Instructor: Dr. Zhe She
Instructor Contact Information: CHE307, Chernoff Hall, Phone: +1-613-533-2790, Email: zhe.she@queensu.ca
Office Hours: Wed 13:30-14:30, or by appointment.

Lectures: Mon 09:30, Wed 08:30 and Thur 10:30 in Walter Light Hall (WALGHT), room 210.

Intended Student Learning Outcomes:
- Understand several different separation techniques commonly used in (bio-)analytical chemistry.
- Compare and discuss detection methods and their strength and limitations.
- Investigate how different instrumental analysis is applied in real-to-life applications during the literature report exercise.

Course Outline
1.) Introduction to Chromatography Liquid-Liquid Extraction, Partition Coefficient TLC, Resolution, Van Deemter Equation, Sources of Band Broadening, Selectivity Factor, Capacity Factor, Theoretical plates, Qualitative and Quantitative Analysis.


3.) HPLC: Instrument Components: injectors, high pressure pumps, solvent gradients, guard columns, analytical columns, common stationary phases (reversed and normal phase, bonded, coated, pellicular), elutropic series, detectors, UV-Vis, Fluorescence, Refractive Index, APCI, Electrospray, Selected Ion Monitoring, Light Scattering, developing and optimizing an HPLC separation.

4.) Ion Chromatography, GPC, Capillary Electrophoresis: Types of exchange resins(anion, cation, cross-linking, functional groups), principals of separation, pH gradients, conductivity detector, suppressor columns. GPC molecular weight determination, size exclusion resins, total inclusion vs. total exclusion. Electrophoresis, Gel, capillary electrophoresis, Electrophoretic Mobility, Electroosmotic Flow, Electrokinetic, injection methods, Detection, MEKC, CEC.

5.) Detection methods: Mass Spectrometry, Ionization Methods, Electrospray Ionization(ESI); Electrochemical Analysis: Coulometric Analysis, Voltametry, Diffusion Current, Polarography, Anodic Stripping, electrochemical biosensors.

Textbooks/Readings
Preferred: Quantitative Chemical Analysis, 9th edition, Daniel C. Harris
Also Ok: Quantitative Chemical Analysis, 8th edition, Daniel C. Harris
Grading Scheme
Midterm  25%
Report   20%
Final Exam  45%
Two problem sets: 10% (i.e. 5% each)

********Midterm in class: Thursday, February 13th, 2020********

Grading Method
All components of this course will receive numerical percentage marks. The final grade you receive for the course will be derived by converting your numerical course average to a letter grade according to Queen’s Official Grade Conversion Scale:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Numerical Course Average (Range)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A+</td>
<td>90-100</td>
</tr>
<tr>
<td>A</td>
<td>85-89</td>
</tr>
<tr>
<td>A-</td>
<td>80-84</td>
</tr>
<tr>
<td>B+</td>
<td>77-79</td>
</tr>
<tr>
<td>B</td>
<td>73-76</td>
</tr>
<tr>
<td>B-</td>
<td>70-72</td>
</tr>
<tr>
<td>C+</td>
<td>67-69</td>
</tr>
<tr>
<td>C</td>
<td>63-66</td>
</tr>
<tr>
<td>C-</td>
<td>60-62</td>
</tr>
<tr>
<td>D+</td>
<td>57-59</td>
</tr>
<tr>
<td>D</td>
<td>53-56</td>
</tr>
<tr>
<td>D-</td>
<td>50-52</td>
</tr>
<tr>
<td>F</td>
<td>49 and below</td>
</tr>
</tbody>
</table>

Late Policy
Please turn in your completed report to my office, 307 Chernoff Hall (under door if I am not there) by noon Wednesday March 11th, 2020. (You can hand it in early, but you cannot be late). Late reports are subject to a 15 % /day late penalty. Student is required to submit both a paper and electronic version of their report. Electronic version emailed to me. (Short acknowledgement of receiving from me.)

Assignments will be released in the term. They must be handed in as a hardcopy on or before the due date. More information will be provided during the lectures and on the course onQ site.

