Liverpool John Moores University

Title:	MECHANICAL COMFORT SERVICES INSTALLATIONS
Status:	Definitive
Code:	**4606BEFDL** (123913)
Version Start Date:	01-08-2016
Owning School/Faculty:	Built Environment
Teaching School/Faculty:	City of Liverpool College

Team	Leader
Alfred Leung	Y

Academic Level:	FHEQ4	**Credit Value:**	20	**Total Delivered Hours:**	75
Total Learning Hours:	200	**Private Study:**	125		

Delivery Options
Course typically offered: Standard Year Long

Component	Contact Hours
Lecture	60
Tutorial	12

Grading Basis: 40 %

Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Exam	AS1	FORMAL EXAMINATION	40	3
Artefacts	AS2	DESIGN PROJECT	60	

Aims

The aim of this module is to develop the students' understanding of the main principles and practices for the design, operation and commissioning of mechanical building services systems in medium sized public sector, commercial or industrial buildings. Among the services included are heating, ventilation, and air conditioning, these are approached with a view to sustainability of design and future

Learning Outcomes

After completing the module the student should be able to:

1 Analyse buildings and identify the needs and priorities for heating, ventilation and air-conditioning.
2 Determine heating and cooling loads required to maintain design temperatures in buildings and the potential peak summertime temperatures for spaces without air conditioning.
3 Produce and evaluate detailed heating, ventilation and air conditioning system designs to satisfy the needs of complex buildings.
4 Select and specify appropriate heating plant, energy sources and their associated equipment for space heating and hot water generation systems and detail their installation and operational requirements.
5 Select and specify appropriate cooling plant and associated equipment for air conditioning systems and detail their installation and operational requirements.
6 Produce data and documentation necessary to facilitate the commissioning of heating, ventilation and air conditioning,

Learning Outcomes of Assessments

The assessment item list is assessed via the learning outcomes listed:

FORMAL EXAMINATION	2	5		
DESIGN PROJECT	1	3	4	6

Outline Syllabus

Specification and requirements for heating, ventilation and air conditioning: analysis of client and building needs, heating, ventilation and air conditioning design standards and publications. Identifying targets for sustainability and energy efficiency. Overview of mechanisms for assessing the compliance with statutory and non-statutory environmental compliance. Influence of sustainability standards and targets on design solutions

Designing for health and safety, risk assessment to identify potential risks.
Thermal comfort: Selecting design conditions for thermal comfort effect of radiation on comfort.

Steady and non-steady state heat transfer in buildings: concept of steady state energy transfer networks. Steady state heating loads. Effect of intermittent and highly intermittent heating on heat loads, pre-heat periods. Application of diversity, use of margins, rules of thumb, strategies for reducing heat loads, levels of air tightness in buildings, methods of testing air tightness, assessing infiltration rates in buildings.
Cooling loads due to solar radiation: transmission of solar radiation through glass and building structures. Strategies for reducing cooling loads. Cooling loads due to solar gain. Determining casual and internal gains, use of profiles with casual gains. Impact of alternative design temperature.

Total cooling load and cooling plant capacity: Peak summertime temperatures anticipated in the absence of air conditioning. Use of thermal analysis software to determine heating and cooling loads.

Heat emitters: selection criteria for radiant, convection and mixed output emitters, direct fired emitters, design requirements, design standards for under-floor heating, and heated ceilings.

Design of heating systems: for non-domestic buildings. Layout, specification and control systems, integration of heating requirements with other services installations. Evaluation of proposed systems.

Primary Heat Sources and hot water generators: types of commercial LPHW boiler, primary heat sources and hot water generation plant, use of ground and air source heat pumps as primary heat sources. Configuration and control of single and multiple boiler installations, boiler and heat pump combinations. Fuel consumption and operational efficiency. Alternative methods of heating buildings.

Fuels: properties, characteristics, performance, and environmental implications, renewable fuels, storage and feed requirements.

Combustion principles: stoichiometric air fuel ratios, excess air

Products of combustion: flue gas analysis, air fuel ratios and combustion efficiency. Firing equipment: Control and safety monitoring systems. Air/Fuel adjustment and burner commissioning.

Boiler-room ventilation, draught and flue requirements: legislation and standards of flue systems for single and multiple boiler installations. Legislation and standards design and installation of flue systems for single and multiple boiler installations. Specification and requirements: Factors influencing the decision to install mechanical air conditioning or ventilation systems. Alternative methods of cooling buildings. Ventilation systems: natural and mechanical ventilation systems for commercial and industrial buildings.

Design of natural ventilation systems, prediction and calculation of natural ventilation/infiltration rates, effect of window design, manual and automatic operation of natural ventilation, risk and implications of use of natural ventilation. Air leakage testing. Passive cooling systems. Mixed mode and displacement ventilation systems.

Fume and dust extraction systems. Combination of ventilation with commercial air conditioning systems.

Air conditioning systems: Single duct, terminal re-heat, VAV, fan-coil, Control systems for the various systems. Design, sizing and selection of plant, ductwork and pipework, Implications on space, maintenance and commissioning requirements, capital and operating costs. Use of heat recovery techniques within ventilation and air conditioning systems. Centralised v packaged equipment,

Commissioning and testing requirements: Commissioning schedules and documentation.

Needs analysis and legislative requirements for public health engineering systems: client and building operational requirements, legislative constraints, statutory requirements, design standards and relevant publications. Health, safety and welfare arrangements, energy efficiency considerations. Compliance requirements, methods of achievement and benchmark targets.

Learning Activities

Lectures, tutorials, case studies, workshops, site visits.

Notes

This module is a key component for those students wishing to complete the programme following a 'mechanical' building services pathway. It provides those students who have a basic awareness of the principles and processes of heating, ventilation and air conditioning with a detailed understanding of the mechanisms involved in the thermal response of building and the ability to design and specify commercially viable systems. It also develops a detailed understanding of the principles and procedures associated with energy efficient within commercial buildings.