Liverpool John Moores University

Title:	HEATING
Status:	Definitive
Code:	**5511BEFDL** (118935)
Version Start Date:	01-08-2011
Owning School/Faculty:	Built Environment
Teaching School/Faculty:	Built Environment

Team	Leader
Derek King	

Academic Level:	FHEQ5	**Credit Value:**	12.00	**Total Delivered Hours:**	56.00
Total Learning Hours:	120	**Private Study:**	64		

Delivery Options
Course typically offered: Standard Year Long

Component	Contact Hours
Lecture	36.000
Tutorial	12.000
Workshop	6.000

Grading Basis: 40 %

Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Report	Report	Project based assignment	40.0	
Exam	Exam	Formal examination	60.0	2.00

Aims

The aim of this module is to further develop the student's understanding of the principles and applications of heating installations. This is achieved by developing the students understanding and experience of the more specialised forms of space and process heating, which tend to be associated with the large and complex installations.

Learning Outcomes

After completing the module the student should be able to:

1 Determine energy requirements using data related to climate, building envelope, occupancy and use.
2 Produce and analyse designs for steam and high pressure hot water systems and select and specify appropriate heating plant and primary energy sources for heating and hot water generation for space and process heating.
3 Evaluate the use of district heating schemes.
4 Design and evaluate the use of electrical heating systems for commercial/industrial buildings.
5 Analyse and evaluate the principles, application and operational characteristics of heat pump plant and equipment.

Learning Outcomes of Assessments

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

Project based report	1	2	5
Exam	3	4	

Outline Syllabus

Energy Requirements: Seasonal climatic variations: use of weather data. Application and use of Degree Days.
Heat loss data: operating profiles for occupancy movement, lighting, machinery/equipment, infiltration/ventilation etc.
Loadings: heating loads, diversity for central plant, use of thermal analysis /simulation software.

Properties of steam: heat content of pressurised water, wet, dry and superheated steam
Design of steam systems: layouts, plant arrangements, types, operation and requirements for steam traps, relay points, pressure reducing valves. Design of steam systems. Steam for process work. Use and design of flash steam recovery systems. Use of steam to water heat exchangers. Plant and equipment sizing and selection.
High Pressure Hot Water:: methods of pressurisation, Analysis of safe working temperatures/pressures. Anti-flash margins. Effect of pump location. Design of HPHW Systems: system design, installation and control arrangements. Expansion volumes, sizing and selection of plant including pressurisation plant, use of high temperature hot water, comparison with the use of low temperature hot water and steam systems. Conversion from high temperature hot water to low temperature hot water.

District heating schemes: Use and application of district heating, comparison with the use of individual plants. Alternative primary heat sources/fuels inc waste incineration, CHP schemes, geothermal sources. Distribution methodologies, operating

temperatures, design of distribution networks, distribution ducting. Plant for district heating schemes Consumer charging and energy metering.

Heating plant, appliances and equipment: arrangements for saturated and superheated steam and high temperature hot water systems. Steam super-heaters. Thermal efficiency of steam and high temperature hot water boiler plant. Boiler feed-water treatment, Blow-down rates, feed pumps.
Primary Heat sources: use of renewable low grade heat within primary heat source plant i.e. heat pumps, seasonal operating characteristics of heat pumps. Implications, risk, justification and financial incentive for the use of renewable low grade heat sources. Design, selection and specification of installations utilising low grade heat sources and systems using a combination of low and medium grade heat. Design selection and specification of installations incorporating CHP and micro CHP plant. Cost v benefit justification of CHP plant, maintenance requirement and costs. Design, selection and specification of CHP installations

Electrical heating : application of electrical space heating equipment. Immersion heaters, electrode boilers, thermal storage, trace heating, quartz/luminous heaters, embedded resistance cables. Energy requirements: active store, daily design energy requirement and charge acceptance in storage heating. Pressurised electro-thermal storage systems: plant size and power requirements.

Learning Activities

Lectures, tutorials, case studies, lab-work, workshops, site visits.

References

Course Material	Book
Author	Moss, K.
Publishing Year	2003
Title	Heating and Water Services Design in Buildings
Subtitle	
Edition	
Publisher	Spon Press
ISBN	0-415-29185-2

Course Material	Book
Author	Moss, K.
Publishing Year	1998
Title	Heat and Mass Transfer in Building Services Design
Subtitle	
Edition	
Publisher	Spon Press
ISBN	0-419-22650-8

Course Material	Book
Author	Underwood, C.
Publishing Year	1998
Title	HVAC Control
Subtitle	Modelling, Analysis and Design
Edition	
Publisher	Spon Press
ISBN	0-419-20980-8

Course Material	Book
Author	Chartered Institution of Building Services Engineers
Publishing Year	2006
Title	Guide A
Subtitle	Environmental Design
Edition	
Publisher	CIBSE, London
ISBN	1903287669

Course Material	Book
Author	Chartered Institution of Building Services Engineers
Publishing Year	2005
Title	Guide B
Subtitle	Heating, Ventilation, Air Conditioning & Refrigeration
Edition	
Publisher	CIBSE, London
ISBN	1903287588

Course Material	Book
Author	Chartered Institution of Building Services Engineers
Publishing Year	2004
Title	Guide F
Subtitle	Energy Efficiency in Buildings
Edition	
Publisher	CIBSE, London
ISBN	1903287340

Course Material	Book
Author	Chartered Institution of Building Services Engineers
Publishing Year	2003
Title	Comfort
Subtitle	
Edition	
Publisher	CIBSE, London
ISBN	1903287677

Notes

This module is a key component for those students wishing to complete the programme following a 'mechanical' building services pathway. It aims to develop the students depth of understanding of heating installations by analysing some of the core concepts and exploring some of the more specialised applications and processes within building services.