Location and Timing of Final Examinations
The exam dates for each Term are listed on the Faculty of Arts and Science webpage under “Important Dates.” Student exam schedules for the Fall Term are posted via SOLUS immediately prior to the Thanksgiving holiday; for the Winter Term they are posted on the Friday before Reading Week, and for the Summer Term they are individually noted on the Arts and Science Online syllabi. Students should delay finalizing any travel plans until after the examination schedule has been
posted. Exams will not be moved or deferred to accommodate employment, travel/holiday plans or flight reservations. Also, as indicated in Academic Regulation 8.3, students must write all final examination in all on-campus courses on the Kingston campus.

Academic Integrity
Academic Integrity is constituted by the six core fundamental values of honesty, trust, fairness, respect, responsibility and courage (see www.academicintegrity.org). These values are central to the building, nurturing and sustaining of an academic community in which all members of the community will thrive. Adherence to the values expressed through academic integrity forms a foundation for the "freedom of inquiry and exchange of ideas" essential to the intellectual life of the University (see the Senate Report on Principles and Priorities http://www.queensu.ca/secretariat/policies/senate/report-principles-and-priorities).

Students are responsible for familiarizing themselves with the regulations concerning academic integrity and for ensuring that their assignments conform to the principles of academic integrity. Information on academic integrity is available in the Arts and Science Calendar (see Academic Regulation 1 http://www.queensu.ca/artsci/academic-calendars/regulations/academic-regulations/regulation-1), on the Arts and Science website (see http://www.queensu.ca/artsci/academics/undergraduate/academic-integrity), and from the instructor of this course. Departures from academic integrity include plagiarism, use of unauthorized materials, facilitation, forgery and falsification, and are antithetical to the development of an academic community at Queen's. Given the seriousness of these matters, actions which contravene the regulation on academic integrity carry sanctions that can range from a warning or the loss of grades on an assignment to the failure of a course to a requirement to withdraw from the university.

Calculator Policy
As noted in Academic Regulation 9.2, “Calculators acceptable for use during quizzes, tests and examinations are intended to support the basic calculating functions required by most Arts and Science courses. For this purpose, the use of the Casio 991 series calculator is permitted and is the only approved calculator for Arts and Science students.”

Copyright of Course Materials
“This material is designed for use as part of CHEM/ENCH321: Instrumental Analytical Chemistry at Queen's University and is the property of the instructor unless otherwise stated. Third party copyrighted materials (such as book chapters and articles) have either been licensed for use in this course or fall under an exception or limitation in Canadian Copyright law.

Copying this material for distribution (e.g. uploading material to a commercial third-party website) can lead to a violation of Copyright law. Find out more about copyright here: http://library.queensu.ca/copyright.”

Accommodations for Disabilities
Queen's University is committed to achieving full accessibility for people with disabilities. Part of this commitment includes arranging academic accommodations for students with disabilities to ensure they have an equitable opportunity to participate in all of their academic activities. The Senate Policy for Accommodations for Students with Disabilities was approved at Senate in November 2016 (see
Academic Considerations for Students in Extenuating Circumstances

Queen’s University is committed to providing academic consideration to students experiencing extenuating circumstances that are beyond their control and are interfering with their ability to complete academic requirements related to a course for a short period of time, not to exceed three months. Students receiving academic consideration must meet all essential requirements of a course. The Senate Policy on Academic Consideration for Students in Extenuating Circumstances was approved at Senate in April, 2017 (see http://www.queensu.ca/secretariat/sites/webpublish.queensu.ca.uslcwww/files/files/policies/senateandtrustees/Academic%20Considerations%20for%20Extenuating%20Circumstances%20Policy%20Final.pdf) Each Faculty has developed a protocol to provide a consistent and equitable approach in dealing with requests for academic consideration for students facing extenuating circumstances. Arts and Science undergraduate students can find the Faculty of Arts and Science protocol and the portal where a request can be submitted at: http://www.queensu.ca/artsci/accommodations. Students in other Faculties and Schools who are enrolled in this course should refer to the protocol for their home Faculty.

If you need to request academic consideration for this course, you will be required to provide the name and email address of the instructor/coordinator.
Please use the following:

Instructor/Coordinator Name: Dr. Zhe She

Instructor/Coordinator email address: zs22@queensu.ca