**Module Descriptor**

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| **Title** | Electromagnetism | | |
| **Session** | 2025/26 | **Status** | Published |
| **Code** | PHYS09003 | **SCQF Level** | 9 |
| **Credit Points** | 20 | **ECTS (European Credit Transfer Scheme)** | 10 |
| **School** | **Computing, Engineering and Physical Sciences** | | |
| **Module Co-ordinator** | Gregory V. Morozov | | |

**Summary of Module**

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

The basic laws of electromagnetism will be studied, including the integral and differential forms of Gauss's law, Ampere's law and Faraday's law. A discussion of dielectrics and polarization as well as magnetics and magnetization will be included. Ohm's law in differential form and Drude model of electron conductivity in metals will be introduced. The energy content of electrostatic and magnetostatic fields will be considered.

The concept of displacement current will be introduced. A detailed discussion of Maxwell's equations will follow. Maxwell's equations will lead to a wave equation for EM fields.

Electromagnetic waves in vacuum and in linear isotropic homogeneous media will be discussed. Concepts such as velocity of EM waves, Poynting vector, and refractive index will be developed.

The theoretical ideas presented in the module will be reinforced and explored using a suite of laboratory experiments.

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] ☐ |
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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** | Apply vector calculus to electromagnetic problems. |
| **L2** | Demonstrate a broad knowledge and understanding of the laws of electromagnetism. |
| **L3** | Solve problems involving electric and magnetic fields and waves. |
| **L4** | Conduct experiments in electromagnetism and critically analyse the results. |
| **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 9**<br>A broad knowledge of basic electromagnetic theory with a critical understanding of the physical phenomena involved. |
| **Practice: Applied Knowledge and Understanding** | **SCQF 9**<br>Electromagnetic theory, which forms the foundation of many technological applications such as those which may be found in modern communications systems. |
| **Generic Cognitive skills** | **SCQF 9**<br>Problem-solving, mathematical reasoning, practical skills. |
| **Communication, ICT and Numeracy Skills** | **SCQF 9**<br>The communication of complex physical ideas, application of vector calculus, use of computers to process data from experiments. |

[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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| **Autonomy, Accountability and Working with Others** | **SCQF 9**<br>Academic integrity, working together with laboratory partners, presenting the results of joint experiments as an individual. |

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| **Prerequisites** | **Module Code**<br>PHYS08002<br>PHYS08004<br>PHYS08006<br>PHYS08007<br>PHYS08009 | **Module Title**<br>Optics & Electronics<br>Properties of Matter<br>Mathematics for Physics 1<br>Classical Mechanics<br>Modern Physics |
| | **Other** or equivalent | |
| **Co-requisites** | **Module Code**<br>PHYS09012 | **Module Title**<br>Mathematics for Physics 2 |

| **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.<br>Due to the inclusion of ASPIRE at Level 8, this module has been increased to 60 hours to compensate the fact that some of the key underpinnings of electromagnetism have necessarily been displaced or moved to corequisite level. The key electromagnetic material in the displaced Oscillations, Waves and Fields module has been embedded in this module. | |
| **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 |
| Laboratory / Practical Demonstration / Workshop | 12 |
| Independent Study | 140 |
| 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>D. J. Griffiths, "Introduction to Electrodynamics, Fourth Edition", Pearson, 2012.<br>(or any later edition).<br>S. Grant and W. R. Phillips, “Electromagnetism (Manchester Physics Series), Second Edition", Wiley, 1990 (or any later edition). |

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| **(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. 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><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** | Y. Chen |
| **External Examiner** | M. Gorman |
| **Accreditation Details** | Institute of Physics (IoP) |
| **Module Appears in CPD catalogue** | ☐ **Yes** ☒ **No** |

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| **Changes / Version Number** | 3.0<br>Module descriptor amended to conform to the new template format.<br>The number of contact hours amended.<br>Moderator updated. |

| **Assessment (also refer to Assessment Outcomes Grids below)** |
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| **Assessment 1** |
| Class Test (60%) |
| **Assessment 2** |
| Coursework: Problem Sets and Laboratory Work (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** | | | | | | | |
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| **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 | 12 |

| **Component 3** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Assessment Type** | **LO1** | **LO2** | **LO3** | **LO4** | **LO5** | **Weighting of Assessment Element (%)** | **Timetabled Contact Hours** |
| | ☐ | ☐ | ☐ | ☐ | ☐ | | |
| **Combined total for all components** | | | | | | 100% | 14 hours |

**Change Control**

| **What** | **When** | **Who** |
|---|---|---|
| Moved to new template | 21/03/2025 | G. V. Morozov |
| Contact hours amended | 21/03/2025 | G. V. Morozov |
| Moderaror updated | 21/03/2025 | G. V. Morozov |

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