Canadian Society for Chemistry | ***For Our Future***
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CSC Accreditation Guidelines

The Accreditation of Canadian University Undergraduate Chemistry Programs.

1. The Purpose of Accreditation

1.1 Accreditation ensures that educational programs have the potential to prepare graduates to practice their profession in a competent scientific manner. It also helps to maintain standards of education by providing an external audit service for programs, and by promoting the portability of the qualifications of graduates from such programs.

1.2 Accreditation should provide a broad basis for the recognition of acceptable degree programs while allowing differing details and breadth in curriculum development. Thus, accreditation identifies to the constituent members of the Canadian Society for Chemistry (hereinafter referred to as CSC), and to other interested provincial professional associations, those undergraduate degree programs whose graduates satisfy the criteria for qualification for membership in the CSC.

1.3 Accreditation also fosters cooperation between educational institutions and provides a medium for the interchange of ideas between universities and industry.

1.4 Accreditation will apply to individual degree programs leading to Bachelor's degrees, rather than to the Institution or Faculty. This is based on the premise that degree programs of different characteristics are to be found within the same institution.

2. Procedures

2.1 The evaluation of a program is to be undertaken only at the invitation of a particular institution, and will normally be initiated by a letter, to the CSC Director responsible for Accreditation, requesting such an evaluation from the Department Chair or Head. This, or a subsequent letter, must confirm the institution's willingness to provide the appropriate information, to host the Site Visit Team (hereafter referred to as SVT), and to pay the appropriate fee and expenses if applicable.

2.2 The duration of the accredited status will be up to 8 years. The accreditation evaluation can be aligned with institutional review processes; a site visit is required for each program evaluation with at least one member of the CSC Accreditation committee acting as a program evaluator.

2.3 The areas to be assessed by the SVT will include:

i the physical facilities of the department;
ii the adequacy of the financial support from the university;
iii the appropriateness of the student: teacher ratios in terms of meeting the stated objectives of the program;
iv the general and professional education of the faculty, their teaching loads and administrative responsibilities;
v evidence of an appropriate commitment to research and teaching activities by the university and its faculty members;
vi the curriculum of the program;
vii the presence of an effective and valid assessment system of student performance;
viii the library, whether separate or within the department, its convenience and accessibility to students, and the appropriateness of the library holdings in the subject. In keeping with modern usage, web access to journals will be considered adequate for accreditation purposes.

2.4 Much of the information listed above should be supplied to the SVT before it arrives on campus, so that the members can come equipped with a general picture of the department, its aims and its achievements as these pertain to undergraduate education. The information supplied must include:

i Departmental self-study document

ii calendars and other official program descriptions;

iii provide faculty members' curricula vitae, including information on teaching, research and professional activities (including any training for equity, diversity, inclusion, and indigenization of curriculum); electronic copies may be requested;

iv a complete list of the course requirements, separate for each program under consideration;

v for each required course, the actual number of class hours, textbook(s) used, copies of past examinations and summary statistics of examination results;

vi a description of procedures for introducing and implementing curriculum changes;

vii a list of actual student laboratory hours for each course involving laboratory instruction;

viii a list of instrumentation used by students completing the program under consideration;

ix descriptions of any unique features which the institution thinks appropriate.

2.5 During the visit, there should be opportunities for face-to-face interviews with administrative officers such as the Dean and/or Academic Vice-President, the Department Head or Chair, the library representative, groups of, or individual, faculty members, and groups of, or individual, senior students, lab personnel and

other instructors. There should also be conducted impromptu tours of the physical facilities such as laboratories, libraries, computing facilities, etc.

2.6 A visit will normally take 1–2 days to complete and will provide an opportunity for the team to assess collectively those factors that cannot be documented in written form.

3. Guidelines

3.1 General

A program to be considered for accreditation shall extend over four years, each year to consist of the traditional two terms, or the equivalent if the institution operates on a “trimester” or “quarter” system. The program shall lead to a baccalaureate degree at the educational institution under review.

