2024 / 25

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South East Technological University

Module Descriptor

Mathematical Methods (Computing and Mathematics)

Mathematical Methods (A10873)

Short Title: Mathematical Methods
Department: Computing and Mathematics
Credits: 5 **Level:** Introductory

Description of Module / Aims

This module deals with the mathematical concepts and techniques needed to tackle problems in two and three dimensions.

Programmes

		stage/semester/status
MTHS-0039	BSc (Hons) in Applied Computing (WD_KACCM_B)	2 / 3 / M
MTHS-0039	BSc (Hons) in Applied Computing (WD_KCOMP_B)	2 / 3 / M
MTHS-0016	BSc (Hons) in Computer Forensics and Security (WD_KCOFO_B)	2 / 3 / M
MTHS-0039	BSc (Hons) in Computer Science (WD_KCMSC_B)	2 / 3 / M

Indicative Content

- Matrix algebra: matrix operations; solution of linear systems using Cramers rule; matrix inversion and numerical methods; eigenvalues and eigenvectors; applications of eigenvalues/eigenvectors
- Vector algebra: dot and cross product; parametric equation of lines and planes; intersection of lines and planes; decomposition of vectors using the dot product
- Linear transformations: Rotations, reflections, and translations; homogeneous coordinates
- Eigenvalues and eigenvectors: diagonalisation and similar matrices; powers of matrices
- Partial differentiation: critical points; local extrema and saddle points
- Vector calculus: gradient, curl and div; volume and surface integrals

Learning Outcomes

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

1. Use expressions involving vectors and matrices and find the solution set of a system of linear equations using standard methods.
2. Compute expressions involving partial derivatives and vector calculus operators.
3. Use partial derivatives to determine stationary points of multivariate functions and apply techniques to appropriate problems.
4. Use vector algebra to solve three-dimensional geometric problems such as finding where a given line cuts a given plane, intersection of polygons, etc.
5. Apply existing mathematical software and students' own code to represent and solve problems arising in computer science.

Learning and Teaching Methods

- Delivery of the module will be through a mixture of lectures, tutorial classes and computer laboratory sessions.
- 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 demonstrated in the lectures and described module material.
- The practical sessions will utilise software that supports linear algebra and multivariate calculus. Students will use this software to solve selected problems and implement matrix and vector operations and algorithms covered in lectures.
- Active engagement with frequent practice on examples is strongly encouraged through regular course work and class tests.

Learning Modes

Learning Type	F/T Hours	P/T Hours
Lecture	36	
Practical	12	
Independent Learning	87	

Assessment Methods

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

Assessment Criteria

<40%: Inability to demonstrate knowledge or understanding of the fundamental concepts and techniques in vector calculus and matrix systems as outlined in the syllabus content, inability to apply such concepts to selected problems.

40%–49%: Able to demonstrate a basic understanding of the fundamental concepts and techniques in vector calculus and matrix systems as concepts outlined in syllabus content.

50%–59%: In addition to above, able to find the complete solution set to basic problems, and in addition, uses standard notation to express mathematical entities.

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

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

Supplementary Material(s)

- Anton, H. *Elementary Linear Algebra.* NY: Prentice Hall, 2008.

Requested Resources

- Room Type: Computer Lab