Assignment 02 – Steam Systems, Fuel Gas Supply, Vertical Transportation, Telecommunication and Extra Low Voltage Systems (2023-2024)

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 1200 kg/h of condensate at 10 bar gauge passes through a steam trap to 1 bar gauge. Calculate how much flash steam will be produced and the residual condensate. Discuss the different ways to reuse the condensate in a steam boiler system and briefly describe the common methods to return the condensate to the boiler plant.

Given: Specific enthalpy of water at 10 bar gauge = 782 kJ/kg
Specific enthalpy of water at 1 bar gauge = 505 kJ/kg
Specific enthalpy of evaporation at 1 bar gauge = 2201 kJ/kg

(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 in the bathroom.

(7 marks)

2.2 A gas pipework is supplying liquefied petroleum gas (LPG) to a kitchen appliance. Based on the following information, calculate the gas flow rate and pressure loss. If the pipe diameter is changed to 15 mm, determine the respective pressure loss and comment on whether this is acceptable or not.

Appliance heat output = 15 kW
Appliance efficiency = 75%
Gross calorific value of LPG = 116 $MJ.m^{-3}$
Specific gravity of LPG = 1.91
Pipe diameter = 22 mm
Actual length of the gas pipe = 10 m
Allowances for pipe fittings = 4 bends x 0.4 m each
Design tolerance for the pressure loss = 1 millibar

(10 marks)

3. Vertical Transportation

3.1 Describe the different circulation elements in buildings and explain how they will affect the planning and design of vertical transportation.

(8 marks)

3.2 A lift system comprising four cars of rated speed 1.6 m/s and rated car capacity of 12 persons have door opening times of 2.8 seconds and door closing times of 3.6 seconds. The flight time between adjacent floors of interfloor distance 3.5 m is 4.3 seconds. Assuming passengers can enter/exit at 1.2 seconds (average time), calculate the round trip time (RTT). Assume that the highest floor reached is 10 and the number of stops is 9. If the lift speed is increased to 2.2 m/s, what is the effect on the RTT?

(10 marks)

3.3 Discuss the precautions needed for escalator planning and design to prevent the spread of fire and smoke in atrium and multi-story buildings. Illustrate with diagram(s).

(7 marks)

3.4 Describe the common lift passenger safety devices provided for lift systems. Explain the requirements on energy efficiency of lift and escalator installations in the building energy codes in Hong Kong.

(8 marks)

4. Telecommunication Services

4.1 Draw a conceptual diagram to show the typical examples of information technology (IT) and telecommunication systems in a multi-story commercial building. Discuss the key factors and major considerations for planning and designing these systems.

(10 marks)

4.2 Explain the meaning of structured cabling system (SCS) and describe the major sub-systems of SCS.

(7 marks)

5. Extra Low Voltage Systems

5.1 Define what is safety extra low voltage (SELV) system and explain how it can ensure safety of the electric circuit. Illustrate with diagrams.

(8 marks)

5.2 Briefly explain the basic concepts and design considerations for the following extra low voltage (ELV) systems. Illustrate with diagram(s).

(a) Communal aerial broadcast distribution (CABD) and satellite master antenna television (SMATV) systems
(b) Closed circuit television (CCTV) system

(8 marks)