Subject Description Form

Subject Code	ABCT4740
Subject Title	POLYMER CHEMISTRY AND NANOTECHNOLOGY
Credit Value	3
Level	4
Pre-requisite	Organic Chemistry I
Objectives	The course aims to teach fundamental principles of polymerization reactions, polymer properties and characterization methods. Current technologies for the production of a variety of industrially important polymers and their applications in our daily life will be discussed. Furthermore, the underlying principles and applications of the emerging field of nanotechnology will be introduced, and nanotechnology applications in engineering and materials, physics, chemistry, biology, energy, medicine etc. are presented.
Intended Learning Outcomes	Upon completion of this subject, students will be able to: a. understand the mechanisms of major polymerization approaches; b. know the production methods of different types of polymers; c. predict the basic polymer structure and property relationship d. utilize common characterization and testing techniques for evaluation of chemical and physical properties of the polymer; e. correlate structure, properties and applications of some representative commercial polymers; f. explain the nanoscale paradigm in terms of properties at the nanoscale dimension. g. Demonstrate a working knowledge of nanotechnology principles and industry applications.
Subject Synopsis/ Indicative Syllabus	Definition of general terms and classification of polymers Chain growth polymerization: free radical polymerization including initiation, propagation, termination and chain transfer; types of initiator; Stereochemistry of polymer; ceiling temperature; comparison of bulk, solution, suspension and emulsion polymerization systems; Anionic polymerization; cationic polymerization; coordination polymerization Step growth polymerization: Various condensation polymerization methods and their formation mechanism for different types of commercially important polymers . Factors which affect polymer properties: types of average relative molar mass and methods of determining these averages; crystalline and amorphous regions; phase transitions in polymers; intermolecular forces. .

<table>
<tr><td></td><td>Analysis and testing of polymers: thermal analysis; mechanical and thermal properties

Fabrication techniques: injection moulding; compression moulding; extrusion; blow moulding; RIM; additives, degradation of polymers

Introduction to nanotechnology: History, definition, chemical and physical properties of nanomaterials; approaches to prepare nanomaterials; applications of nanomaterials in selected applications</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>Basic principles will be introduced and discussed in lectures, and further consolidated through class exercise and tutorials. Fundamental knowledge gained will be applied through independent learning of a variety of commercial products. Student’s competence in Polymer Chemistry and Nanotechnology will be developed through class presentation of new commercial products and receiving feedback from fellow students.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="7">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td>f</td><td>g</td></tr>
<tr><td>1. Examination</td><td>60</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>2. Continuous assessment</td><td>40</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Total</td><td>100 %</td><td colspan="7"></td></tr>
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Student performance will be assessed on the basis of three components:
1) two tests
2) Final examination

Student’s knowledge on polymerization mechanisms, characterization methods, polymer production, processing technologies, structure-property relationship and property of nanomaterials will be assessed through two tests and a final examination.</td></tr>
<tr><td rowspan="2">Student Study Effort Expected</td><td>Class contact:</td><td></td></tr>
<tr><td>▪ Lecture</td><td>33 Hrs.</td></tr>
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	▪ Tutorial	6 Hrs.
	Other student study effort:	
	▪ Self-study	50 Hrs.
	▪ Homework / assignment	8 Hrs.
	Total student study effort	100 Hrs.
Reading List and References	Essential Allcock H R Lampe F W, Contemporary Polymer Chemistry, Prentice-Hall 2003 Supplementary Malcolm P. Stevens, Polymer Chemistry, An introduction 3rd, Oxford University Press 1999 Seymour R B & Carralier C E, Structure-Properties Relationships in Polymers, Plenum Press 1984 Introduction to nanoscience by S.M. Lindsay. Oxford : Oxford University Press, 2010. Useful website : http://plc.cwru.edu http://www.psrc.usm.edu/macrog/index.htm	