Liverpool John Moores University

Title:	SUSTAINABLE BUILDING SERVICES ENGINEERING
Status:	Definitive
Code:	**6124BEUG** (118077)
Version Start Date:	01-08-2019
Owning School/Faculty:	Built Environment
Teaching School/Faculty:	Built Environment

Team	Leader
Laurence Brady	Y

Academic Level:	FHEQ6	**Credit Value:**	24	**Total Delivered Hours:**	51
Total Learning Hours:	240	**Private Study:**	189		

Delivery Options
Course typically offered: Standard Year Long

Component	Contact Hours
Lecture	24
Tutorial	24

Grading Basis: 40 %

Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Exam	AS1	Examination	70	3
Report	AS2	Report 1	15	
Report	AS3	Report 2	15	

Aims

To investigate environmental consequences of energy use in general and via building services installations in particular.

To critically evaluate the environmental and economic benefits of various strategies and technologies for reducing the energy usage and environmental impact of building services.

To establish the principles of the value engineering through the construction process and develop tools for controlling costs and minimising waste.

Learning Outcomes

After completing the module the student should be able to:

1 Explain how sustainable development is defined and analyse how various definitions are applied to create the statutory and non statutory drivers for sustainability.
2 Evaluate energy use in recent history and investigate future energy strategies and the requirements of the main climate change agreements and protocols.
3 Investigate, compare and critically evaluate the range of sustainable development and renewable energy strategies available to construction professionals.
4 Evaluate the practicality of various of low and zero carbon technologies in different construction scenarios and investigate strategies for obtaining optimum building performance by passive means.
5 Critically evaluate energy and environmental performance rating of buildings and their services installations and make comparisons with established performance indicators and targets.
6 Critically analyse the requirements of the FAST functional model in relation to: planning, organisation and the decision making processes involved in value engineering.
7 Evaluate the requirements and methodology of various financial modelling techniques including: NPV, (Net Present Value); IRR, (Internal Rate of Return); ROI (Return on Investment) and whole-life costing models to describe the financial implications of VE outcomes.
8 Undertake complex service life predictions of individual components and performance audits and reviews concerned with ensuring the effective implementation of service life planning and conduct complex capital investment risk management appraisals.
9 Critically examine sensitivity testing to assess the degree of risk of investment proposals and to be able to know when, and when not to apply the Value Engineering technique.

Learning Outcomes of Assessments

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

EXAMINATION	1	2	3	6	9
REPORT 1	4	5			
REPORT 2	7	8			

Outline Syllabus

Climate Change and Depletion of Natural Resources:
How energy is derived, generated and transported. Energy utilisation and environmental impact. Water resource demands of building services. The need for conservation and reform. International environmental agreements and protocols. The

role of the building services engineer in meeting the objectives of the climate change programme.

Energy sources and sustainability of alternative energy sources:
Sustainability in the generation and utilisation of energy and water. Application and economics of renewable energy sources; conventional solar systems, photovoltaic, active and passive solar energy systems. Hydro-electric, wind, bio-mass, waste incineration, combined heat and power. Ground source heat pumps, use of ground water as an energy medium or for domestic water usage. Rainwater harvesting, use of water recovery or grey water schemes.

Energy efficient design:
Role of the building services engineer within the building design team. Energy efficient solutions for maintaining the internal environment. Designing for reduced energy requirements and carbon emissions. Heat recovery technologies and opportunities. Technology, application and economics of CHP. Sizing and selection of M&E building services plant and equipment to minimise energy requirement and environmental impact. Techniques for cooling load reduction. Free and passive cooling techniques, applications and strategies. Role of controls, BMS, commissioning and hand over procedures in energy reduction.

Energy Audit and Performance Rating
Determining the energy utilisation, performance and running costs for commercial buildings. Assessing the energy and CO2 performance of buildings and their services against legislative requirements, energy performance indicators and benchmarks. Strategies, procedures and techniques for assessing carbon emission. Carbon Trading, creating a low carbon economy.

Value Engineering:
Function Analysis:
Basics of function modelling with FAST; dimensioning techniques used to give the Functional Analysis Systems Techniques model greater meaning; FAST applications supported by business case studies including; Soft and Hard Process Analysis, Planning, Organization Effectiveness, Supply Chain models, Business System Re-engineering, Advanced Product Development, Project Management and Decision Analysis and others.
Life Cycle costing:
General Principles - methodology for whole-life costing of buildings, and their installations.

Financial modelling:
How to deliver results senior management expect. Communicating the worth of ideas to senior management. NPV, (Net Present Value), IRR, (Internal Rate of Return), ROA, Hurdle Rate, to describe VE outcomes. Use of ROI (Return on Investment) model.
Service life prediction principles:
service life predictions of individual components.

Performance audits and reviews:
Effective implementation of service life planning as a basis for internal reviews or for

formal third-party audits and compliance monitoring

Risk Management:
Major categories of risk in capital investment appraisals: Uncertainty, Optimistic Bias, Variability.
Sensitivity Testing:
Assessing the degree of risk in investment proposals.

Learning Activities

Lectures, tutorials, case studies.

Notes

The module provides an understanding of the environmental consequences of energy use in general and via building services installations in particular. It also provides the knowledge and skills to critically evaluate the environmental and economic benefits of various strategies and technologies for reducing the energy usage and environmental impact of building services.

Further to the environmental theme the module aims to foster an understanding of value engineering strategies, and introduces tools and techniques