**Module Descriptor**

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| **Title** | Mathematics for Physics 2 | | |
| **Session** | 2025/26 | **Status** | Published |
| **Code** | PHYS09012 | **SCQF Level** | 9 |
| **Credit Points** | 20 | **ECTS (European Credit Transfer Scheme)** | 10 |
| **School** | **Computing, Engineering and Physical Sciences** | | |
| **Module Co-ordinator** | Ryan P. Meeten | | |

**Summary of Module**

This is a core SCQF Level 9 module for the Physics Programmes presented in the first term.

This module is an essential module for all students of physics.

The module will begin with a practical treatment of complex variable theory with particular emphasis on the application of the Calculus of Residues for evaluating definite real integrals.

We will then discuss Fourier Analysis, beginning with Fourier series in both trigonometric and exponential forms. The Fourier transform (and its inverse) will be presented. A brief discussion on the Inverse Laplace transform via the Bromwich integral will be considered. The concept of convolution and the convolution theorem will be presented.

The module will also cover the fundamentals of vector calculus required for the study of electromagnetism and field theory. In particular, the concepts of gradient, divergence and curl, including coordinate free definitions of divergence and curl will be discussed. We will also explore vector calculus versions of the Fundamental Theorem of Calculus i.e., Gradient theorem, Divergence theorem and the Circulation theorem. Vector calculus will be presented in the standard coordinate systems (Cartesian, cylindrical and spherical).

We have defined a set of Graduate Attributes that are the skills, personal qualities and understanding to be developed through your university experience that will prepare for life and work in the 21st century (https://www.uws.ac.uk/current- students/your-graduate-attributes/). The Graduate Attributes relevant to this module are listed below.

• Graduate Attributes - Academic: critical thinker; analytical; inquiring; knowledgeable; digitally literate; problem solver; autonomous; incisive; innovative

• Graduate Attributes - Personal: effective communicator; influential; motivated

• Graduate Attributes - Professional: collaborative; research-minded; enterprising; ambitious; driven

| Module Delivery Method | On-Campus[1] ☒ | Hybrid[2] ☐ | Online[3] ☐ | Work -Based Learning[4] ☐ |
|---|---|---|---|---|
| **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** | Appreciate and apply the central results of complex variable theory |
| **L2** | Understand and calculate Fourier series and transforms |
| **L3** | Manipulate vector calculus operators and understand the physical significance of vector fields |
| **L4** | Fluently use alternative coordinate systems to solve problems |
| **L5** | Analyse advanced mathematics concepts using a computer algebra system |

| **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 9**<br>Mathematical techniques that are essential for physics, including contour integration, Fourier series and transforms and vector calculus. |
| **Practice: Applied Knowledge and Understanding** | **SCQF 9**<br>Routine mathematical skills and methods to model and solve physics problems. |
| **Generic Cognitive skills** | **SCQF 9**<br>• Performing calculations efficiently and accurately at a level suitable for SCQF Level 9<br>• Presenting clear and logical arguments<br>• Demonstrating appropriate mathematical maturity |

[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 9**<br>• Presenting mathematical arguments in a clear and coherent manner.<br>• Effective use of a computer algebra system. |
| **Autonomy, Accountability and Working with Others** | **SCQF 9**<br>Group working will encourage collaboration and the demonstration of academic integrity.<br>Exercising initiative and independence in carrying out defined activities.<br>Taking account of own and others' roles and responsibilities in carrying out and evaluating tasks |

| **Prerequisites** | **Module Code** | **Module Title** |
|---|---|---|
| | PHYS08002 | Optics & Electronics |
| | PHYS08004 | Properties of Matter |
| | PHYS08006 | Mathematics for Physics 1 |
| | PHYS08007 | Classical Mechanics |
| | PHYS08009 | Modern Physics |
| | **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 | 24 |
| Laboratory / Practical Demonstration / Workshop | 24 |
| 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:** |

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| Riley, Hobson and Bence – "Mathematical Methods for Physics and Engineering: A Comprehensive Guide" (Third Edition) |
| **(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 log in 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 that 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. This module has lab-based teaching and as such you are advised to speak to the Module Co-ordinator to ensure that specialist assistive equipment, support provision and adjustment to assessment practice can be put in place, 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** | Mathematics and Physics |
| **Moderator** | M. Barbier |
| **External Examiner** | M. Gorman |
| **Accreditation Details** | Institute of Physics (IoP) |

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| **Module Appears in CPD catalogue** | ☐ **Yes** ☒ **No** |
| **Changes / Version Number** | 3.0<br>Module descriptor amended to conform to the new template format.<br>External examiner info updated. |

| **Assessment (also refer to Assessment Outcomes Grids below)** |
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| **Assessment 1** |
| Class Test (60%) |
| **Assessment 2** |
| Coursework: Problem Sets (40%) |
| **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** |
| Class Test | ☒ | ☒ | ☒ | ☒ | ☐ | 60 | 2 |

| **Component 2** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Assessment Type** | **LO1** | **LO2** | **LO3** | **LO4** | **LO5** | **Weighting of Assessment Element (%)** | **Timetabled Contact Hours** |
| Coursework | ☒ | ☒ | ☒ | ☒ | ☒ | 40 | 0 |

| **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** |
|---|---|---|
| Moved to new template | 22/03/2025 | R. Meeten |
| Updated external examiner info | 22/03/2025 | R. Meeten |

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