Department of Electronics Module Specifications

Module title
Mathematics for Music Technology ELE00013C
Credit value
20
Module credit level
Level 4
Module coordinator (if known) and department(s) involved in delivery of the module
Dr Martin Robinson Dr Janet Clegg, Dr Alice Courvoisier
Indicative JACS subject code for the module
H600 (Electronic Engineering)
Teaching cycle
Spring & Summer Terms. Taught annually.
Pre-requisite modules/co-requisite modules/prohibited combinations
BSc Stage 1: *Maths Fundamentals*
Shared teaching (if known)
Maths lectures only are shared with Stage 0 *Maths 2*
Breakdown of the module workload

Activity	Total hours
Lectures	59
Tutorials	24
Laboratories	16
Directed Assignments	36
Assessment	17

Module aims

This module involves mathematics and modelling for music technology systems.
It aims:

- To develop the students' knowledge and facility in mathematics for engineering
- To develop an understanding of how musical sounds are represented, modelled and created.

Module learning outcomes

By the end of the module, students should:

- Be familiar with mathematical techniques required by subsequent courses.
- Be able to produce a variety of musical sounds, having worked with them in practical laboratories and MATLAB code.

Further information about the module content

Indicative Content:

Musical sounds: pitch, loudness, attack-decay. Timbre & overtones. Beats, vibrato, tremolo, chirp. Noise, percussive sounds, chaotic sounds.

Relationships between sounds: Octaves, chords, harmony, discord, intervals, scales, temperament, keys.

Modelling & Simulation of sound: Sinusoidal signals (frequency, amplitude & phase), envelopes, harmonics, non-sinusoidal signals, amplitude & frequency modulation, noise, chaos. Logarithmic and linear relationships.

Introduction to MATLAB: including sound generation and waveform construction.

Laboratory exercises: Creating & monitoring sounds with standard laboratory bench equipment, such as signal generators and oscilloscopes. Observing effect of waveform shape on sound quality. Combination of sounds.

Logarithms and exponentials

Introduction to Calculus - basic polynomial differentiation.

Surds - manipulation, simplification, and rationalisation of denominators.

Matrices - addition, subtraction, multiplication, 2x2 inverses and determinants, solution of matrix equations, solution of simultaneous equations, and application to geometry.

Series - sigma notation, arithmetic and geometric progressions, and the binomial series.

Geometry - tangent to a curve.

Differentiation - products, quotients, functions of functions, exponentials, logarithmic functions, turning points, trigonometric functions.

Complex Numbers - Cartesian form and Argand diagrams, addition, multiplication, division, modulus, and solution of quadratic equations.

Vectors - addition and subtraction, scalar (dot) product and angles between vectors; position, displacement, velocity and acceleration vectors, and work.

Trigonometric Identities - basic identities, double and half angle formulae, addition and multiplication

formulae; angles outside .

Integration - introduction, trigonometric functions, constants of integration, substitution, partial fractions, by parts, indefinite/definite integrals.

Series - sigma notation for sums of n^2 and n^3, Maclaurin expansions for sin(x), cos(x), e^x and ln(1+x).

Complex Numbers - modulus-argument form, exponential form, Euler's identity, and solution of $z^n=k$.

Probability and Statistics - mean, mode, median, percentiles, standard deviation; combined probabilities and independent events.

Differential Equations - simple first order.

Assessment	
Continuous assessment	Please refer to the Statement of Assessment and the Assessment and Feedback Summary
Reassessment	Please refer to the Statement of Assessment

Feedback to students

Assessments are marked and returned within 3 weeks (maximum).

Students get immediate feedback from directed practice assignments throughout the term.

Reading List

Key to recommended books:

** Strongly recommended for purchase (available from the University bookshop)

* Recommended purchase

++ Essential library reading

+ Supportive library reading

** Stroud, KA, 'Engineering Mathematics: Programmes and Problems', Macmillan, 2001, 5th Edition. ISBN 9780333919392

** Bostock, L and Chandler, S, 'Core Mathematics for A-Level', Stanley Thornes, 1994. ISBN 0-74871-779-X.

+ Bostock, L, Chandler, S, Shepherd and Smith, 'GCSE Higher Mathematics: A Full Course', Macmillan, 1996. ISBN 0-74872-647-0.

+ French AP, 'Vibrations and Waves,' Nelson 1971. ISBN 0177610786.

+ Feynman RP, Leighton RB and Sands M, 'The Feynman Lectures on Physics,' Addison-Wesley 1963, Vol I, Chs 47-50. ISBN 0201021161.

Date on which the module template was last updated	23rd November 2009

Date approved by BoS	3rd March 2010