Liverpool John Moores University

Title:	SCIENCE AND MATERIALS
Status:	Definitive
Code:	**4118BEUG** (118130)
Version Start Date:	01-08-2018
Owning School/Faculty:	Built Environment
Teaching School/Faculty:	Civil Engineering

Team	Leader
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Academic Level:	FHEQ4	**Credit Value:**	24	**Total Delivered Hours:**	98
Total Learning Hours:	240	**Private Study:**	142		

Delivery Options
Course typically offered: Standard Year Long

Component	Contact Hours
Lecture	48
Practical	24
Tutorial	24

Grading Basis: 40 %

Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Presentation	AS1	Lab folio (Group)	20	
Test	AS2	Multiple Choice Test	20	
Exam	AS3	Examination	60	2

Aims

To provide an introduction to steady state heat transmission, acoustics and light in order to evaluate building, thermal, acoustic and visual performance and its influence

upon energy consumption, condensation incidences, human comfort and the environment

To enable students studying construction related programmes to analyse, apply, investigate and evaluate scientific principles and the properties and behaviour of materials in construction related situations.

To encourage students to utilize appropriate analytical methods in connection with scientific problems related to building and in common building situations and scenarios.

Learning Outcomes

After completing the module the student should be able to:

1	Apply analytical methods to scientific problems related to environmental processes and materials in buildings;
2	Apply analytical methods to a range of construction situations and scenarios;
3	Identify the properties of common building materials and classify their performance characteristics, with due regard to the natural environment and potential environmental impacts;
4	Apply basic scientific principles in the context of the built environment and understand their relevance to building design and performance;
5	Perform laboratory experiments and deal with recording, analysing and reporting of results;
6	Describe and evaluate factors which influence human comfort juxtaposed with the utility, sustainability and energy efficiency of buildings, with respect to temperature, humidity, air movement, lighting and noise levels.
7	Describe the thermal properties of common building structures and evaluate heat losses from simple buildings.
8	Describe the thermal and hygroscopic properties of air and evaluate condensation risk in buildings

Learning Outcomes of Assessments

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

Lab folio (group)	5			
Multiple choice test	1	2	8	
Examination	3	4	6	7

Outline Syllabus

Analytical methods:
Algebra: linear, simultaneous and quadratic equations, laws of indices and logarithms, common and Napierian logarithms, indicial equations, direct and inverse proportion, inequalities, functional notation and manipulation of algebraic problems.
Graphical representation: functions, points of intersection between two graphs,

graph sketching (straight line, polynomial, exponential and logarithmic), fit lines to experimental data using least squares method.
Space, time and motion: plot space/time and velocity/time diagrams, determine displacement, velocity and acceleration. Laws of motion, momentum, impulse and projectiles.
Analytical methods - surveying,testing and control
Trigonometry: basic trigonometric ratios and their inverses, trigonometric ratios for the four quadrants, solution of triangles, calculusation of areas and volumes of solids
Determination of co-ordinates in 2-d and 3-d geometry.
Trapezoidal and Simpson's rule

Statistics and probability:
Tabular and graphical form: data collection methods, histograms, bar charts, line diagrams, cumulative frequency diagrams, scatter plots.
Central tendency and dispersion: introduction to the concept of central tendency and variance measurement, mean, median, mode, standard deviation, variance and inter-quartile range, application to construction.
Analytical methods- analysis of structural and building engineering systems; trigonometric methods: to solve problems such as static forces, relative motion, frameworks.
Calculus: to differentiate and integrate simple equations and demonstrate applications of calculus.

Environmental Science:
Light; Properties of light and measurement of light. Artificial lighting systems; lamps & luminaires, lighting design, colour rendering. Use of natural light; daylight factors, combined lighting systems
Sound; nature of sound and nature of hearing, properties of sound (frequency, pitch, amplitude etc), measurement of sound levels. Noise in buildings; measurement of noise, noise transfer, noise control, sound insulation & absorption, attenuation. Room acoustics; reflection, absorption, reverberation.
Heat and heat transfer; radiation, conduction & convection. Thermal effects in buildings; thermal insulation, thermal capacity, thermal resistance of building components, thermal bridging, structural temperatures. Energy use in buildings; thermal comfort, heat losses and gains, energy balance, energy regulations. Ventilation; natural and mechanical ventilation systems, basics of air conditioning systems. Properties of air, moisture in air, vapour, humidity and condensation. Condensation in buildings, interstitial condensation.

Materials:
Important properties, design criteria and specification of materials including bricks and brickwork, cement, mortar, concrete, plaster, metals, alloys, timber (including engineered timbers), clay products, insulation materials and polymers including vapour and damp-proofing barriers. Use of protective coatings including paints, stains and renders. Need for maintenance and replacement of building components, introduction to sustainability and environmental issues relating to construction.

Learning Activities

The module is based on a lecture and tutorial programme including video and Power-Point presentations together with a number of practical sessions.
Students should develop a competence in using scientific equipment using an active learning approach.
Laboratory work will have an emphasis on the manipulation, interpretation and analysis of the data, which should allow reasoned conclusions and recommendations to be made.
Certain key mathematical skills will be integrated within the laboratory reports, while other mathematical content will be assessed through application to construction based scenarios.

Notes

The module is designed to provide the student with a sound basic understanding of the characterisation and behaviour of the principal materials used in construction and also the application of scientific principles to environmental services within construction. Alongside this the student will be encouraged to apply appropriate analytical methods to the solution of related construction based problems.