Department of Chemistry Online Course Syllabus

Chem 325S: Introduction to Polymer and Materials Chemistry, Fall 2022

I. CONTACTS

INSTRUCTORS

Eugenia Kumacheva

Email: eugenia.kumacheva@utoronto.ca, Office: Room 627

Online student hours: Thursdays 3-4 pm.

Eugenia Kumacheva is a University Professor, Distinguished Professor of Chemistry and Canada Research Chair in Advanced Polymer Materials. Her research interests are in the field of Soft Matter, i.e., polymers, colloids, liquid crystals and biological soft matter. She held scholarship positions in Harvard, Oxford, and Cambridge University, The Universities of Strasburg and Bayreuth, Moscow State University and the University of Information Technologies, Mechanics and Optics (Russia). She in an author of a book "Microfluidic Reactors for Polymer Particles".

Geoffrey Ozin

Email: g.ozin@utoronto.ca, Office: Room 326

Online student hours: Thursdays, 3-4 pm.

Geoffrey A. Ozin is a Distinguished University Professor and Government of Canada Research Chair in Materials Chemistry and Nanochemistry. He currently spearheads the Solar Fuels Team www.solarfuels.utoronto.ca at the University of Toronto St. George Campus. He has held positions as Honorary Professor at The Royal Institution of Great Britain and University College London, External Adviser for the London Centre for Nanotechnology, Alexander von Humboldt Senior Scientist at the Max Planck Institute for Surface and Colloid Science and the Center for Functional Nanostructures at the Karlsruhe Institute of Technology, and Global Chair at Bath University. He is the author of five books: Cryochemistry (Wiley 1986); Nanochemistry: A Chemical Approach to Nanomaterials (RSC 2006); Concepts of Nanochemistry (Wiley-VCH 2009), The Story of CO2: Big Ideas for a Small Molecule (University Toronto Press 2021), Energy Materials Discovery for a Sustainable Future (RSC 2022).

TEACHING ASSISTANTS

Yutong (Maggie) Wang, email: maggiewyt.wang@mail.utoronto.ca

Haley Dobbie, email: haley.dobbie@mail.utoronto.ca

II COURSE OVERVIEW

COURSE DESCRIPTION

A course on polymer and materials chemistry designed as a follow-up to CHM 247 (Introductory Organic Chemistry II) and CHM 238 (Introduction to Inorganic Chemistry).

Polymer Section

Polymers are widely employed both as commodity materials and for specialty applications. Commodity materials include plastics such as polyethylene, polypropylene, and polystyrene, elastomers such as polyisoprene, and coatings constituents' such as acrylic polymer nanoparticles. Polymers designed for specialty applications are sometimes referred to as "advanced polymer materials" and find application in diverse areas such as photoresists for microelectronic device fabrication, compatibilizers for polymer blends, and colloidal species such as block copolymer micelles and microgels for drug delivery and other biomedical applications. In this series of six two-hour lectures, students will be introduced to concepts in polymer synthesis, structure, and architecture, polymer solutions and melts, and polymer in the solid state.

Inorganic Materials Section

Traditional metals and semiconductors are normally associated with solid state materials like Na, Ag, Pt and Si, GaAs, CdSe. Their structure–property relations are described within the framework of Block-Wilson electronic band theory and Schottky-Frenkel defect theory. This section of the course is about non-traditional metals and semiconductors. The building units are not atoms of the periodic table organized in an extended periodic 1D, 2D or 3D network structure. Instead, they are comprised of regular arrangements of organic and inorganic molecule, coordination and organometallic compounds, cluster, and polymer building blocks, which can function as novel kinds of metals and semiconductors and even superconductors, with myriad applications in advanced materials and biomedical science.

STUDENT LEARNING OUTCOMES

Polymer Section

The goal of this section is to introduce students into the world of polymer materials. The topics included in this section include the main classes of polymerization reactions and processes, polymer solubility concepts and thermomechanical properties of polymers. Several applications

of polymer applications in drug delivery, optical data storage, shape memory and self-healing will be demonstrated.

