Module Descriptor

Title	Statistical Physics & Thermodynamics		
Session	2025/26	**Status**	Published
Code	PHYS10015	**SCQF Level**	10
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 10 module for the Physics programmes presented in the first term.

The module covers fundamental concepts of Thermodynamics and Statistical Physics. The syllabus of the module is as follows.

Macroscopic and microscopic descriptions of a thermodynamic system. Equilibrium. Revision of laws of thermodynamics: General, Zeroth, First and Second laws. Macroscopic entropy. Fundamental thermodynamic identity. Third Law of thermodynamics. Enthalpy. Helmholtz free energy, Gibbs free energy. Further thermodynamic identities. Maxwell relations. Thermodynamics of magnetic and dielectric materials. Chemical potential. Systems with variable number of particles. Phase transformations. Phase Diagrams.

Macrostates and microstates. Multiplicity. Isolated and interacting systems. Ensembles. Ergodic hypothesis. Postulate of Equal a Priori Probabilities. Microcanonical ensemble. Statistical entropy. Sackur-Tetrode equation. Canonical ensemble. Boltzmann factor. Boltzmann statistics. Average values. Partition function. Equipartition theorem. Maxwell Speed Distribution. Partition function of ideal gas. Quantum statistics. Gibbs factor. Grand canonical ensemble. Grand partition function. Bosons and Fermions. Density of states. Fermi-Dirac and Bose-Einstein distributions. Photons. Blackbody radiation. Conduction Electrons.

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 ☐ Dumfries	☐ Lanarkshire ☐ London ☒ Paisley	☐ Online / Distance Learning ☐ Other (specify)	

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	
L1	Demonstrate critical understanding of the principles of thermodynamics.
L2	Demonstrate broad knowledge of the principles of statistical mechanics.
L3	Understand how to apply the principles of thermodynamics and statistical mechanics to solve appropriate problems in solid state physics.
L4	
L5	

Employability Skills and Personal Development Planning (PDP) Skills	
SCQF Headings	**During completion of this module, there will be an opportunity to achieve core skills in:**
Knowledge and Understanding (K and U)	**SCQF 10** Demonstrate a broad knowledge of core concepts of thermodynamics and basics statistical physics.
Practice: Applied Knowledge and Understanding	**SCQF 10** Use a selection of the principal skills, techniques, practices enabling further studies. Practice up to date literature search on some unclear/hot topics in thermodynamics and statistical physics.
Generic Cognitive skills	**SCQF 10** Problem-solving, mathematical reasoning, practical skills.

[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

Communication, ICT and Numeracy Skills	**SCQF 10** The communication of complex physical ideas, use numerical and graphical data.
Autonomy, Accountability and Working with Others	**SCQF 10** Exercise some initiative and independence in carrying out defined activities, for example, homework assignments, associated with the study of the module material. Working towards deadlines.

Prerequisites	**Module Code**	**Module Title**
	PHYS09003	Electromagnetism
	PHYS09008	Quantum Mechanics
	PHYS09012	Mathematics for Physics 2
	PHYS09013	Atoms, Nuclei & Particles
	Other or equivalent	
Co-requisites	**Module Code**	**Module Title**

Learning and Teaching	
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 During completion of this module, the learning activities undertaken to achieve the module learning outcomes are stated below:	**Student Learning Hours** (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
The following materials form essential underpinning for the module content and ultimately for the learning outcomes: S. J. Blundell and K. M. Blundell, Concepts in Thermal Physics, Second edition, Oxford, 2019 or later version D. V. Schroeder, An Introduction to Thermal Physics, Addison Wesley Longman, 2000 R. K. Pathria, Statistical Mechanics, Second Edition, Elsevier, 1996 or later version

(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
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. **For the purposes of this module, academic engagement equates to the following:** 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
The University's Equality, Diversity and Human Rights Procedure can be accessed at the following link: UWS Equality, Diversity and Human Rights Code. 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

Divisional Programme Board	**Engineering Physical Sciences**
Overall Assessment Results	☐ **Pass / Fail** ☒ **Graded**
Module Eligible for Compensation	☐ **Yes** ☒ **No** **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	S. Song
External Examiner	M. Gorman
Accreditation Details	Institute of Physics (IoP)
Module Appears in CPD catalogue	☐ **Yes** ☒ **No**

Changes / Version Number	1.0

Assessment (also refer to Assessment Outcomes Grids below)
Assessment 1
Class Test (80%)
Assessment 2
Coursework: Problem Sets (20%)
Assessment 3
(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. (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	☒	☒	☒	☐	☐	80	2

Component 2							
Assessment Type	**LO1**	**LO2**	**LO3**	**LO4**	**LO5**	**Weighting of Assessment Element (%)**	**Timetabled Contact Hours**
Coursework	☒	☒	☒	☒	☐	20	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
New module introduced in 2025/26 AY	21/03/2025	G. V. Morozov