**Module Descriptor**

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| **Title** | Linear Algebra | | |
| **Session** | 2025/26 | **Status** | Published |
| **Code** | MATH08007 | **SCQF Level** | 8 |
| **Credit Points** | 20 | **ECTS (European Credit Transfer Scheme)** | 10 |
| **School** | **Computing, Engineering and Physical Sciences** | | |
| **Module Co-ordinator** | Dr Wan R Mekwi | | |

**Summary of Module**

This module extends the material on matrices and vectors covered in Level 7.

Properties of square matrices of higher order than 2x2 are covered in detail. This includes a treatment of determinants and their properties, and of their inverses, including a discussion on such topics as adjoint matrices and Cramer's rule. The concepts of eigenvalues and eigenvectors are consolidated in this higher order setting, and extended to a wider range of problems including diagonalisation.

The concept of a vector space is introduced, and then developed to include discussion of subspaces, spanning sets, linear independence, basis and dimension.

Linear transformations are discussed, including matrix representation of these and problems involving a change of basis. Fundamental ideas such as kernel, image rank and nullity of these transformations are discussed, as is the Dimension Theorem.

The concept of an inner product space is introduced, and then developed to extend the familiar notion of perpendicular vectors to the more general orthogonality. Such processes as Gram-Schmidt algorithm are discussed.

The Graduate Attributes relevant to this module are given below:

- Academic: Critical thinker; Analytical; Inquiring; Knowledgeable; Problem-solver; Autonomous.
- Personal: Motivated; Resilient
- Professional: Ambitious; Driven.

| Module Delivery Method | On-Campus[1] ☒ | Hybrid[2] ☐ | Online[3] ☐ | Work -Based Learning[4] ☐ |
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| **Campuses for Module Delivery** | ☐ Ayr<br>☐ Dumfries | ☐ Lanarkshire<br>☐ London<br>☒ Paisley | ☐ Online / Distance Learning<br>☐ Other (specify) | |

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| **Terms for Module Delivery** | Term 1 | ☒ | Term 2 | ☐ | Term 3 | ☐ |
| **Long-thin Delivery over more than one Term** | Term 1 – Term 2 | ☐ | Term 2 – Term 3 | ☐ | Term 3 – Term 1 | ☐ |

| **Learning Outcomes** | |
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| **L1** | Determine key features of square matrices of higher order than 2x2, and use them in the solution of a range of problems. |
| **L2** | Use a range of standard techniques in problems involving vector spaces and their applications. |
| **L3** | Apply a range of standard techniques in problems involving inner product spaces and Gram-Schmidt orthogonalisation |
| **L4** | Solve a range of problems that require the use of linear transformations and their associated properties. |
| **L5** | |

| **Employability Skills and Personal Development Planning (PDP) Skills** | |
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| **SCQF Headings** | **During completion of this module, there will be an opportunity to achieve core skills in:** |
| **Knowledge and Understanding (K and U)** | **SCQF 8**<br>Demonstrating a knowledge and understanding of a range of important mathematical constructs in linear algebra |
| **Practice: Applied Knowledge and Understanding** | **Please select SCQF Level**<br>Using a range of standard techniques to solve problems, in a range of contexts. |
| **Generic Cognitive skills** | **Please select SCQF Level**<br>Conceptualising and analysing problems with the aid of appropriate concepts. |

[1] Where contact hours are synchronous/ live and take place fully on campus. Campus-based learning is focused on providing an interactive learning experience supported by a range of digitally-enabled asynchronous learning opportunities including learning materials, resources, and opportunities provided via the virtual learning environment. On-campus contact hours will be clearly articulated to students.

[2] The module includes a combination of synchronous/ live on-campus and online learning events. These will be supported by a range of digitally-enabled asynchronous learning opportunities including learning materials, resources, and opportunities provided via the virtual learning environment. On-campus and online contact hours will be clearly articulated to students.

[3] Where all learning is solely delivered by web-based or internet-based technologies and the participants can engage in all learning activities through these means. All required contact hours will be clearly articulated to students.

[4] Learning activities where the main location for the learning experience is in the workplace. All required contact hours, whether online or on campus, will be clearly articulated to students