Inorganic Materials Section

The goal of this course is to provide a cohesive introduction into the world of non-traditional metals and semiconductors. The topics covered will include the synthesis of various representative members of this class of non-traditional materials, relations between their structure and bonding, properties and function will be examined, and their utility in application areas like solar cells and batteries, light emitting diodes and transistors, smart fabrics, sensors, and digital displays will be explored.

PREREQUISITE COURSES

This course assumes you have a basic understanding of organic and inorganic chemistry, including topics covered by the prerequisites for the course (CHM 238Y and CHM 247).

REQUIRED TEXTS

Polymer Section. Painter, P.C.; Coleman, M. M. Fundamentals of Polymer Science (1998 and 2008) and Lecture Notes.

Inorganic Materials Section. L. Smart and E. Moore, Solid State Chemistry, An Introduction, Chapman and Hall, London, Fifth Edition and Lecture Notes.

III HOW THE COURSE IS ORGANIZED

This course involves 2-hour weekly classes, scheduled Thursday 5-7 pm throughout the spring semester. Lectures will be given online, however contingent on health and safety guidelines tutorials will be given in person. Term tests and the final exam will be given in class. Over the course of each week throughout the term, you are expected to attend the classes, read the PowerPoint class notes and relevant parts of the required texts, supplement this reading with useful material in the recommended texts, participate in office hour sessions and submit assignments according to the due dates.

COURSE SCHEDULE & RELEVANT SESSIONAL DATES:

DATES	LECTURES
January 11th	Meet n' Greet
January 13th	Lecture 1-2_EK
January 20th	Lecture 3-4_EK
January 27th	Lecture 5-6_EK
February 3rd	Lecture 7-8_EK
February 10th	Lecture 7-8_EK
February 17th	**Term test 1**
February 22-25th	Reading week, no classes
March 3rd	Lecture 13-14_GAO
March 10th	Lecture 15-16_GAO
March 17th	Lecture 17-18_GAO
March 24th	Lecture 19-20_GAO
March 31st	Lecture 21-22_GAO
April 7th	**Term test 2**
April 11-29th	Final Assessment Period

Eugenia Kumacheva's lectures will be conducted over Zoom or via Videos. Lecture notes in PDF format will appear on Quercus.

Geoff Ozin's lectures will be conducted LIVE over Zoom, and the recordings will be posted onto Quercus.

Join Zoom Meeting

https://utoronto.zoom.us/j/81828797515

Passcode: materials

OFFICE HOURS

Eugenia Kumacheva and Geoff Ozin: Thursdays 3-4 pm, on Zoom

Join Zoom Meeting

https://utoronto.zoom.us/j/81828797515

Passcode: materials

TUTORIALS

Wednesday 12 - 1 PM, on Zoom.

Join Zoom Meeting https://utoronto.zoom.us/s/81343382667

Passcode: materials

NOTE: After January 31, 2022, depending on health and safety guidelines, tutorials will be given in person in room BL 325, however please follow the announcements.

IV EVALUATION/GRADING SCHEME

Assignment 1	
In class 1 hour test 1	25%
Assignment 2	
In class 1 hour test 2	25%
Final Exam (2 hours)	
April 11-29th Final Assessment Period	50%

Note: if an unexpected health and safety situation arises or a technical issue occurs with a university system (e.g., Quercus services, network outage) that affects availability or functionality, it may be necessary to revise the in-person testing, timing or weighting of the assessments.

V COURSE POLICIES

- Students are highly encouraged to attend a pre-class "**Meet n' Greet**" scheduled for **January 11th, 5-7 PM**. We will go over course etiquette and expectations.

  Join Zoom Meeting

  https://utoronto.zoom.us/j/84091767871

  Getting in touch: please contact the course instructor and teaching assistant with any questions about the course by email, Eugenia Kumacheva: eugenia.kumacheva@utoronto.ca; Geoffrey Ozin: g.ozin@utoronto.ca; TA's: Yutong (Maggie) Wang (polymer part) maggiewyt.wang@mail.utoronto.ca, Haley Dobbie, email: haley.dobbie@mail.utoronto.ca.

