PRIFYSGOL glyndŵr UNIVERSITY

MODULE SPECIFICATION FORM

Module Title: **Formulation Science**	Level: 7	Credit Value: 20

Module code: SCI713	Cost Centre: GAWS	JACS3.0 code: F111

Trimester(s) in which to be offered: 1&2	With effect from: September 2013

Office use only: To be completed by AQSU:	Date approved: September 2013 Date revised: - Version no: 1

Existing/New: New	Title of module being replaced (if any): Formulation Science (validated for MRes May 2012)

Originating Academic Department: Chemistry	Module Leader: Dr Ian Ratcliffe

Module duration (total hours):	200 hrs	Status: core/option/elective (identify programme where appropriate): Core
Scheduled learning & teaching hours	36 hrs lectures/practical 6 hrs tutorials	
Independent study hours	158 hrs	

Programme(s) in which to be offered: MSc Formulation Science MSc Polymer and Biopolymer Science	Pre-requisites per programme (between levels): None

Module Aims:

Formulation Science is concerned with the knowledge and practice of developing formulated products which may be in the form of a solution, gel, film, dispersion, emulsion or a foam and hence is of relevance to a broad range of industrial sectors e.g. food, pharmaceuticals,

cosmetics, personal care, cleaning agents, surface coatings etc.

The module aims to:

- inform students of the physical processes influencing formulation at the molecular level.
- reinforce and broaden knowledge by consideration of a wide range of case studies encompassing the major types of formulation, drawing on examples from the aforementioned product types and industries.
- introduce students to the appropriate analytical and instrumental techniques necessary to test and perfect formulations.
- Explore the importance of external factors for example economics and legislation on formulation.
- Build students' proficiency and self– confidence in undertaking and reporting experimental investigations.

Expected Learning Outcomes:

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

Knowledge and Understanding:

1 Demonstrate a comprehensive and systematic understanding of the origin, consequences, measurement and control of chemical and physical interactions between different molecular species in commercially significant formulations.

2 Design and execute appropriate testing procedures for the evaluation of a formulation.

3 Critically interpret and compare original experimental data to that in the scientific literature in respect of the key physical and chemical processes occurring.

4 Independently carry out and if necessary adapt practical investigations pertinent to formulation development and testing.

Transferable/Key Skills:

Critically evaluate data published in the scientific literature. Report the results of practical investigations in a laboratory notebook and more formally as a written report.

Assessment: please indicate the type(s) of assessment (eg examination, oral, coursework, project) and the weighting of each (%). ***Details of indicative assessment tasks must be included.***

Assessment is intended to allow the learner to demonstrate skills that cover the entire breadth of the programme aims – knowledge and understanding, key practical skills, intellectual skills in interpreting data and report writing.
The learning outcomes will be assessed by:

Assessment (1) a formal written unseen examination testing the student's knowledge and understanding of the course material and
Assessment (2) a portfolio comprising laboratory reports for each of 10* laboratory investigations undertaken throughout the course, and laboratory notebook

*may be reduced to 6 for appropriately experienced PT students.

Assessment number	Learning Outcomes to be met	Type of assessment	Weighting	Duration (if exam)	Word count (or equivalent if appropriate)
1	1	Examination	50%	2.5 hours	N/A
2	2,3	Portfolio	50%	N/A	N/A

Learning and Teaching Strategies:

The basic factual material will be delivered by means of lectures and laboratory demonstrations supported by group discussions and tutorials in which the students will be able to test their knowledge and understanding of the concepts involved. The remainder of the allotted hours are devoted to tasks through directed learning. A significant element of this is completion of 10 4-hour practical investigations. Each of these are presented to the student in the form of a folder comprising appropriate research articles, risk assessment guidance, a standard operating procedure for the instrument(s) involved and an outline of the investigation to be made. Whilst these are designed to foster independent learning, programme team members will be available to provide support where necessary. These tasks facilitate development of the student's ability to critically assess their own experimental data against that reported in the scientific literature.

Syllabus outline:

- Review the commonly encountered physical classes of formulated products. Case studies selected from a range of industries
- Review the individual components of formulated products and their chemical / physical properties. Interaction of these components with each other and aqueous /non-aqueous solvents.
- Component interactions and product stability. Strategies for testing and enhancing product stability, preservation, sterilization.
- Rheology: Implications for processing, formulation, storage and application of products.

- Particulate dispersions [rheology, particle wetting, polymeric dispersants, surfactants]
- Emulsions and microemulsions.
- Environmental / health and safety legislation/ economic factors.
- Innovative formulation and Intellectual Property
- Manufacturing – scale up issues, process and quality control, packaging.

Bibliography:

Essential reading:

AULTON, M.E. (Author); TAYLOR, K.M.G. (Ed.) (2007) '*Aulton's Pharmaceutics: The Design and Manufacture of Medicines' (3rd ed..* Oxford*:* Churchill Livingstone – Elsevier.

COULTATE, T.P. (2008) '*Food - The Chemistry of its Components'* 5th Edition. Cambridge: The Royal Society of Chemistry.

HARGREAVES, A.E. (2003) *Chemical Formulation: An Overview of Surfactant Based Chemical Preparations Used in Everyday Life*. Cambridge: The Royal Society of Chemistry.

TADROS, T.F. (2009) *Emulsion Science and Technology*. Weinheim: Wiley-VCH Verlag GmbH & Co.

Other indicative reading:

BARNES, H.A. (2000) '*Handbook of Elementary Rheology'* Aberystwyth: University of Wales, Institute of Non-Newtonian Fluid Mechanics.

COSGROVE, T. (ed.) (2010) *Colloid Science: Principles, Methods and Applications*. (2nd ed.) Chichester: John Wiley & Sons Ltd.

FENNELL EVANS, D. and WENNERSTROM, H. (1999) *The Colloidal Domain* (2nd Ed.) New York: John Wiley & Sons Inc.

FOX, B.A. and CAMERON, A.G. (1982) *Food Science: A Chemical Approach* (4th ed.) London: Taylor & Francis - Hodder and Stoughton.

LARSON, R.G. (1999) *The Structure and Rheology of Complex Fluids.* New York: Oxford University Press Inc.

SHERMAN, P. (Ed) (1968) *Emulsion Science.* London / New York: Academic Press.

Online resources:

Journal of Food Engineering Elsevier - online access via Science Direct
Food Research International – Elsevier - online access via Science Direct
Pharmaceutical Research - Springer
International Journal of Pharmaceutics – Elsevier - online access via Science Direct
International Journal of Cosmetic Science - Wiley
European Journal of Pharmaceutics and Biopharmaceutics - Elsevier – online access via Science Direct
Journal of Coatings Technology and Research - Springer

http://chemistscorner.com/

Formulatory - A Forum for Formulation Professionals:
http://www.linkedin.com/groups/Formulatory-Forum-Formulation-Professionals-2411840

http://www.intelligentformulation.org/