ENGINEERING MATHEMATICS EE1Y

Course code	7LYU
GU Credits	20
ECTS Credits	10
Co-requisite course	Engineering Mathematics EE1X (7LXU)
Teaching staff (the first has overall responsibility)	Dr N Gadegaard (telephone 5243; email n.gadegaard)
Approximate size of class	80 students

Description of course

Aims

This course provides training in the basic mathematics needed throughout Electronics and Electrical Engineering, particularly simple manipulative skills and an ability to put these together to solve a longer problem in a clear and logical way. Presentation skills will be developed to ensure that engineering and mathematical problems can be explained fluently. The syllabus follows the book by Croft, Davison and Hargreaves.

1. Differentiation and Integration

Syllabus

Differentiation: rates of change; definition of derivative, interpretation as slope of tangent; differentiable functions.
Rules of differentiation: powers, polynomials, rational functions, other algebraic functions; circular functions, chain rule, exponential functions, parametric and implicit differentiation; higher derivatives.
Integration: basic ideas and definitions; definite and indefinite integrals; fundamental theorem of calculus.
Techniques of integration: integral as anti-derivative; further analytical methods.
Exploitation of integration: volumes, root-mean-square values; numerical evaluation.

Learning objectives

Understand significance of derivative as rate of change, and as slope of tangent.
Define derivative from first principles.
Use rules for derivative of a sum, product, quotient and composition of functions.
Apply these rules to functions common in engineering.
Understand significance of second derivative for classifying extrema.
Understand integral as area under curve, difference between definite and indefinite integrals.
State fundamental theorem of calculus, and relation between integral and anti-derivative.
Find integrals from property as anti-derivative with aid of composition rules, partial fractions, integration by parts, and common substitutions.
Use integration to find mean and mean-square values of waveforms.
Evaluate integrals numerically using trapezium and Simpson's rules.

2. Applications of Calculus

Syllabus

Optimization.
Taylor's theorem and related results; L'Hôpital's rule; interpolation and convergence; Newton-Raphson method; numerical integration.

Introduction to ordinary differential equations: motivation, classification; methods of solution.
First and second-order differential equations with constant coefficients: examples from circuit theory; method of solution by substitution; properties of solution, complementary function and particular integral.
Numerical solution of first-order differential equation by Euler's method.

Learning objectives
Use calculus to find and classify extrema of a function.
Evaluate limits using L'Hôpital's rule.
Find roots of an equation with the Newton-Raphson method.
Demonstrate how differential equations arise from the behaviour of simple *LCR* circuits.
Classify differential equations by order, homogeneous and inhomogeneous.
Distinguish between general and particular solutions and explain importance of boundary conditions.
Solve first and second-order differential equations with constant coefficients by substitution.
Distinguish between decaying and oscillating solutions.
Solve first-order differential equation numerically using Euler's method.

3. Assignments

An assignment in two parts will be set in each block of the course. Credit may be refused if assignments are not submitted on time.

4. Lectures, Tutorial and Practical Classes

Normally there are three lectures, one tutorial and one practical class per week. Regular attendance checks are carried out at tutorial and practical classes. Credit may be refused for persistent non-attendance.

Recommended books

Authors	Title, edition	Publisher	Year	ISBN	Cost	Code
A Croft, R Davison and G Hargreaves	Engineering Mathematics (3rd ed)	Prentice Hall	2001	0130268585	£25.99	A
G James and others	Modern Engineering Mathematics (3rd ed)	Prentice Hall	2001	0130183199	£24.99	B
K Stroud	Engineering Mathematics (5th ed)	Palgrave	2001	0333919394	£23.99	B
D Clarke and others	Heinemann Higher Mathematics	Heinemann	1998	0435516132	£14.35	D

Codes : A = compulsory; B = strongly recommended; C = recommended; D = wider reading
The book by Croft, Davison and Hargreaves is *essential* for this course, and must be the latest edition. Stroud and Clarke may be useful for additional assistance.

Study times

Type	Hours
Timetabled lectures, tutorials and laboratories	60
Tutorial sheets	70
Assignments	20
Revision, tests and examination	50

These times are a rough estimate of the work required by a typical student. There will be wide variations between individuals, but you will run a grave risk of failure if you spend significantly less time on this course than these guidelines suggest.

Assessment

Requirements for the award of credits

To ensure that a student will be awarded the credits for a course, he or she must complete the course and reach a minimum level of attainment. This requires that a student:
- be present at lectures, laboratories and tutorials on at least 50% of occasions at which attendance is monitored
- obtain a pass mark in each of the four Moodle tests which will be set; those who fail must attend the remedial laboratories which will be provided.
- attend the class test and gain a nonzero mark
- attend the degree examination and gain a nonzero mark
- achieve the minimum, overall level of attainment defined in the University's Code of Assessment for a G grade (this typically translates into a mark of 10%)

Note that these are minimum requirements: good students will achieve far higher participation rates. Any student who misses an assessment or a significant number of classes because of illness or other good cause should report this. Students in the Department of Electronics and Electrical Engineering should complete a 'Certificate of Absence', which can be obtained from the departmental office in room 720 of the Rankine Building. Other students must follow their department or faculty's usual procedures – we should be informed automatically.

Components of Assessment

%	Type	Details
40	Class test	Weeks 19 and 25, elementary skills, 50 minutes
5	Assignment I	Covering block 1
5	Assignment II	Covering block 2
50	Degree examination	2 hours, no choice of questions, mainly on skills.

The degree examinations are held in week 27 onwards; a resit is available in August/September.
The class test is an assessment of routine skills, and a high level of performance is expected.