Imperial College London

Module Specification (Curriculum Review)

Basic details

			Earliest cohort	Latest cohort
UID		Cohorts covered	2020-21	
Long title	Thermal Physics and Structure of Matter			
New code	PHYS50002	New short title	Ther Physics & Struc of Matter	

Brief description of module *(approx. 600 chars.)*

This module provides a grounding in the structure of matter at the microscopic and macroscopic levels. It includes two of the key foundations of physics, thermodynamics and statistical physics. Thermodynamics, perhaps the most robust and generally applicable of all models in physics, is based on the four laws of thermodynamics and a mathematical framework to describe the thermal behaviour at a macroscopic level. Statistical physics makes the link between the microscopic and thermodynamics, providing some of the most compelling evidence for the fundamental nature of the universe leading to the development of quantum physics, and underpins our understanding of matter ranging from nanotechnology to astrophysics.

719 characters

Available as a standalone module/ short course? N

Statutory details

	ECTS	CATS	Non-credit		
Credit value	10	20	N	HECOS codes	
FHEQ level	5				

Allocation of study hours

	Hours	
Lectures	42	
Group teaching	15	*Incl. seminars, tutorials, problem classes.*
Lab/ practical	0	
Other scheduled	20	*Incl. project supervision, fieldwork, external visits.*
Independent study	138	*Incl. wider reading/ practice, follow-up work, completion of assessments, revisions.*
Placement		*Incl. work-based learning and study that occurs overseas.*
Total hours	250	
ECTS ratio	25.00	

Project/placement activity

Is placement activity allowed? No

Module delivery

Delivery mode	Taught/ Campus	Other	
Delivery term	Year-long	Other	

Ownership

Primary department	Physics
Additional teaching departments	None
Delivery campus	South Kensington

Collaborative delivery

Collaborative delivery?	N
External institution	N/A
External department	N/A
External campus	N/A

Associated staff

Role	CID	Given name	Surname
Module Leader		Vijay	Tymms
		Carl	Paterson

Learning and teaching

Module description

Learning outcomes	On completion of this module you will be able to: 1) Describe how the atomic hypothesis can be used to explain several facets of the behaviour of matter on a macroscopic scale. 2) Describe the assumptions of, and limitations to, kinetic theory and use the theory to perform detailed calculations on the behaviours of gases. 3) Demonstrate an appreciation and understanding of the zeroth, first and third laws of thermodynamics and their applicability and generality across physics. 4) State the various forms of the second law of thermodynamics, show the equivalence between them and describe how the law highlights a fundamental asymmetry in nature. 5) Demonstrate an understanding of the assumptions of statistical mechanics and use statistical mechanics methods to model physical systems. 6) Explain the meaning of entropy, temperature and thermodynamic equilibrium at the microscopic level and how laws of thermodynamics can arise from the microscopic laws of nature. 7) Describe the origins of classical and quantum statistical distributions, and their applicability and use them to model and understand the behaviour of physical systems.
Module content	The module covers three subtopics. Structure of matter covers states of matter, the atomic hypothesis, kinetic theory and the Maxwell-Boltzmann distribution. Thermodynamics covers the four laws that govern the subject, heat capacities, the Maxwell relations, phase changes, chemical potential and entropy from a macroscopic viewpoint. Statistical physics inspects entropy on a microscopic scale, the partition function, statistical ensembles, density of states, and Fermi-Dirac and Bose-Einstein statistics.

Learning and Teaching Approach	Students will be taught over two terms using a combination of lectures, small-group teaching, office hours, study groups and directed exercises on theoretical, practical and computational work. There will be no actual laboratory or computational classes written into the timetable. Each of the shorter components within the module will have a kernel of core lecture material with other modes of delivery (for example small group teaching, quizzes and directed reading) brought in around this central unit.
Assessment Strategy	An exam in term 3 covers all learning outcomes makes up 75% of summative assessment. In-course assessment comprises the remaining 25% of summative assessment.
Feedback	Formative feedback will be provided throughout the module following formative assessment in the form of in-class quizzes, online tests, handwritten problems sheets and verbal feedback for any practical or computational exercises. Feedback for any continuous assessment will be provided within two weeks of the submission date. General feedback on written examinations for each module is provided in the form of written reports from the examiners for the students.
Reading list	The module is self-contained and no additional books are required to be purchased by the students. Further discussion of material covered by the module, along with relevant problems can be found in: • Seers and Zemansky's University Physics with Modern Physics by Young and Freedman • Thermal Physics by Finn • Statistical Physics by F. Mandl • Entropy and its Physical Meaning by J. S. Dugdale • The Feynman Lectures on Physics Volume I

Quality assurance

Date of first approval	
Date of last revision	
Date of this approval	
Module leader	Vijay Tymms

Office use only

QA Lead	
Department staff	
Date of collection	
Date exported	
Date imported	

Notes/ comments

Template version 16/06/2017

Programme structure

Associated modules

UID	Legacy code	Module title	Requisite type

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Assessment details

		Pass mark
Grading method	Numeric	40%

Assessments

Assessment type	Assessment description	Weighting	Pass mark	Must pass?
Examination	2-hour examination	75%		N
Examination	In-course assessment	25%		N
		100%		