IBTM5660 Utility Services

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Assignment 02 – Steam Systems, Fuel Gas Supply, Vertical Transportation, Telecommunication and Extra Low Voltage Systems (2024-2025)

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 steam boiler is rated at 3600 kW and operates at 10 bar gauge with a feedwater temperature of 50 °C. Calculate how much steam can be generated. What are the major heat losses of the boiler plant which will affect the boiler efficiency? Discuss the disadvantages of using superheated steam as the heating medium in process heat exchangers and other heating processes.

Given: Specific heat capacity for water at 0 bar gauge, 50 °C = 209.4 kJ/kg
Specific enthalpy of steam at 10 bar gauge = 2781.3 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 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 towngas required for the appliance. Given the following data and information, calculate the pressure loss of the town gas pipe.

- Gas flow rate = 8 $m^3.hr^{-1}$ - Pipe diameter = 15 mm - Specific gravity of town gas = 0.52 - Length of the pipe = 4.2 m	The Pole formula: $Q = 0.0071\sqrt{\frac{h \times d^5}{s \times l}} \quad (m^3/hr)$

(7 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 of an office building has six lift cars of rated speed 2.5 $m.s^{-1}$ and rated car capacity of 12 persons have door opening times of 3.0 seconds and door closing times of 4.0 seconds. The flight time between adjacent floors of interfloor distance 3.6 m is 4.5 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 11 and the number of stops is 10. If the lift speed is increased to 3 $m.s^{-1}$, what is the effect on the RTT? Comment on the lift design strategy for high-rise office buildings.

(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 Explain the design requirements and considerations for fireman's lift. Discuss the influencing factors and typical options/solutions for the modernisation of lifts and escalators in existing buildings.

(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 steps to design a structured cabling system (SCS) for a commercial building. Illustrate with diagrams.

(7 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.

(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)