UNIVERSITY of BRADFORD

Module Descriptor

Module Details	
Module Title	Introduction to Polymer Science
Module Code	CFS6031-B
Academic Year	2021/2
Credits	20
School	School of Chemistry and Biosciences
FHEQ Level	FHEQ Level 6

Contact Hours	
Type	Hours
Interactive Learning Objects	17
Practical Classes or Workshops	1
Tutorials	8
Directed Study	157
Lectures	17

Availability	
Occurrence	Location / Period
BDA	University of Bradford / Semester 2

Module Aims

This module will introduce you to the chemistry and physics of polymers. No previous knowledge of polymer science is assumed but a good background in organic and physical chemistry or chemical engineering is essential. The purpose of the module is to provide students with the structures and principles required to both synthesise and understand the properties of polymers. The module will prepare you for either advanced studies in the area or will give you the essential concepts required to work in this important industrial area.

Outline Syllabus
1. Structure, architecture, nomenclature and classification of polymers. 2. Mechanisms of polymerisation: chain growth and step growth. 3. Kinetics of polymerisation: chain growth and step growth. 4. Contributions of Inorganic Chemistry to ionic polymerisation, atom transfer radical polymerisation, ringopening polymerisation, silicon polymers, polyurethane synthesis, redox, coordination catalysis 5. Structure and polymerisability. 6. Industrial synthesis of polymers: bulk, solution, emulsion and other dispersion methods. 7. Molar mass and its distribution. 8. The solid state. 9. The Solution state. 10. Viscometry and Size exclusion chromatography.

Learning Outcomes	
Outcome Number	Description
01	Explain the descriptions of molar mass distributions and rationalise how these distributions can be predicted from the various techniques;
02	Categorise the various methods of producing polymers using chain growth and step growth techniques;
03	Examine how polymerisation kinetics effects polymer products;
04	Rationalise the behaviour of polymers in solution;
05	Understand the semi-crystalline & amorphous states of solid polymers, including the melt and glass transition temperatures;
06	Converse using the language of the polymer sciences and be able to communicate with chemists, physicists and engineers using the appropriate concepts.

Learning, Teaching and Assessment Strategy

The module uses a blended approach to support learning and achievement. Students will engage with a series of weekly online learning packages. These will include short videos that address key concepts, a set of structured activities (reading, online discussions etc.) that 'scaffold' the learning, and a range of formative tasks that generate feedback on progress. On-campus lectures, workshops and tutorials will also be used to support learning and monitor progress as students move through the curriculum.

We will study the major classes of both synthetic polymers and learn how to specifically describe their structure. We will then turn our attention to the synthesis of synthetic polymers and we will illustrate both chemically and mathematically how the various techniques lead to different types of polymer. Contributions of Inorganic Chemistry to ionic polymerisation, atom transfer radical polymerisation, ring-opening polymerisation, silicon polymers, polyurethane synthesis, redox, coordination catalysis will be explored too. Our studies will extend into examining the structural factors that dictate if monomers can be polymerised and the concepts of copolymerisation. Industrial methods of carrying out polymerisations will then be described. Molar mass and the distributions of molar mass will be studied and we will show how various synthetic methods produce different molar mass distributions.

In the second half of this module we study the physical chemistry of polymers and concepts discussed here are equally important in other areas of macromolecular science; eg proteins and nucleic acid behaviour. We will discuss the solid state including important concepts for both crystalline and amorphous polymers. We will then study the solution state; both developing theory and showing how these concepts lead to useful characterisation methods.

Directed study provides you with the opportunity to undertake guided reading and to develop your own portfolio of learning to enhance transferable skills and subject knowledge.

The VLE will be used to provide access to online resources, lecture notes and external links to websites of interest.

Assessment 1: Virtual quizzes covering examples of key calculations

Assessment 2: Independent learning assessed by a virtual presentation

Assessment 3: Summative examination to cover the whole module

Mode of Assessment

Type	Method	Description	Weighting
Summative	Examination - Open Book	Open book exam (2 Hrs)	60%
Summative	Presentation	Online Submission of Presentation following Independent Study (15 Mins)	20%
Summative	Examination - MCQ	Virtual Quizzes	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.

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