PRIFYSGOL glyndŵr UNIVERSITY

MODULE SPECIFICATION FORM

Module Title: **Structure and Function of Industrial Biopolymers**	Level: 7	Credit Value: 20

Module code: SCI714	Cost Centre: GAWS	JACS3.0 code: F162

Trimester(s) in which to be offered: 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):

Originating Academic Department: Chemistry	Module Leader: Prof. Peter Williams

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:

Hydrocolloids is a term often used to describe polysaccharides and proteins that are widely

used in the food industry because of their ability to thicken and gel aqueous solutions and stabilise dispersions and emulsions. There is an increasing awareness of the need to utilise these hydrocolloid materials in a broad range of other industrial sectors including pharmaceuticals, cosmetics, water treatment, agrochemical, adhesives, surface coatings, paper making, personal care, etc. in order to reduce the reliance on polymers derived from oil based chemicals.

The aims of this module are:

- to provide the student with a systematic knowledge and understanding of the latest developments relating to hydrocolloids- including their structure, physicochemical properties in solution, rheological and interfacial behaviour, interactions, phase behaviour and applications.
- Enable students to analyse and critically interpret complex data
- Develop students' originality in problem solving.
- 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. Exhibit a comprehensive knowledge of the various types of commercially important hydrocolloids
2. Demonstrate current knowledge and a comprehensive understanding of the source, structure and physicochemical characteristics of hydrocolloids.
3. Demonstrate a systematic understanding and critical awareness of the solution and interfacial behaviour of hydrocolloids at the forefront of current knowledge.
4. Independently carry out and if necessary adapt practical investigations pertinent to the field of industrial biopolymers.

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 <u>indicative</u> 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	All	Examination	50%	2.5 hours	N/A
2	All	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.

*or 6 4-hour practical investigations for PT students.

Syllabus outline:

Commercially important hydrocolloids: an overview of the source, extraction, processing and variability of hydrocolloids of global significance. Factors affecting supply and price stability.

Structural characteristics of biopolymers: An overview of the generic structural features of biopolymers, in particular polysaccharide and protein.

Structure of individual hydrocolloids: the key structural features defining a range of hydrocolloids are introduced and their significance considered. Exemplars to be studied including gelatine, milk proteins, starch, pectin, galactomannans, glucomannans, agar, carrageenan, gum Arabic, gum tragacanth, xanthan gum, gellan gum, chitosan.

Rheological properties of hydrocolloids: Structural features defining rheology modifiers and gelling agents. Specific examples to be studied illustrating a range of viscosification and gelation mechanisms and the performance properties associated with each.

Interfacial properties of hydrocolloids: Influence of structural features of biopolymers on their behaviour at interfaces and how this can be exploited in specific applications, e.g. emulsion stabilization.

Phase behaviour of mixed hydrocolloid systems: Overview of associative and segregative phase separation. Beneficial and detrimental effects.

Derivatisation of hydrocolloids: Motivation for derivatisation. Historical overview of chemical modification of hydrocolloids. Current technologies – green and enzymatic routes. Future perspectives. Legislative issues.

Hydrocolloid applications: An overview considering past, present and projected markets for hydrocolloids and how new applications relate to latest developments in modification and processing technology.

Bibliography:

Essential reading:

PHILLIPS, G.O. and WILLIAMS, P.A. (eds.) (2011). *Handbook of Food Proteins.* Cambridge: Woodhead Publishing Ltd.

WILLIAMS, P.A. (ed.) (2011) *Renewable resources for functional polymers and biomaterials.* Cambridge: The Royal Society of Chemistry.

PHILLIPS, G.O. and WILLIAMS, P.A. (eds.) (2009) *Handbook of Hydrocolloids* Cambridge: Woodhead Publishing Ltd.

STEPHEN, A.M., PHILLIPS, G.O. and WILLIAMS, P.A. (eds.) (2006).'Food Polysaccharides and their applications' (2nd ed.) Boca Raton: CRC Press - Taylor and Francis Group.

Other indicative reading:

Journals:

Biomacromolecules
Food Hydrocolloids
Carbohydrate Polymers