- The University of Toronto is committed to equity, human rights, and respect for diversity. All members of the learning environment in this course should strive to create an atmosphere of mutual respect where all members of our community can express themselves, engage with each other, and respect one another's differences. **We have the highest expectations from you all to act in a respectful manner towards your peers and colleagues.**

- This course, including your participation, will be recorded on video and will be available to students in the course for viewing remotely and after each session. Course videos and materials belong to your instructor, the University, and/or other sources depending on the specific facts of each situation and are protected by copyright. **Do not download, copy, or share any course or student materials or videos without the explicit permission of the instructor.** For questions about recording and use of videos in which you appear please contact your instructor.

- Submission for all assignments will take place on Quercus, with a penalty of 10% deducted for each day late.

- Students are responsible for informing the instructor and TA about any expected absences. In case of emergency, it is vital to notify us as soon as possible so accommodations can be made.

VI TECHNOLOGY REQUIREMENTS

Specific guidance from the U of T Vice-Provost, Students regarding student technology requirements is available here: https://www.viceprovoststudents.utoronto.ca/covid-19/tech-requirements-online-learning/

This course requires the use of computers, and of course sometimes things can go wrong when using them. You are responsible for ensuring that you maintain regular backup copies of your files, use antivirus software (if using your own computer), and schedule enough time when completing an assignment to allow for delays due to technical difficulties. Computer viruses, damaged hard drives, lost or corrupted files, incompatible file formats, and similar mishaps are common issues when using technology, and are not acceptable grounds for a deadline extension.

VII INSTITUTIONAL POLICIES AND SUPPORT

ACADEMIC INTEGRITY

On Academic Integrity:

Academic integrity is essential to the pursuit of learning and scholarship in a university, and to ensuring that a degree from the University of Toronto is a strong signal of each student's individual academic achievement. As a result, the University treats cases of cheating and plagiarism very seriously. The University of Toronto's Code of Behaviour on Academic Matters (https://governingcouncil.utoronto.ca/secretariat/policies/code-behaviour-academic-matters-july-1-2019) outlines the behaviours that constitute academic dishonesty and the processes for addressing academic offences. Potential offences include, but are not limited to:

In papers and assignments:

1. Using someone else's ideas or words without appropriate acknowledgement.
2. Submitting your own work in more than one course without the permission of the instructor.
3. Making up sources or facts.
4. Obtaining or providing unauthorized assistance on any assignment.

On tests and exams:

1. Using or possessing unauthorized aids.
2. Looking at someone else's answers during an exam or test.

3. Misrepresenting your identity.

In academic work:

1. Falsifying institutional documents or grades.
2. Falsifying or altering any documentation required by the University.

All suspected cases of academic dishonesty will be investigated following procedures outlined in the Code of Behaviour on Academic Matters. If you have questions or concerns about what constitutes appropriate academic behaviour or appropriate research and citation methods, you are expected to seek out additional information on academic integrity from your instructor or from other institutional resources (see https://www.academicintegrity.utoronto.ca/).

Use of Turnitin

Students will be required to submit their work to Quercus, which makes use of Turnitin.com for a review of textual similarity and detection of possible plagiarism. In doing so, students will allow their essays to be included as source documents in the Turnitin.com reference database, where they will be used solely for the purpose of detecting plagiarism. The terms that apply to the University's use of the Turnitin.com service are described on the Turnitin.com web site.

ACCESSIBILITY NEEDS

Students with diverse learning styles and needs are welcome in this course. The University of Toronto is committed to accessibility: if you require accommodations for a disability, or have any other accessibility concerns about the course, please contact Accessibility Services as soon as possible.

ADDITIONAL SERVICES and SUPPORT

The following are some important links to help you with academic and/or technical service and support

- General student services and resources at Student Life
- Full library service through University of Toronto Libraries
- Resources on conducting online research through University Libraries Research
- Resources on academic support from the Academic Success Centre
- Learner support at the Writing Centre
- Information for Technical Support/Quercus Support