University of the West of Scotland

Module Descriptor

Session: 2024/25

Title of Module: Solid State Physics			
Code: PHYS10009	**SCQF Level: 10 (Scottish Credit and Qualifications Framework)**	**Credit Points: 20**	**ECTS: 10 (European Credit Transfer Scheme)**
School:	School of Computing, Engineering and Physical Sciences		
Module Co-ordinator:	Shigeng Song		

Summary of Module

This is a core module at SCQF Level 10 for all Physics programmes.

The module covers fundamental concepts of Solid State Physics.

General Syllabus details of the module are as follows.

Crystal structure, lattice, basis, primitive cell, Bravais lattice, Miller indices, reciprocal lattice, x-ray diffraction, Bragg's law, structure factor, production of x-rays, lattice vibrations, Brillouin zones in monatomic and diatomic chains, dispersion, Bose-Einstein distribution, Planck distribution, phonons, Einstein and Debye theory of heat capacities of solids, electrical and thermal conductivities, Hall effect, thermoelectricity, Drude model of metals, electronic specific heat and magnetic susceptibility of metals, quantum free-electron theory of metals, Fermi-Dirac distribution, band theory, metal insulators and semiconductors, band gaps, Fermi energy, intrinsic and extrinsic semiconductors, electron/hole densities, mobility and lifetimes, diffusion and Einstein relations, superconductors, Meissner effect, high temperature superconductivity.

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					
Face-To-Face	**Blended**	**Fully Online**	**HybridC**	**Hybrid 0**	**Work-Based Learning**
☒	☐	☐	☐	☐	☐
See Guidance Note for details.					

Campus(es) for Module Delivery						
The module will **normally** be offered on the following campuses / or by Distance/Online Learning: (Provided viable student numbers permit) (tick as appropriate)						
Paisley:	Ayr:	Dumfries:	Lanarkshire:	London:	Distance/Online Learning:	Other:
☒	☐	☐	☐	☐	☐	Add name

Term(s) for Module Delivery					
(Provided viable student numbers permit).					
Term 1	☐	Term 2	☒	Term 3	☐

Learning Outcomes: (maximum of 5 statements) **These should take cognisance of the SCQF level descriptors and be at the appropriate level for the module.** At the end of this module the student will be able to:	
L1	Describe and understand simple crystal structures, use the appropriate nomenclature and interpret x-ray diffractograms.
L2	Describe atomic vibrations in crystalline solids, account for heat capacity and solve related problems.
L3	Describe and account for the electronic transport properties of metals, semiconductors and superconductors and solve related problems.
L4	Understand some practical analysis and experimental techniques in solid state physics.

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 Level **10** Knowledge of core concepts of basic solid state physics. Critical understanding of solid state physics methods. Critical approach towards experimental work at a high level.	
Practice: Applied Knowledge and Understanding	SCQF Level **10** Use of a selection of skills, techniques and practices applicable to work in the field of solid state physics and enabling further studies (MSc, PhD). Practice of up-to-date literature search on hot topics in solid state physics.	
Generic Cognitive skills	SCQF Level **10** Presenting and evaluating arguments, information and ideas in physics. Using a range of approaches to addressing problems and issues in physics.	
Communication, ICT and Numeracy Skills	SCQF Level **10** Use of computers for advanced study. Literary skills, enabling the communication of abstract concepts in written and verbal forms.	
Autonomy, Accountability and Working with others	SCQF Level **10** Taking responsibility for individual studying and retrieval of scientific literature. Presenting results from self-study in front of peers.	
Pre-requisites:	Before undertaking this module the student should have undertaken the following:	
	Module Code: PHYS09003 PHYS09007 PHYS09008 PHYS09011	**Module Title:** Electromagnetism Thermodynamics & Statistical Physics Quantum Mechanics Atoms & Nuclei
	Other:	or equivalent
Co-requisites	**Module Code:**	**Module Title:**

*Indicates that module descriptor is not published.

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** (Normally totalling 200 hours): (Note: Learning hours include both contact hours and hours spent on other learning activities)
Lecture/Core Content Delivery	36
Tutorial/Synchronous Support Activity	6
Laboratory/Practical Demonstration/Workshop	6
Independent Study	152
	200 Hours Total

****Indicative Resources: (eg. Core text, journals, internet access)**

The following materials form essential underpinning for the module content and ultimately for the learning outcomes:

Steven H. Simon, Lecture Notes for Solid State Physics, Oxford University, 2012

Kittel, C., Introduction to Solid State Physics, John Wiley and Sons, 1996

Giuseppe Grosso & Giuseppe Pastori Parravicini, Solid Sate Physics, 2nd ed, 2014

(**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.

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.

Please ensure any specific requirements are detailed in this section. Module Co-ordinators should consider the accessibility of their module for groups with protected characteristics.
(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 and Physical Sciences
Assessment Results (Pass/Fail)	Yes ☐No ☒
School Assessment Board	Physical Sciences
Moderator	Nara Singh Bondili
External Examiner	H Boston
Accreditation Details	Institute of Physics
Changes/Version Number	**7.0** Module descriptor amended to conform to the new template format and to reflect outcomes from ILR 2023.

Assessment: (also refer to Assessment Outcomes Grids below)
Assessment 1 – Class Test (80%)
Assessment 2 – Written Coursework and Laboratory Work (20%)
(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.)

Assessment Outcome Grids (**See Guidance Note)**

Component 1						
Assessment Type (Footnote B.)	**Learning Outcome (1)**	**Learning Outcome (2)**	**Learning Outcome (3)**	**Learning Outcome (4)**	**Weighting (%) of Assessment Element**	**Timetabled Contact Hours**
Exam	✔	✔	✔		80	2

Component 2						
Assessment Type (Footnote B.)	**Learning Outcome (1)**	**Learning Outcome (2)**	**Learning Outcome (3)**	**Learning Outcome (4)**	**Weighting (%) of Assessment Element**	**Timetabled Contact Hours**
Portfolio of Written Work	✔	✔	✔		10	0
Laboratory	✔	✔	✔	✔	10	6
Combined Total for All Components					100	8