

Assignment 02 – Steam Systems, Fuel Gas Supply, Telecommunication Systems, Extra Low Voltage Systems, Security Design & Planning (2023-2024)

1. Steam Systems

1.1 Describe the unique properties of steam which can provide many benefits for building and industrial applications. Explain the meaning of superheated steam. Discuss the disadvantages of using superheated steam as the heating medium in process heat exchangers and other heating processes.

(10 marks)

1.2 Draw a schematic diagram to show the principal areas and components of a steam system. 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. Explain the major heat losses of the boiler plant which will affect the boiler efficiency.

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

(9 marks)

1.3 Discuss the importance of condensate recovery in steam systems and explain the different ways to reuse condensate to enhance the overall system performance. Briefly compare the vented and pressurized systems for condensate recovery.

(6 marks)

1.4 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)

2. Fuel Gas Supply

2.1 A commercial laundry equipment running on liquefied petroleum gas (LPG) (with a calorific value of 116 MJ/m³) has a heat output of 40 kW and an efficiency of 70%. Determine the flow rate of LPG required for the appliance. Given the following data and information, calculate the pressure loss of the gas pipe. Also, describe the different methods for arranging a LPG supply system in buildings.

<ul style="list-style-type: none">- Gas flow rate = 8 m³/hr- Pipe diameter = 15 mm- Specific gravity of LPG = 1.91- Length of the pipe = 3.2 m	The Pole formula: $Q = 0.0071 \sqrt{\frac{h \times d^5}{s \times l}} \quad (m^3/hr)$
--	---

(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 steps to design a structured cabling system (SCS) for a high-tech office building. Discuss the effective strategies for cable routing and distribution in such a building. (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 extra low voltage (ELV) and explain the principles of using ELV design to 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)