MODULE SPECIFICATION

Module Title:	Introduction to Nanotechnology	**Level**:	4	**Credit Value**:	20

Module code:	SCI424	New ✓ Existing ☐	**Code of module being replaced**:	SCI516

Cost Centre:	GAFS	**JACS3 code**:	F100

Trimester(s) in which to be offered:	1	**With effect from:**	September 16

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

Scheduled learning and teaching hours	50 hrs
Guided independent study	150 hrs
Placement	0 hrs
Module duration (total hours)	200 hrs

Programme(s) in which to be offered	Core	Option
BSc Chemistry with Green Nanotechnology	✓	☐

Office use only
Initial approval July 16
APSC approval of modification July 16 Version 1
Have any derogations received SQC approval? Yes ☐ No ✓

Module Aims
The module initially revises elements of prior knowledge from within physics, chemistry, biology and engineering and highlights their significance as the platform for understanding technology development at the nanoscale. Through exploration of nanotechnology applications in various sectors, students gain knowledge but also experience how it is exploited. The delivery modes and assessment are designed to train students to not only use lectures, seminars and scientific literature / patents effectively, but also to enhance their metacognitive skills. The module will enable students to assess both potential benefits, and downfalls or barriers to using nanotechnology in various applications through a review of case histories and recent research in the field and consideration of the regulatory aspects

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	Interpret scientific literature and patents in the field of nanotechnology in terms of the key underpinning chemical, physical, biological and engineering principles.	KS5	KS4
2	Select with justification appropriate instrumental methods for measuring specific nanostructures and for each, describe its operating principles.	KS3	
3	Evaluate the impact of ethics, resourcing, intellectual property and legislation on present and future commercial exploitation of nanomaterials.	KS3	
4	Reflect critically in their own learning in lectures, seminars and private study.	KS9	

Derogations
None

Assessment:

Assessment 1: **Learning Journal**. A defined number of key areas within the syllabus will be assessed by the student submitting a learning journal. This will require them to self-assess their prior knowledge at the outset of the task, and to summarise knowledge gained in engagement with preparation for the lecture, the lecture proper, and both private study and class discussion following the lecture.

Assessment 2: **End of module exam** (1.5 hours) to test breadth of knowledge.

Please indicate the type(s) of assessment (eg examination, oral, coursework, project) and the weighting of each (%). Normally, each intended learning outcome should be assessed only once.

Assessment number	Learning Outcomes to be met	Type of assessment	Weighting (%)	Duration (if exam)	Word count (or equivalent if appropriate)
1	1, 4	Learning logs/journals	50%		2000
2	2, 3	Examination	50%	1.5 hours	

Learning and Teaching Strategies:

Methods of delivery:

Researchers / lecturers from within the programme team and visiting external researchers will deliver lectures highlighting specific topics within the field. Students will be encouraged to engage with appropriate peer reviewed literature through directed study, which will be reinforced by seminars. Students will be briefed thoroughly on how to complete the learning journal task successfully and will be given formative assessment for draft submissions throughout the course.

Syllabus outline:

An introduction to nanotechnology: definition and historical background;
revision of important scientific concepts key to nanotechnology (chemistry, physics biology and engineering perspectives).

Investigation at the nanoscale. light, electron and scanning probe microscopy; spectroscopy.

Applications: optics, computers and electronics, sensors and smart materials, nanomedicine.

Perspectives: risks, ethics and regulatory aspects of nanomaterials; nanotechnology futures

Bibliography:

Essential reading

WOLF, E.L. (2006) Nanophysics and Nanotechnology: An Introduction to Modern Concepts in Nanoscience. 2nd Ed. Weinheim: Wiley VCH.

MENDELSON, M.I. (2013) Learning Bio-Micro-Nanotechnology. Boca Raton, FL.: CRC Press.

Other indicative reading

DREXLER, K.E. (2013) Radical Abundance. How a Revolution in Nanotechnology Will Change Civilisation. New York: Public Affairs.

DREXLER, E. (1988) Engines of Creation: *The Coming Era of Nanotechnology.* New York: Anchor Books.

RATNER, M.A. and RATNER, D. (2003) *Nanotechnology: A Gentle Introduction to the Next Big Idea.* Upper Saddle River, NJ. : Prentice Hall.

Online resources:

Nanomedicine: Nanotechnology, Biology and Medicine - online access via Science Direct
Photonics and Nanostructures - Fundamentals and Applications- online access via Science Direct
Nanostructured Materials- online access via Science Direct