Assignment 02 – Steam Systems, Fuel Gas Supply, Telecommunication Systems, Extra Low Voltage Systems, Security Design & Planning (2024-2025)

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   Briefly describe the four steps of the steam and condensate loop. Illustrate with diagram(s).

(5 marks)

1.3   Draw a conceptual diagram to show the basic principle and the inputs/outputs of a boiler plant. Clearly indicate the components and elements.

(6 marks)

1.4   A hospital building has a steam boiler plant operating at 700 kPa absolute pressure. Condensate is being discharged at saturation temperature from the plant with a flow rate of 2.5 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)
700	698	2066	2763
200	506	2201	2707

(4 marks)

1.5   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 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 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   Briefly explain the six major issues of security design. Describe the key concepts of crime prevention through environmental design (CPTED).

(10 marks)

5.2   Describe the risk-based approach to planning security for a commercial building. What are the major considerations for the risk assessment?

(8 marks)