# MODULE DESCRIPTOR

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|---|---|---|---|---|---|---|
| **MODULE TITLE** | **Energy, Matter and the Universe** | | | | | |
| **MODULE CODE** | AA1056 (L4) | **JACS CODE** | **F300** | **CREDIT VALUE** | **20 credits** | |
| **DATE OF APPROVAL** | *April 2017* | | | | **VERSION NUMBER** | 1 |
| **SCHOOL** | **Physical Sciences and Computing** | | **PARTNER INSTITUTION** | | **N/A** | |

## RELATIONSHIP WITH OTHER MODULES

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|---|---|---|---|---|---|
| **Co-requisites** | **NONE** | **Pre-requisites** | **AA1051** | **Excluded Combinations** | **None** |

## MODULE AIMS

This module aims to:

- Provide astronomy students with a quantitative understanding of the physical and mathematical concepts underlying astrophysical processes and a foundation for Level 5 study in astronomy.
- Provide an understanding of physical laws and concepts as applied to the Universe.
- Provide the opportunity to develop skills and techniques used in astronomy, which have wider applications (eg problem solving).
- Enable students to solve elementary problems in physics and maths and to use independent judgement and extrapolation /synthesis of concepts to solve more open-ended problems in astronomy

## MODULE CONTENT

**Fundamental Interactions**
gravity according to Newton and Einstein
electromagnetism
weak and strong nuclear forces

**Classical Forces And Fields**
the physical and mathematical description of gravity and magnetism
forces that push and pull: newton's laws, linear momentum
forces that turn: torque and angular momentum

**Motion Of Objects**
describing motion
orbits: planetary, stellar and spacecraft
rotating bodies: planets, stars and galaxies
particle trajectories

**Energy**
energy of motion: the kinetic energy of particles and bodies; rotational KE
energy of place: gravitational potential energy
forces: doing work and transferring energy
energy stored in fields: electromagnetic field energy density

**Light In The Universe**
emission and absorption of light: classical and quantum processes
the spectrum of light
the nature of light: electromagnetic waves and photons

**Matter In The Universe**
the fundamental particles: the particle zoo; particle transformations and decays
the core of atoms - nuclei: atomic number and weight; isotopes
changing nuclei: binding energies; fission; fusion; particle capture and emission

creating the elements
the rest of the atom - electrons and shells: Bohr model and simple quantum physics

**Light And Matter: Fundamentals of Spectroscopy**

characteristic spectra of the elements
formation of spectra: electronic structure; emission and absorption of photons
the atom alone: the effects of temperature on electron states and spectra
the atom in a gas: the effects of pressure on spectral lines

**Heat And Matter**

the meaning of temperature
the meaning of 'heat' energy
thermal properties of gases: the ideal gas law; other equations of state
energy stored: heat capacity in gases; degrees of freedom

**Relativity**

the absolute velocity of light, Michelson-Morley experiment, Lorentz transformation
the effects of relative motion: time dilation and length contraction; the mysterious muon
velocity transformation, relativistic mass, energy and momentum.

**Mathematics**

understanding functions in physics: physical variables and parameters
manipulating and displaying variables: simple functions and plots
properties and use of trigonometric functions
interpreting and solving algebraic equations in physics
describing motion: co-ordinates and vectors
physical meaning of differentiation and integration
differentiating and integrating useful functions in physics
the meaning of simple differential equations in physics: Newton's laws, equations of state

## INTENDED LEARNING OUTCOMES

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

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|---|---|
| **1.** | Explain physical concepts relevant to a range of astronomical topics. |
| **2.** | Use relevant physical and mathematical concepts and tools to solve simple problems in physics and astronomy. |
| **3.** | Use independent judgement and extrapolation /synthesis of concepts to solve open-ended problems in astronomy |

## ASSESSMENT METHODS

The method of assessment for this module has been designed to test all the learning outcomes. Students must demonstrate successful achievement of these learning outcomes to pass the module.

| Number of Assessments | Form of Assessment | % weighting | Size of Assessment/Duration/ Wordcount | Category of assessment | Learning Outcomes being assessed |
|---|---|---|---|---|---|
| 2 | Question Sheets | 2 x 30% | 6-8 Problems | Coursework | 1,2 |
| 1 | Question Sheet with Open-Ended Problem | 40% | 3-5 problems + Open-ended problem | Coursework | 3 |

## MODULE PASS REQUIREMENTS

To pass this module you must achieve a mark of 40% or above, aggregated across all the assessments.

## APPENDIX

**MODULE CODE:** AA1056 (L4) **MODULE TITLE:** Energy, Matter and the Universe

## LOCATION OF STUDY: *UCLAN CAMPUS*

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|---|---|
| **MODULE TUTOR(S)** | Anne Sansom |

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|---|---|---|---|---|---|---|---|---|
| **MODULE DELIVERY** | Semester Long | Semester 1 | | Semester 2 | | Semester 3 | | |
| | Year long | Semester 1 & 2 | ✓ | Semester 2 & 3 | | | | |
| | Other (please indicate pattern of delivery) | DISTANCE LEARNING | | | | | | |

## MODULE LEARNING PLAN

**LEARNING, TEACHING AND ASSESSMENT STRATEGY**

Distance learning students will learn via self-study, supported by detailed distance learning material supplied by the Course Team according to a Course Schedule. Tutorial support via online discussion forums, online classrooms email and telephone as required.

The learning materials include Course Notes with worked examples, self-test exercises with detailed model answers, and assessed coursework. Additional material and suggested further reading are available via Blackboard. Some of the activities contain questions to encourage students to solve conceptual and numerical problems and to build their confidence prior to attempting the assessed question sheets. The assessed question sheets are designed to enable students to demonstrate their understanding and ability to solve problems and explain the concepts involved.

The maths topics are chosen to provide the mathematical tools required for the physics of this module and future modules at levels 5 and 6. The mathematical techniques are assessed early in the module and later assessment is designed to use these techniques and build confidence in applying them to physical problems.

The final assessment is more open ended and is designed to enable students to use independent judgement and extrapolation /synthesis of concepts to solve open-ended problems in astronomy.

| **SCHEDULED LEARNING AND TEACHING ACTIVITY** | *No. of hours* |
|---|---|
| **Tutorial** | |
| **TOTAL SCHEDULED LEARNING HOURS** | 8 |
| **GUIDED INDEPENDENT STUDY** | |
| First reading of posted materials (equiv. to lectures)<br>*Working through details*<br>*Background reading*<br>*Working on coursework assignments*<br>*Reflection of feedback* | |
| **TOTAL GUIDED INDEPENDENT STUDY HOURS** | 192 |
| ***TOTAL STUDENT LEARNING HOURS***<br>***(eg 200 hours per 20 credits)*** | 200 |

## BIBLIOGRAPHY AND LEARNING SUPPORT MATERIAL

On-line Booklist: *http://readinglists.central-lancashire.ac.uk/search.html?q=aa1056*