Unit 17: Principles of Public Health Engineering

Unit code	**F/615/1403**
Unit level	**4**
Credit value	**15**

Introduction

The role of a public health engineer is a very important and diverse one in the construction process. They design systems for water supply and sanitation that help buildings work better for occupants, owners and the environment. This may vary from a drainage system in a hospital to a water supply system in a high rise apartment building.

This unit introduces students to the principles of public health engineering. Students will develop a broad understanding of domestic hot and cold water services, sanitation and rainwater systems that serve large commercial and complex multi-zone buildings.

On successful completion of this unit students will be able to calculate, design and select appropriate pipework systems and plantroom equipment for hot and cold water services, sanitation and rainwater systems for large commercial buildings.

Learning Outcomes

By the end of this unit students will be able to:

1. Explain the different types of domestic water services systems and above ground drainage that serve large commercial and complex buildings.
2. Identify relevant design considerations for buildings when selecting water, drainage pipework, plant and equipment.
3. Develop sustainable design strategies for public health engineering.
4. Design and specify water and sanitation services for large non-domestic buildings.

Essential Content

LO1 **Explain the different types of domestic water services systems and above ground drainage that serve large commercial and complex buildings**

Cold water:

Sources of water: water quality, hardness, water treatment, corrosion.

Distribution systems: direct and indirect systems, boosted cold water systems, water storage, pressure reduction and control, domestic sprinkler systems.

Hot water:

Hot water production: local vs central, vented and unvented, calorifiers, plate heat exchangers, local heaters.

Distribution systems; secondary circulation, pumps and balancing, trace heating, avoidance of dead legs.

Above ground drainage:

Sanitary pipework systems: attributes, primary ventilated stack system, secondary ventilated stack system, ventilated and unventilated branches, stub stacks, pumped drainage systems.

Kitchen and laboratory drainage.

Rainwater systems:

Rainwater pipework systems: gravity and siphonic systems, gutters and roof outlets, paved area drainage, sound attenuation, soakaways.

LO2 **Identify relevant design considerations for buildings when selecting water, drainage pipework, plant and equipment**

Cold water:

Water regulations, categories of fluid, contamination risks, air gaps and backflow prevention, legionella prevention and monitoring, disinfection and flushing of systems, British Standards and codes of practice, commissioning and maintenance.

Hot water:

Legionella prevention, thermal balancing, hot water temperatures, legionella prevention vs scalding, building regulations, mixers and blending of hot water, thermostatic control, safety features for unvented hot water.

Above ground drainage:

Limits of stack system, trap seal loss, high rise building drainage, invert levels, secondary venting, air admittance valves (A.A.V.), positive air pressure attenuators (P.A.P.A.), offsets and vent termination. Sewer capacities.

Building regulations and codes of practice.

Rainwater systems:

Green, brown and blue roofs, pitched roof types, rainfall intensities, Sustainable Urban Drainage Systems (SUDS), rainwater attenuation.

Building regulations and codes of practice.

LO3 **Develop sustainable design strategies for public health engineering**

BREEAM and LEED

Water flow rates and leak detection methods: requirements and solutions.

Water consumption and water conservation measures: types and techniques.

Hot water generation: Combined Heat and Power (CHP) overview and solar thermal overview.

Grey water recycling systems: benefits and pitfalls.

Rainwater harvesting systems: requirements and uses.

LO4 **Design and specify water and sanitation services for large non-domestic buildings**

Cold water systems:

Cold water storage requirements, cistern sizing, probability theory and loading units, cold water pipe sizing, pressure, flow rates and velocity, booster set sizing.

Hot water systems:

Hot water generator sizing, reheat/recovery period, storage, semi-storage or instantaneous, hot water flow and return pipe sizing, circulating pump size, mass flow rate and pressure drop.

Above ground drainage systems:

Stack and drain sizing, invert level calculations and relevant falls of pipework.

Rainwater systems:

Surface water run-off calculations, storm return periods/rainfall intensities, gutter and roof outlet sizing, attenuation tank sizing.

Learning Outcomes and Assessment Criteria

<table>
<tr><th>Pass</th><th>Merit</th><th>Distinction</th></tr>
<tr><td colspan="2">LO1 Explain the different types of domestic water services systems and above ground drainage that serve large commercial and complex buildings</td><td rowspan="5">LO1 LO2
D1 Critically analyse different water and sanitation systems and plant choices, explaining how such choices may impact on the building's construction and performance.</td></tr>
<tr><td>P1 Identify the main hot & cold water and sanitation systems for commercial buildings.
P2 Describe the main plant items for water and sanitation systems.</td><td>M1 Illustrate the operation of a hot & cold water and sanitation system for a given building type.</td></tr>
<tr><td colspan="2">LO2 Identify relevant design considerations for buildings when selecting water, drainage pipework, plant and equipment</td></tr>
<tr><td>P3 Explain the current legislation and codes of practice that influence the design and selection of water and sanitation systems.
P4 Identify relevant design fundamentals that are needed in order to undertake the design of water and sanitation schemes for buildings.</td><td>M2 Analyse the relationship between design fundamentals and legislative requirements needed for an effective public health design of a building.</td></tr>
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Pass	Merit	Distinction
LO3 Develop sustainable design strategies for public health engineering		
P5 Identify the main drivers, both economic and legislative, for sustainable design in public health engineering. **P6** Produce a design strategy for a public health engineering installation in a given context.	**M3** Compare sustainable design strategies for public health engineering in relation to a given context.	**LO3 LO4** **D2** Evaluate the impact of incorporating a sustainable public health scheme within a building design.
LO4 Design and specify water and sanitation services for large non-domestic buildings		
P7 Explain the parameters that inform the design of public health engineering services for a building. **P8** Produce drawings and specification for water and sanitation services in a large non-domestic building.	**M4** Calculate the required plant and pipe sizes for a public health engineering design.	

Resource List

Textbooks

BUTLER, D. and DAVIES J. (2010) *Urban Drainage.* 3rd Ed. Spon Text. Routledge.

CHADDERTON, D. (2012) *Building Services Engineering*. 6th Ed. Routledge.

CIBSE (2014*) CIBSE Guide G: Public Health and Plumbing Engineering.*

GARRETT, R.H. (2008) *Hot and Cold Water Supply*. 3rd Ed. Wiley-Blackwell.

HALL, F. and GREENO, R. (2015) *Building Services Handbook.* 8th Ed. Routledge.

INSTITIUTE OF PLUMBING (2002) *Plumbing Engineering Services Design Guide.*

WATER REGULATIONS ADVISORY SCHEME (WRAS) (2000) *Water Regulations Guide.* 2nd Ed.

Links

This unit links to the following related units:

Unit 2: Construction Technology

Unit 8: Mathematics for Construction

Unit 9: Principles of Heating Services Design & Installation

Unit 10: Principles of Ventilation and Air Conditioning Design & Installation

Unit 31: Advanced Heating, Ventilation and Air Conditioning Design & Installation

Unit 43: Hydraulics