

Assignment 02 – Steam Systems, Fuel Gas Supply, Vertical Transportation, Telecommunication and Extra Low Voltage Systems

1. Steam Systems

1.1 Discuss the importance of condensate recovery in steam systems. Explain the operating principles of different types of steam traps. Illustrate with diagrams.

(9 marks)

1.2 A hospital has a steam boiler plant operating at 800 kPa absolute pressure. Condensate is being discharged at saturation temperature from the plant with a flow rate of 1.8 kg.s⁻¹. Calculate the amount of saturated flash steam that would be produced at 200 kPa absolute pressure and the amount of residual condensate. The properties of the condensate and flash steam can be found in the following table.

Absolute pressure (kPa)	Specific enthalpy (kJ.kg ⁻¹)		
	In saturated liquid (h_f)	Latent heat of evaporation (h_{fg})	In saturated vapour (h_g)
800	721	2047	2768
200	505	2202	2707

(8 marks)

2. Fuel Gas Supply

2.1 Briefly describe the four types of gas water heaters for domestic bathroom application. Discuss the issue of accidental carbon monoxide poisoning and suggest a suitable type of gas water heater to avoid such an accident.

(10 marks)

2.2 A commercial kitchen appliance running on town gas (with a calorific value of 17.27 MJ.m⁻³) has a heat output of 20 kW and an efficiency of 70%. Calculate the flow rate of town gas required for the appliance. Draw a simple schematic diagram to show the major parts of the gas installation and controls.

(7 marks)

3. Vertical Transportation

3.1 Discuss the objectives and strategy for planning and designing the passive and active circulation elements in large commercial buildings. Compare the characteristics of lifts and escalators so as to identify their scope of application.

(6 marks)

3.2 Explain the typical safety devices for passenger lifts and escalators. Discuss how modernization of lifts and escalators could enhance their safety level and operation.

(7 marks)

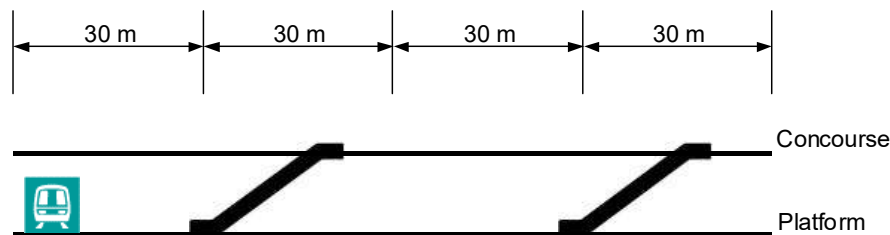
- 3.3 A proposed office building has 10 floors above ground and will require a lift system with an appropriate performance. Given the following data, calculate the round trip time (RTT), select a suitable lift car capacity and numbers, and determine the up-peak interval (UPPINT), up peak handling capacity (UPPHC) and percentage of total daily population that can be served (%POP).

(10 marks)

Given data:

Number of floors to be served	= 10
Interfloor distance	= 3.4 m
Gross floor area per floor	= 1,200 m ²
Floor density	= one person per 10 m ²
Gross to usable (floor area) ratio	= 80%
Attendance ratio (of occupants)	= 90%
Rated speed of lift	= 1.6 m.s ⁻¹
Lift car capacity factor	= 80%
Performance (floor-to-floor cycle) time	= 8.0 s
Passenger transfer time	= 1.2 s
Desirable lift performance:-	Interval less than 30 s and peak arrival rate = 12%

- 3.4 The design engineer of a mass transit railway company is asked to check the proposed transportation system for a new terminal subway station as described below.



Building type:	Terminal MTR (mass transit railway) station
Occupant:	Passengers
Population:	800 passengers per train
Number of floors:	Two (one platform and one concourse)
Length of the train:	120 m (= length of the platform)
Train interval:	Design for a 2.5 minute headway during peak hours
Lift:	1 no. passenger (disabled access)
Escalators:	8 no. total in two sets:- 2 no. up, 2 no. down at the one quarter point of the platform 2 no. up, 2 no. down at the three quarter point of the platform

Identical equipment for all the escalators:-

- rated speed = 0.5 m.s⁻¹
- escalator width = 1000 mm
- step width = 400 mm

Escalator handling capacity:-

- theoretical handling capacity, C_e , in persons/minute is:

$$C_e = 150 \times V \times k$$

where V = speed along the incline (m.s^{-1})
 k = average people per escalator step
($k = 2.0$ for escalator width 1000 mm)
- assume the actual handling capacity is only half of the theoretical handling capacity

Passenger walk: Assume an average speed of 1.5 m.s^{-1} (for working persons)

For the following two operation modes of the escalators, perform evaluation and suitable calculations to determine if the platform will be clear by the time the next train arrives and the likely condition of passengers queuing. Comment on the ideal strategy for operating and maintaining the escalators.

- (a) Normal mode: 2 no. up, 2 no. down (for both sets of escalators)
- (b) Tidal flow mode: 3 no. up, 1 no. down (for both sets of escalators)

(10 marks)

4. Telecommunication Services

- 4.1 Explain the meaning of structured cabling system (SCS) and describe the six sub-systems of structured cabling. Illustrate with diagrams.

(9 marks)

- 4.2 Compare the system design options for in-building wireless systems. Discuss the pros and cons of the design options.

(8 marks)

5. Extra Low Voltage Systems

- 5.1 Briefly describe the three types of extra low voltage (ELV) sources and illustrate with diagrams. Explain the principles of using ELV design to ensure safety of the electric circuit.
- 5.2 Explain the basic concepts and design considerations for the following electronic security systems.

(8 marks)

- (a) Closed circuit television (CCTV) system
- (b) Access control system
- (c) Intercom system
- (d) Burglar alarm system

(8 marks)