PRIFYSGOL glyndŵr UNIVERSITY

MODULE SPECIFICATION FORM

Module Title: **Introduction to Nanotechnology**	Level: 5	Credit Value: 20

Module code: SCI516	Cost Centre: GAFS	JACS3 code: F100

Trimester(s) in which to be offered: 1	With effect from: September 2014
Office use only: To be completed by AQSU:	Date approved: July 2014 Date revised: - Version no: 1

Existing/New: New	Title of module being replaced (if any):

Originating Academic Department: Chemistry	Module Leader: Dr Ian Ratcliffe

Module duration (total hours): 200 Scheduled learning & teaching hours 50 Independent study hours 150	Status: core/option/elective (identify programme where appropriate): Core

Programme(s) in which to be offered: BSc (Hons) Chemistry with Green Nanotechnology.	Pre-requisites per programme (between levels): None

Module Aims:

The module initially revises elements of 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:

At the end of this module, students will be able to ...

1. Interpret scientific literature and patents in the field of nanotechnology in terms of the key underpinning chemical, physical, biological and engineering principles. (KS5)
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.
4. Reflect critically on their own learning in lectures, seminars and private study. (KS9)

Key skills for employability

1. Written, oral and media communication skills
2. Leadership, team working and networking skills
3. Opportunity, creativity and problem solving skills
4. Information technology skills and digital literacy
5. Information management skills
6. Research skills
7. Intercultural and sustainability skills
8. Career management skills
9. Learning to learn (managing personal and professional development, self management)
10. Numeracy

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 itself, and both private study and class discussion following the lecture.

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

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%	2 hours	

Learning and Teaching Strategies:
Students will attend formal timetabled lectures throughout the trimester.

Seminar and workshop will be used to support students' learning.

Students will research case studies and carry out guided self-study.

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