Liverpool John Moores University

Title:	BUILDING SERVICES ENGINEERING MATHEMATICS & APPLIED ELECTRICAL SCIENCE
Status:	Definitive
Code:	**5507BEFDL** (118289)
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:**	24.00	**Total Delivered Hours:**	111.00
Total Learning Hours:	240	**Private Study:**	129		

Delivery Options
Course typically offered: Standard Year Long

Component	Contact Hours
Lecture	72.000
Practical	12.000
Tutorial	24.000

Grading Basis: 40 %

Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Exam	Exam	Formal examination	80.0	3.00
Report	Lab report		20.0	

Aims

This module aims to provide the students with the fundamental mathematical and scientific knowledge and analytical techniques to support the mathematical and analytical functions required in the other modules of the programme. The module is further intended to enable students studying the electrical pathway of the Building Services programme to apply the mathematical and analytical techniques, associated with the electrical principles of AC theory, circuit calculations and analysis

of complex networks. It also provides the underpinning electrical principles to support many of the techniques and technologies implicit in electrical installations design contained within other modules of this programme, and in associated building services plant and systems in processing analogue and digital information.

Learning Outcomes

After completing the module the student should be able to:

1 Construct differential equations for the purpose of solving building services engineering problems.
2 Demonstrate a knowledge of the properties of trigonometrical functions and relate these to the characteristics of wave forms.
3 Analyse and solve problems using statistics and probability.
4 Evaluate and analyse ac networks in a series of combinations and relate the analysis to the application of complex quantities.
5 Investigate the application of circuit theorems and complex quantities techniques to practical networks met in electrical building services engineering.
6 Analyse the response of circuits to transients.
7 Investigate the effect of varying the frequency in ac circuits as related to the control of power in circuits and communication systems.
8 Investigate the principles of analogue and digital information conversion and transmission.

Learning Outcomes of Assessments

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

Exam	1	2	3	4	6	8
Lab reports assignment	5	7				

Outline Syllabus

Differential Equations: General and particular solutions. Boundary condition. Differential equation models in building services engineering.
Trigonometrical Functions: Properties of waves: Amplitude, wavelength, frequency, phase difference, etc
Graphs: Sin θ, cos θ, sin 2θ, sin θ/2 etc.
Trigonometrical identities: sin θ/cos θ = tan θ, sin2 θ + cos2 θ = 1, compound angle ,formula, etc
Addition of wave-forms: a sinθ + b cosθ = R sin (θ ± α)
Statistics and Probability: Mutually exclusive and independent events. Binomial, Poisson and normal distributions.
Matrices: Multiplication, transposition and inversion, applications.

Transformation theorems: single phase RLC circuits, series and parallel. Three phase
Star/Delta networks, balanced and unbalanced loads. Star/Delta Transformation

Theorems
Power factor: power measurement and power factor control.
Applications of Complex quantities: Admittance, conductance and susceptance, complex power analysis.
DC Circuit theorems: Thevenin's theorem, Norton's theorem, Superposition theorem. Maximum power transfer theorem.
AC Circuit theorems and applications: Thevenin's theorem, Norton's theorem, application to transmission lines, T and P networks, power system configurations and reductions, complex quantities analysis. RLC networks, frequency variations, series and parallel networks, Q factor, filter circuits, bandwidth, coupled circuits, power networks, communication circuits
Transient analysis: capacitance and inductance. R/C and R/L circuits growth and decay of voltage and current. Exponential functions. Sinusoidal and step inputs. Differentiator and integrator networks.
Transmission systems: dc and ac transmission signals, frequency and wavelength, relationships, analogue/digital signals, modulation, series/parallel data transmission, protocols.

Learning Activities

Lectures, tutorials, laboratory based practical work.

References

Course Material	Book
Author	Greer, A. & Taylor, G.
Publishing Year	2004
Title	Mathematics for Technicians
Subtitle	
Edition	
Publisher	Nelson & Thorns
ISBN	928-0-7487-7949-9

Course Material	Book
Author	Bird, J.
Publishing Year	2009
Title	Basic Engineering Mathematics
Subtitle	
Edition	5th
Publisher	Newnes
ISBN	0-7506-6575-0

Course Material	Book
Author	Stroud, K.A.
Publishing Year	2007

Title	Engineering Mathematics
Subtitle	
Edition	
Publisher	Palgrave Macmillan
ISBN	1-4039-4246-3

Course Material	Book
Author	Bird J.
Publishing Year	2010
Title	Electrical Circuit Theory and Technology
Subtitle	
Edition	4th
Publisher	Newnes
ISBN	10185617770X

Course Material	Book
Author	Hughes E. rev. Hiley J.
Publishing Year	2008
Title	Hughes Electrical and Electronic Technology
Subtitle	
Edition	
Publisher	Prentice Hall
ISBN	100132060116

Notes

This module is a specialist module for students pursuing the electrical building services pathway. It aims to support and contextualise mathematical and analytical techniques, and other specialist scientific knowledge, such as principles of AC theory, circuit calculations and analysis of complex networks.