 marks)

(d) Integrate the relationship between pump cavitation and its effect on characteristic curves, including an explanation and appropriate examples.

(6 marks)

(e) Based on your understanding, evaluate the significance of specific speed in matching pumps to piping systems and justify your evaluation with examples of scenarios where specific speed considerations are crucial for optimal pump performance.

(4 marks)

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Q3 Cold water service shall consist of a pressurized piping distribution system incorporating a separate supply line from the tap in the existing outside water main to the equipment area inside the building.

(a) State **THREE (3)** main components of a clean water supply system.

(3 marks)

(b) Outline **TWO (2)** purposes of a supply and distribution system in a building.

(4 marks)

(c) As an Engineering Technologist in company ABC, you are required to planning a building's plumbing system, which involves designing and strategizing the layout and components of the plumbing infrastructure to ensure efficient water supply, distribution, and waste removal within the building. Employ the principles of hot and cold-water services during the design of a building's plumbing system and explain clearly to your client.

(5 marks)

(d) Differentiate the design considerations between domestic pipe sizing in single-family homes and high-rise apartment buildings.

(9 marks)

(e) Discuss **TWO (2)** importance of proper domestic pipe sizing in ensuring water efficiency and preventing wastage.

(4 marks)

Q4 All sanitary fitments discharging into a system of drainage must be fitted with a water seal device or trap, to prevent and stops sewer gases from coming into the building.

(a) Define the term "stack" in plumbing systems.

(2 marks)

(b) Explain the pressure variations in plumbing systems can affect the performance of traps.

(5 marks)

(c) Describe the function of traps in plumbing systems and point out **TWO (2)** importance of maintaining water seals.

(6 marks)

(d) Sketch and label the components and layout of a typical piped gas system installed in residential buildings. Discuss briefly how each component contributes to the overall functionality and safety of the system.

(8 marks)

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(e) Discuss the benefits and drawbacks of using compressed air systems in manufacturing plants over traditional mechanical systems.

(4 marks)

- END OF QUESTIONS -

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APPENDIX A

Average daily flow = 225 litres per capita per (lpcd)

Peak Flow Factor (PFF) = $4.7\ p^{-0.11}$

p = population equivalent (PE) in thousand

Peak Flow = PFF x average daily flow

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