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| **Communication, ICT and Numeracy Skills** | **SCQF 8**<br>Making formal written presentation(s) based on the output from an investigative problem. |
| **Autonomy, Accountability and Working with Others** | **SCQF 8**<br>Exercising independence and initiative in carrying out a range of activities. |

| **Prerequisites** | **Module Code**<br>MATH07009 | **Module Title**<br>Single Variable Calculus |
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| | **Other** or equivalent | |
| **Co-requisites** | **Module Code** | **Module Title** |

| **Learning and Teaching** | |
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| In line with current learning and teaching principles, a 20-credit module includes 200 learning hours, normally including a minimum of 36 contact hours and maximum of 48 contact hours. | |
| **Learning Activities**<br>During completion of this module, the learning activities undertaken to achieve the module learning outcomes are stated below: | **Student Learning Hours**<br>(Note: Learning hours include both contact hours and hours spent on other learning activities) |
| Lecture / Core Content Delivery | 36 |
| Tutorial / Synchronous Support Activity | 12 |
| Independent Study | 152 |
| Please select | |
| Please select | |
| Please select | |
| **TOTAL** | 200 |

| **Indicative Resources** |
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| **The following materials form essential underpinning for the module content and ultimately for the learning outcomes:**<br>H. Anton and C. Rorres, Elementary linear algebra: applications version, John Wiley &<br>Sons, 2013<br>D. Poole, Linear algebra: A modern introduction, Cengage Learning, 2014 |
| **(N.B. Although reading lists should include current publications, students are advised (particularly for material marked with an asterisk*) to wait until the start of session for confirmation of the most up-to-date material)** |

| **Attendance and Engagement Requirements** |
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| **In line with the Student Attendance and Engagement Procedure, Students are academically engaged if they are regularly attending and participating in timetabled on-campus and online teaching sessions, asynchronous online learning activities, course-related learning resources, and complete assessments and submit these on time.**<br><br>**For the purposes of this module, academic engagement equates to the following:**<br><br>The School of Computing, Engineering and Physical Sciences considers attendance and engagement to mean a commitment to attending, and engaging in, timetabled sessions. You will scan your attendance via the scanners each time you are on-campus and you will login to the VLE several times per week. Where you are unable to attend a timetabled learning session due to illness or other circumstance, you should notify the Programme Leader that you cannot attend. Across the School an 80% attendance threshold is set. If you fall below this, you will be referred to the Student Success Team to see how we can best support your studies. |

| **Equality and Diversity** |
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| **The University's Equality, Diversity and Human Rights Procedure can be accessed at the following link: UWS Equality, Diversity and Human Rights Code.**<br><br>Aligned with the University's commitment to equality and diversity, this module supports equality of opportunity for students from all backgrounds and learning needs. Using the VLE, material will be presented electronically in formats that allow flexible access and manipulation of content. This module complies with University regulations and guidance on inclusive learning and teaching practice. Specialist assistive equipment, support provision and adjustment to assessment practice in accordance with the University's policies and regulations. |
| **(N.B. Every effort will be made by the University to accommodate any equality and diversity issues brought to the attention of the School)** |

**Supplemental Information**

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| **Divisional Programme Board** | **Engineering Physical Sciences** |
| **Overall Assessment Results** | ☐ **Pass / Fail** ☒ **Graded** |
| **Module Eligible for Compensation** | ☒ **Yes** ☐ **No**<br>**If this module is eligible for compensation, there may be cases where compensation is not permitted due to programme accreditation requirements. Please check the associated programme specification for details.** |
| **School Assessment Board** | Computing, Engineering and Physical Sciences |
| **Moderator** | Dr Raymond Carragher |
| **External Examiner** | P Wilson |
| **Accreditation Details** | |
| **Module Appears in CPD catalogue** | ☐ **Yes** ☐ **No** |
| **Changes / Version Number** | |

| **Assessment (also refer to Assessment Outcomes Grids below)** |
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| **Assessment 1** |
| A portfolio of written work (50%) |

| **Assessment 2** |
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| Class test: formal unseen assessment (50%) |
| **Assessment 3** |
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| (N.B. (i) Assessment Outcomes Grids for the module (one for each component) can be found below which clearly demonstrate how the learning outcomes of the module will be assessed.<br>(ii) An indicative schedule listing approximate times within the academic calendar when assessment is likely to feature will be provided within the Student Module Handbook.) |

| **Component 1** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Assessment Type** | **LO1** | **LO2** | **LO3** | **LO4** | **LO5** | **Weighting of Assessment Element (%)** | **Timetabled Contact Hours** |
| Portfolio | ☒ | ☒ | ☒ | ☒ | ☐ | 50 | |

| **Component 2** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Assessment Type** | **LO1** | **LO2** | **LO3** | **LO4** | **LO5** | **Weighting of Assessment Element (%)** | **Timetabled Contact Hours** |
| Class Test | ☒ | ☒ | ☒ | ☒ | ☐ | 50 | 2 |

| **Component 3** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Assessment Type** | **LO1** | **LO2** | **LO3** | **LO4** | **LO5** | **Weighting of Assessment Element (%)** | **Timetabled Contact Hours** |
| | ☐ | ☐ | ☐ | ☐ | ☐ | | |
| **Combined total for all components** | | | | | | 100% | 2 hours |

**Change Control**

| **What** | **When** | **Who** |
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