MEBS6000 Utility Services

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Assignment 02 – Steam Systems, Fuel Gas Supply, Telecommunication Systems, Extra Low Voltage Systems, Security Design & Planning (2022-2023)

1. Steam Systems

1.1 Explain the unique properties of steam which can provide many benefits for building and industrial applications. Discuss the advantages and disadvantages of using steam systems over hot water systems.

(10 marks)

1.2 Draw a schematic diagram to show the principal areas and components of a steam system. Explain the function of a steam separator and the common separating principles/mechanisms.

(9 marks)

1.3 In a steam system, condensate discharges at steam temperature operating at 9 bar gauge. If the pressure in the return line is atmospheric (0 bar gauge), determine the relative volume occupied by steam and water in the return pipework.

(9 marks)

1.4 For an indirect steam heating system, calculate the log mean temperature difference (LMTD) and the arithmetic mean temperature difference (AMTD) of the heat transfer process based on the following information.

- Steam temperature = 100 °C
- Product inlet temperature = 35 °C
- Product outlet temperature = 95 °C

(6 marks)

2. Fuel Gas Supply

2.1 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)

2.2 Briefly describe the key components of a fuel gas supply system starting from the gas main pipe utility connection to the customers inside the building. Illustrate with diagrams.

(6 marks)

3. Telecommunication Systems

3.1 Explain the meaning of structured cabling system (SCS) and describe the major sub-systems of SCS. What is the main purpose of a firewall system in a telecommunication network?

(10 marks)

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

(7 marks)

4. Extra Low Voltage Systems

4.1 Define what is safety extra low voltage (SELV) system and explain how it can ensure safety of the electric circuit. Briefly describe the different methods and components of access control systems.

(9 marks)

4.2 Explain the meanings of monitored and unmonitored systems for the design of security systems. Discuss the common causes of false alarms.

(8 marks)

5. Security Design & Planning

5.1 Explain the "4D principle" of security design measures. Briefly describe the four layers of physical security.

(8 marks)

5.2 Explain the meanings of the broken windows theory in security planning. Briefly describe the key concepts of crime prevention through environmental design (CPTED).

(8 marks)