MODULE DESCRIPTOR

MODULE TITLE	**Extreme States of Matter**					
MODULE CODE	AA3056 (L6)	**JACS CODE**	**F510**	**CREDIT VALUE**	*20 credits*	
DATE OF APPROVAL	April 2017			**VERSION NUMBER**	1	
SCHOOL	**Physical Sciences and Computing**		**PARTNER INSTITUTION**			

RELATIONSHIP WITH OTHER MODULES

Co-requisites	**NONE**	**Pre-requisites**	**AA1056**	**Excluded Combinations**	**None**

MODULE AIMS

This module aims to:

- Present at an advanced level the physical concepts behind a number of astrophysical phenomena that occur in extreme conditions.
- Extend students' mathematical and physical skills and understanding
- Provide a solid foundation for further study.

MODULE CONTENT

Nucleosynthesis: origin of the elements, problems with production of heavy elements, binding energies, neutron-capture, cross-sections, beta-decay, s process abundances, r process abundances massive stars and SN events, mass loss in AGB stars and Planetary Nebulae, novae.

Emission Mechanisms: electromagnetic radiation, astrophysical plasma, bremsstrahlung, cyclotron, synchrotron, masers, radiative transfer. Applications in jets, novae, accretion disks, Eddington limit.

Quantum and Statistical Mechanics: wave-particle duality, particle in box, density of states, Fermi Energy, degenerate matter, relativistic and non-relativistic cases, degenerate equations of state and their application to WD and NS. He-flash in stellar cores.

Spectroscopy and its applications: dipole and quadrapole radiation, absorption and emission processes, forbidden lines. Examples of astrophysical spectra.

Thermodynamics: classical thermodynamics, temperature, entropy, heat, equilibrium, radiation. Black Holes, horizon, application of thermodynamics to black holes, pair production and evaporation from BH, rotating BH, time reversal of BH.

Gravitational Radiation: production of gravitational waves, quadrapole mechanism, inverse square law geometric dilution of gravitational waves, frequency spectrum. Interaction with matter/cross-section for absorption. Sources of gravitational waves (energy/frequency plot), gravitational wave detectors, results so far.

INTENDED LEARNING OUTCOMES

On successful completion of this module a student will be able to:	
1.	use advanced mathematics to describe astrophysical processes or circumstances.
2.	explain the behaviour of astrophysical phenomena using advanced physics concepts.
3.	use mathematical techniques and physical concepts to model astrophysical objects.

4.	solve advanced problems associated with topics on the syllabus and derive numerical results or estimates.

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 (problems involving maths/physics application to Astrophysics)	30%+40%	4-6 questions	Coursework	1,2,3,4
1	Timed coursework (open book)	30%	3-4 questions during specified 2.5 day window.	Coursework	1,2,3,4

MODULE PASS REQUIREMENTS

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

APPENDIX

MODULE CODE: AA3056 (L6) **MODULE TITLE:** Extreme States of Matter

LOCATION OF STUDY: *UCLAN CAMPUS*

MODULE TUTOR(S)	*Barbara Hassall*

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

All modules should include details of the average learning time based upon 200 hours per 20 credits.

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. Students will be encouraged to participate in on-line class discussions.

The learning materials include Course Notes with worked examples, self-test exercises and assessed coursework. Additional material and suggested further reading are available via Blackboard. The approach is advanced and more mathematical than previous modules.
Each syllabus topic in the course notes will have two approaches; the first will concentrate on the physics and mathematics and the second will use the material to describe an astrophysical example.
This module will be taught using detailed course notes, directed reading, self-test problems and problem/question sheets which will be used for feedback and assessment.
Self test exercises contain questions with detailed model answers to encourage students to solve conceptual and numerical problems and to build their confidence prior to attempting the assessed question sheets.

- The assessed question sheet is designed to enable students to demonstrate their understanding and ability to solve problems and explain the concepts involved.
- The timed assessment is essentially open book, but requires students to undertake the work within a 2-3 day period. This strategy requires the student to have consolidated their knowledge and understanding, and is therefore a robust test of their ability to grasp the advanced subject matter.

SCHEDULED LEARNING AND TEACHING ACTIVITY	No. of hours
On-line tutorial	
TOTAL SCHEDULED LEARNING HOURS	6
GUIDED INDEPENDENT STUDY	
Reading lecture notes Reviewing course notes Exercise questions Background reading Working on coursework assignments Reflection on feedback	
TOTAL GUIDED INDEPENDENT STUDY HOURS	194

TOTAL STUDENT LEARNING HOURS ***(eg 200 hours per 20 credits)***	200

BIBLIOGRAPHY AND LEARNING SUPPORT MATERIAL

On-line Booklist: http://readinglists.central-lancashire.ac.uk/search.html?q=AA3056