PX431-15 Structure & Dynamics of Solids

20/21

Department
Physics
Level
Undergraduate Level 4
Module leader
Thomas Hase
Credit value
15
Module duration
10 weeks
Assessment
100% exam
Study location
University of Warwick main campus, Coventry

Description

Introductory description

Characterising and, where possible, controlling the structure of materials is one the most important areas of research in science. The microscopic structure of a material determines its mechanical strength, its electrical properties and, at surfaces, the way the material interacts with the outside world (for example as a catalyst, in electrical contacts or as it corrodes). The first half of this module looks at the methods for identifying and studying structure. The second half studies how the distribution of charge and current flows affect the structural and electrical properties of insulators and semiconductors.

Module web page

Module aims

To cover a range of theoretical concepts and practical techniques used in experimental condensed matter physics. Topics covered will be in the areas of the structural and electrical properties of solids.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

1. Part I: Revision of second and third year material on structure of solids – bonding, crystal structure and symmetry; Crystal growth; Phase Transitions and Phase Diagrams; Kinematical X-ray diffraction: revision, theory and analysis; Real crystals and their defects; Surfaces, thin films and growth techniques; Strain engineering devices (Nanostrain)
2. Part II: Revision of second and third year material on semiconductors and the photoelectric effect; Semiconductors out of equilibrium; metal-semiconductor contacts; Transport and charge injection in insulators; Piezoresistive materials and force sensors; Piezoelectric and pyroelectric materials and applications; Ferroelectric materials and multiferroics; Phase transitions in ferroics; Materials for non-volatile memories

Learning outcomes

By the end of the module, students should be able to:

- Describe experimental techniques to measure physical properties of materials
- Characterise crystal structures
- Describe the physics of some semiconductor devices
- Explain piezo- pyro- and ferroelectricity
- Start postgraduate research in materials physics

Indicative reading list

M.T. Dove, Structure and Dynamics, OUP; S. R. Elliott, The physics and chemistry of solids, Wiley; D.P. Woodruff and T.A. Delchar, Modern Techniques of Surface Science, CUP; S Blundell, Magnetism in Condensed Matter, OUP.

View reading list on Talis Aspire

Subject specific skills

Knowledge of mathematics and physics. Skills in modelling, reasoning, thinking.

Transferable skills

Analytical, communication, problem-solving, self-study

Study

Study time

Type	Required
Lectures	30 sessions of 1 hour (20%)
Seminars	(0%)
Private study	120 hours (80%)
Total	150 hours

Private study description

Working through lecture notes, solving problems, wider reading, discussing with others taking the module, revising for exam, practising on past exam papers

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group B1

	Weighting	Study time	Eligible for self-certification
Assessment component			
Online Examination Answer 3 questions from 4	100%		No

- Answerbook Pink (12 page)
- Students may use a calculator

Reassessment component is the same

Feedback on assessment

Personal tutor, group feedback

Past exam papers for PX431

Availability

Courses

This module is Optional for:

- Year 4 of UPXA-F303 Undergraduate Physics (MPhys)

This module is Option list B for:

- Year 4 of UPXA-FG33 Undergraduate Mathematics and Physics (BSc MMathPhys)
- Year 4 of UPXA-FG31 Undergraduate Mathematics and Physics (MMathPhys)