MODULE SPECIFICATION PROFORMA

Module Code:	SCI624

Module Title:	Advanced Inorganic and Materials Chemistry

Level:	6	**Credit Value:**	20

Cost Centre(s):	GAFS	JACS3 **code**:	F100

School:	Applied Science, Computing & Engineering	**Module Leader:**	Dr Ian Ratcliffe

Scheduled learning and teaching hours	24 hrs
Guided independent study	176 hrs
Placement	0 hrs
Module duration (total hours)	200 hrs

Programme(s) in which to be offered (not including exit awards)	Core	Option
BSc (Hons) Chemistry	✓	☐
	☐	☐
	☐	☐

Pre-requisites
None

Office use only
Initial approval: **Mar 18 – validation of BSc Chemistry** **Version no: 1**
With effect from: **Sept 18**
Date and details of revision: **Version no:**

Module Aims

Advanced Inorganic and Materials Chemistry develops and reinforces concepts in inorganic chemistry introduced at level 4, with emphasis upon the exploitation of inorganic materials in current and emerging technologies. A key theme is the design, synthesis and characterisation of novel advanced materials, which students will learn through a number of case studies drawn from academic and industrial sources.

Intended Learning Outcomes

Key skills for employability

KS1	Written, oral and media communication skills
KS2	Leadership, team working and networking skills
KS3	Opportunity, creativity and problem solving skills
KS4	Information technology skills and digital literacy
KS5	Information management skills
KS6	Research skills
KS7	Intercultural and sustainability skills
KS8	Career management skills
KS9	Learning to learn (managing personal and professional development, self-management)
KS10	Numeracy

At the end of this module, students will be able to		Key Skills	
1	Devise plausible synthetic strategies for the production of novel advanced inorganic materials.	KS3	KS6
2	Interpret representative x-ray / neutron / electron diffraction data to reveal crystal structure.	KS3	
3	Propose appropriate computational chemistry approaches to solving inorganic material design problems.	KS10	KS4
		KS1	
4	Critically assess specific applications of advanced inorganic materials in terms of the underlying inorganic chemistry principles.	KS3	
5	Propose plausible solutions to given technological problems through demonstrable knowledge of advanced organic materials and their applications.	KS3	KS1

Transferable skills and other attributes

- *verbal reasoning skills*
- *data interpretation*

Derogations
N/A

Assessment:

Indicative Assessment Tasks:

Assessment (1): Students to complete three short case study exercises exploring synthesis techniques for inorganic materials, computational chemistry and interpretation of structure elucidation data.

Assessment (2): Students compile a report based upon investigative sessions in the laboratory.

Assessment number	Learning Outcomes to be met	Type of assessment	Weighting (%)	Duration (if exam)	Word count (or equivalent if appropriate)
1	1,2,3	Coursework	50		2000
2	4,5	Report	50		2000

Learning and Teaching Strategies:

Directed learning at the start of the module will allow students to revise and develop ideas and concepts introduced at level 4.Taught content will be delivered by lectures from course tutors and visiting lecturers. Significant use will be made of appropriate case studies which students will study independently or in small groups, with discussion and feedback facilitated during scheduled seminars and tutorial sessions. Laboratory sessions will be employed to support taught material.

Syllabus outline:

This module will focus upon the design and synthesis of advanced inorganic materials to solve current and emerging technical challenges:
Energy conversion: solar cells, photocatalysis of water
Energy storage: fuel cells, lithium ion batteries
Energy transport: superconductors
Pollution control: catalytic converters

Key ideas and concepts are developed in an ‘applied’ context and include:

- Sourcing and extraction of elements used in advanced inorganic materials. Ethical and sustainability issues in usage of rare earth minerals.

- Preparative approaches to synthesis: specific process strategies and exemplars representing the main classes of inorganic compounds, inorganic materials and functional inorganic aggregates.

- Structure elucidation of crystalline materials: e.g. through use of diffraction (X-ray / neutron/ electron)

- Exploration of the utility of computational chemistry in mapping the structure of advanced materials to their functions (e.g. magnetic, optical, electronic, structural and thermal properties) and as an enabling technology in advanced material design, allowing *in-silico* evaluation of novel materials.

Indicative Bibliography:

Essential reading

Smart, L.E. and Moore, E.A. (2012), *Solid State Chemistry: An Introduction.* 4th ed. Boca Raton, FL: CRC Press.

Weller, M.T. (1994), *Inorganic Materials Chemistry.* Oxford: Oxford University Press.

Other indicative reading

Allcock, H.R. (2008), *Introduction to Materials Chemistry.* Hoboken, NJ: John Wiley and Sons, Inc.

Lewars, E.G. (2016), Computational Chemistry: Introduction to the Theory and Applications of Molecular and Quantum Mechanics. 3rd ed. Springer.

Sangeeta, D. and LaGraff, J.R. (2005), *Inorganic Materials Chemistry Desk Reference.* 2nd Edition. Boca Raton, FL: CRC Press.

Xu, R. and Xu, Y. (eds.) (2017), *Modern Inorganic Synthetic Chemistry.* 2nd ed. Amsterdam: Elsevier.

Journals, accessible via Science Direct:
Inorganica Chimica Acta
Materials Chemistry and Physics
Materials Today
Solid State Sciences