UNIVERSITY of BRADFORD

Module Descriptor

Module Details	
Module Title:	Physical Chemistry 2
Module Code:	CFS5018-B
Academic Year:	2019-20
Credit Rating:	20
School:	School of Chemistry and Biosciences
Subject Area:	Chemistry
FHEQ Level:	FHEQ Level 5
Pre-requisites:	
Co-requisites:	

Contact Hours

Type	Hours
Lectures	44
Tutorials	6
Directed Study	150

Availability

Occurrence	Location / Period
BDA	University of Bradford / Academic Year (Sept - May)

Module Aims

This module will build on the material covered by the Physical Chemistry 1 module. By the end of this module, students should have a deeper understanding of thermodynamics, including statistical thermodynamics. This module will also introduce students to electrochemistry, quantum mechanics, colloids and physical chemistry at surfaces and interfaces.

Outline Syllabus

Fundamental Mathematical Concepts: calculus, vectors, matrices, series and determinants

Thermodynamics: Phase behaviour of single component systems, phase diagrams, phase transitions, behaviour at phase boundaries. Inter & Intramolecular Interactions, attractive, repulsive and total. Phase behaviour of two component systems, phase diagrams, dissolution of solids in liquids, vapour-liquid equilibria, solutions, colligative properties, distillation of liquid mixtures.

Electrochemistry: Introduction of electrochemistry terms and concepts; ionic strength and activity; conductivity, molar conductivity and limiting molar conductivity; electrochemical cells and half cells; standard reduction potentials and their use to determine spontaneity and standard cell potentials; thermodynamics and equilibria; electrolysis; Nernst equation.

Quantum Mechanics: Quantum theory, spectra containing discrete energies, photoelectric effect, electron diffraction, wave-particle duality, the Schrödinger equation, the Born interpretation, the uncertainty principle, quantum theory applied to (i) translation (ii) rotation (iii) vibration.

Statistical Thermodynamics: Boltzmann distribution (its general form and origin); partition function and interpretation; molecular partition function; examples of the uses of the partition function (internal energy, heat capacity).

Surfaces/Interfaces and Colloids: surfactants; micelles; colloidal stability; surface energy; solid-state kinetics (adsorption, desorption and surface active models); scattering techniques; excluded volume repulsion; electrostatic, van der Waals, entropic and steric/depletion forces.

Learning Outcomes	
1	Interpret the behaviour of both mono- and multicomponent systems & rationalise the inter- and intramolecular forces that give rise to their phase behaviour.
2	Explain how ions interact with one another in solution and that the freedom of movement of the ions impacts on the degree of charge flow and its relation to current.
3	Rationalise why ions may be tabulated according to their standard reduction potential values and the utility of such a table in determining standard cell potentials.
4	Discuss the development of, and ideas contained within, quantum theory and demonstrate the utility in comparing physical and observable quantum effects with the fundamental assumptions of this theory.
5	Understand the significance of the Boltzmann distribution, and its role in determining partition functions.
6	Rationalise the application of statistical mechanics to quantifying a number of thermodynamic properties.
7	Apply mathematical models to explain scientific observations in quantum mechanics and statistical thermodynamics.
8	Manipulate mathematical equations and understand the significance of mathematical formulae and units.
9	Use bibliographic databases to investigate an example from a defined topic area and produce an essay supported by research literature selected on the basis of accuracy and relevance.

Learning, Teaching and Assessment Strategy

Lectures will deliver core content; providing students with the opportunity to acquire the information to enhance their knowledge and understanding of undergraduate-level physical chemistry. Lectures will be complemented by seminars and quizzes to allow students to apply this learning to specific exemplar problems.

A coursework assignment will require the students to construct an essay on topics in phase behaviour, electrochemistry, nanotechnology and computational chemistry. Students will explore the selected example using the research literature. The essay will be assessed on the ability to extract information from the research literature and understanding of the topic.

Directed study will provide students with the opportunity to undertake guided reading and to develop their own portfolio of learning to enhance transferable skills & knowledge relating to evaluation of own role and subject provision. The VLE will be used to provide access to online resources, lecture notes & external links to websites of interest.

Assessment 1: Summative coursework (1500 word essay): LOs 1- 9

Assessment 2: Summative classroom test Jan to cover material taught in semester 1: LOs 1-3,8

Assessment 3: Summative examination in May to cover the whole module: LOs 1-8

Assessment 4: Summative online quiz during delivery of QM/ST content: LOs 4-8

Mode of Assessment

Type	Method	Description	Length	Weighting
Summative	Examination - closed book	Summative assessment: closed book exam	2 hours	50%
Summative	Coursework	Essay writing (1500 words)	-1500 words	20%
Summative	Classroom test	VLE Quiz		10%
Summative	Classroom test	Classroom test	1.5 hours	20%

Reading List

To access the reading list for this module, please visit https://bradford.rl.talis.com/index.html.

Please note:

This module descriptor has been published in advance of the academic year to which it applies. Every effort has been made to ensure that the information is accurate at the time of publication, but minor changes may occur given the interval between publishing and commencement of teaching. Upon commencement of the module, students will receive a handbook with further detail about the module and any changes will be discussed and/or communicated at this point.