MEBS6000 Utility Services

http://ibse.hk/MEBS6000/

Assignment 01 – Water Supply Systems, Drainage and Sewage Disposal (2024-2025)

1. Cold and Hot Water Supply Systems

1.1 Explain the typical process of planning and designing utility connections in urban cities. Comment on the pros and cons of using urban utility tunnels.

(10 marks)

1.2 Draw a simplified schematic diagram to show the typical arrangement and key components of a cold water supply system for a multi-storey building in Hong Kong, starting from the government water mains. Explain the maintenance responsibility for different parts of the water supply system.

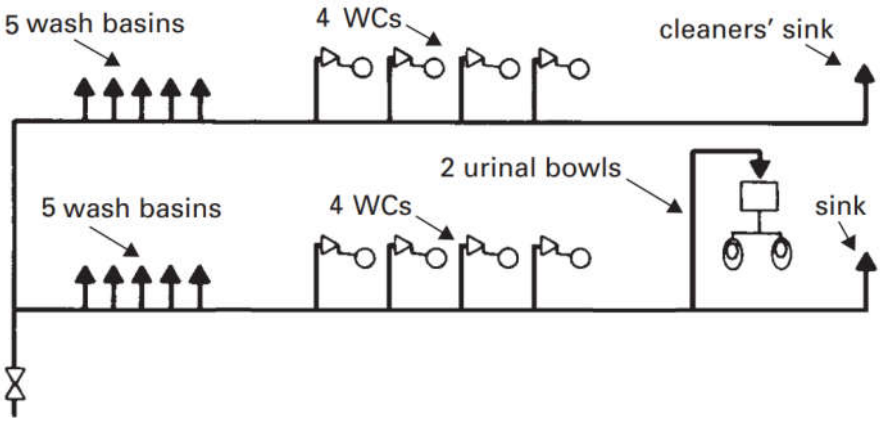
(10 marks)

1.3 Briefly describe the five categories of water resources in Hong Kong. Discuss the important areas of Total Water Management (TWM) strategy in our society and the implications to plumbing engineering design.

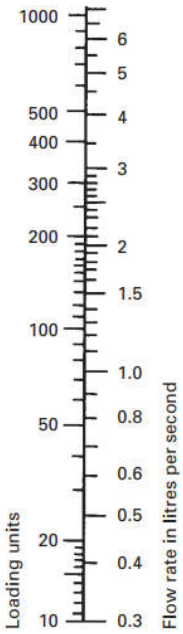
(10 marks)

1.4 A water supply piping system is shown on the following figure. Determine the total loading units and required flow rate for the system. Assume each of the two urinals has a continuous flow of 0.004 litre/s, calculate the design flow rate of the whole system. Explain the principle and key factors of simultaneous demand used for the water supply piping system.

(10 marks)



Type of appliance	Loading unit
WC flushing cistern	2
Wash basin 1⁄2 – DN 15	1.5 to 3
Bath tap 1 – DN 25	22
Sink tap 1⁄2 – DN 15	3



1.5 Explain why a balanced flue gas water heater is considered a better design arrangement than the conventional flue gas water heater. Discuss the important factors to consider when determining acceptable locations for the gas water heaters in residential buildings. Illustrate with diagram(s).

(10 marks)

1.6 Briefly explain the design requirements in Hong Kong for centralised hot water systems. Discuss the major considerations when designing hot water systems for high-rise buildings.

(10 marks)

2. Sanitation and Drainage

2.1 A roof sloping at 42 degree has a level box gutter 125 mm wide and 50 mm deep. The roof is 15 m long and 5 m up the slope. Calculate whether the gutter will adequately convey rainwater when the rainfall intensity is 75 mm/h. Recommend the outlet location (an end outlet or a centre outlet).

Given:
Drain water flow rate (Q_D) for a roof pitch in L/s:
$Q_D = 0.021 \times (1 + 0.462 \tan \theta) \times A_r$
where θ is the roof pitch in degrees, and A_r is area drained (m^2)

Gutter flow capacity (Q) in L/s is:

$$Q = \frac{9.67}{10^5} \times \sqrt{\left(\frac{A_o^3}{W}\right)}$$

where A_o is the area of flow at the outlet (mm^2), and W is the width of the water surface (mm), also a centre outlet would have the effect of halving the flow load on the gutter as compared with an end outlet.

(10 marks)

2.2 The sanitary drainage system could be a risk for the spread of COVID-19 and SARS disease in high-rise residential buildings. Briefly explain the possible disease transmission paths and discuss the possible methods to prevent this.

(10 marks)

3. Sewage Disposal

3.1 Septic tank is a common method of sewage disposal to partially treat raw sanitary wastewater. Explain the basic principles of septic tank and illustrate with diagram(s). Briefly describe the statutory requirements for septic tanks in Hong Kong.

(10 marks)

3.2 Explain the three common acceptance tests of drainage systems. Illustrate with diagram(s). Discuss the safety precautions for doing testing and maintenance in underground manholes.

(10 marks)