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South East Technological University

Module Descriptor

Applied Calculus (Computing and Mathematics)

Applied Calculus (A10872)

Short Title: Applied Calculus
Department: Computing and Mathematics
Credits: 5 **Level:** Introductory

Description of Module / Aims

This module is intended to provide the student with a review of univariate calculus and elementary complex variables with a strong emphasis on the investigation of the concepts using mathematical software.

Programmes

		stage/semester/status
COMP-0545	BSc (Hons) in Applied Computing (WD_KACCM_B)	1 / 2 / M
COMP-0545	BSc (Hons) in Applied Computing (WD_KCOMP_B)	1 / 2 / M
COMP-0545	BSc (Hons) in Computer Forensics and Security (WD_KCOFO_B)	1 / 2 / M
COMP-0545	BSc (Hons) in Computer Science (WD_KCMSC_B)	1 / 2 / M

Indicative Content

- Complex numbers: arithmetic of complex numbers; complex valued exponential functions of a real variable
- Functions: polynomials; rational functions; transcendental functions; limits and continuity
- Differential calculus: derivatives using first principles and tables/rules; finite differences; curve–sketching using critical points and simple optimisation problems; Newton's method; Taylor expansions
- Integral calculus: integration using analytical and numerical methods; application to averages and moments; differential equations solvable by anti-derivatives
- Difference Equations: discretising differential equations and chaos

Learning Outcomes

On successful completion of this module, a student will be able to:

1. Compute routine calculations with complex numbers and use the relationships between complex-valued exponential and trigonometric functions to solve problems.
2. Calculate the derivative and the integral of functions.
3. Use appropriate derivative and integral methods to solve elementary optimisation problems.
4. Explain the most important properties of the elementary functions (including piecewise) and illustrate these properties using appropriate examples.
5. Apply concepts indicated in the syllabus content to appropriate problems and interpret the solutions obtained.
6. Employ mathematical software to analyse problems requiring the use of univariate functions and simple multivariate functions.

Learning and Teaching Methods

- Delivery of the module will be through lectures, tutorials and computer based practicals.
- The lectures will develop theory, lead students through worked examples and introduce the context for the module material.
- The tutorial classes will underpin and rehearse the skills covered in lectures. Students will be encouraged, through the problem sheets, to construct valid and precise mathematical arguments and will be expected to produce solutions using appropriate mathematical notation.
- The practical sessions will be used to discuss applications of the theory and to utilise and implement mathematical software.
- The practical programme is designed to re-enforce the strong interconnections between the mathematical concepts covered in this module and Computer Science concepts through the use of Computer Algebra Systems (CAS) and guided development of students' own code. A typical activity consists of investigating a number of basic quadrature techniques and their application to problems in computer science.

Learning Modes

Learning Type	F/T Hours	P/T Hours
Lecture	36	
Tutorial	12	
Practical	12	
Independent Learning	75	

Assessment Methods

	Weighting	Outcomes Assessed
Continuous Assessment	25%	
Practical	25%	6
Final Written Examination	75%	1,2,3,4,5

Assessment Criteria

<40%: Inability to graph standard functions, complete simple drill exercises in differentiation and integration.

40%–49%: Able to demonstrate a basic understanding of the fundamental concepts in calculus as outlined in the indicative content, and apply, to some degree, these concepts to problems in computer science.

50%–59%: All the above, in addition to using the standard notation to express mathematical entities.

60%–69%: In addition, to be able to determine appropriate mathematical techniques to analyse applied problems and to express their work with rigour and precision.

70%–100%: All the previous to an excellent level. Demonstrates an ability to put a solution into a context and assess whether such solutions are meaningful.

Supplementary Material(s)

- "Helping Engineers Learn Mathematics (HELM)." http://www.personal.soton.ac.uk/jav/soton/HELM/helm_workboo
- Croft, A. and R. Davison. *Foundation Maths*. 5. NY: Pearson, 2010.
- Hughes-Hallett, D. *Calculus*. 6. NY: Wiley, 2012.

Requested Resources

- Room Type: Computer Lab