3.2 Considerations

In considering a program, the primary concern of the Committee shall be the quality of the undergraduate education offered, including the curriculum,the number and credentials of the members of the faculty who teach in the program and their research or other scholarly interest, and the equipment and facilities available to the students, including library, computer, and other resources. The SVT will also make general inquiries about the success of recent graduates in employment and in graduate schools.

3.3 Limitations

The SVT or the Accreditation Committee shall neither prescribe a detailed curriculum beyond the minimum requirements detailed below nor require uniformity among programs. It shall, however, suggest and encourage improvements and examine the breadth and depth of program requirements, and the opportunities for some specialization.

3.4 Requirements

NOTE: here and in subsequent sections, a 1.0 credit course is considered one that typically takes place over two terms, while a 0.5 creditcourse typically takes place over one term. A term is typically 12–13 weeks in length. For context, a typical undergraduate degree program in the sciences would be expected to require some 20.0 credits overall, with a student workload of 5.0 credits per academic year.

The core program beyond the first-year level shall include the equivalent of 6.0 credits in chemistry, including 0.5 credits in at least three of the five traditional subdisciplines of chemistry (*i.e.*, analytical, biochemistry, inorganic, organic and physical chemistry). For pure chemistry programs, at least 0.5 credits in each of the five subdisciplines is required. Departments presenting more specialized or interdisciplinary programs are encouraged to provide the opportunity for students to access 0.5 credits in each of the five subdisciplines. In cases where courses are in an emerging discipline, an explanation of the chemistry components of the course should be described in order for the accreditation committee to evaluate how the course would contribute towards the chemistry count. In addition, there shall be a selection of advanced course

offerings to demonstrate a progression of learning within the chemistry discipline to bring the total number of hours of instruction up to that described in Section 3.6.

In cases where the accredited program is not pure chemistry, the degree title should reflect the nature of the program taken.

3.5 Non-Chemistry courses

A program shall include at least 2.5 credits in two or more of mathematics (algebra, calculus, statistics), physics, computer science and biology. In the case of pure chemistry programs, at least 1 credit in each of calculus and physics is required. The inclusion of other cognate subjects as well as some liberal arts requirements is encouraged.

3.6 Hours of instruction

A program must involve a total of about 1000 hours of laboratory and classroom work in chemistry, with the minimum hours of each being about 400. The active laboratory hours should be distributed in such a way that every student is exposed to meaningful laboratory experience across the subdisciplines. Research-based laboratories, when they are a part of the degree program, should not constitute more than 50% of the required laboratory hours; no more than 30% of the required laboratory hours may be spent in a fourth-year independent research project. In this context, classroom work includes lectures, active learning sessions, tutorials, and seminars. To provide a broad educational experience to students in accredited chemistry programs, it should not be necessary to exceed this requirement of 1000 hours of chemistry instruction to an unreasonable degree.

3.7 Joint and Interdisciplinary Programs

The Committee shall evaluate the **entire** program to ensure that the chemistry content is a major part of the program. When the total hours of instruction are equivalent to those specified in item 3.6, and all other items of these guidelines apply, such programs can be awarded full accreditation.

3.8 Integrated Courses

Classroom and laboratory hours in integrated courses, i.e., courses involving some combination of the core subjects (listed in item 3.4), will be proportioned among the core subjects for the purpose of determining whether the requirements listed in 3.4 are met.

3.9 Laboratory work

Laboratory work shall include hands-on training on equipment currently used in research, industry and government laboratories. Laboratory and associated work spaces shall be sufficiently modern and follow institutional safety guidelines.

3.10 Professional skills

The Department shall explain to the SVT, with appropriate supporting Documentation how students' communication skills are developed and evaluated in that program, including the writing of technical reports and presentations. The program shall also offer opportunities for students to explicitly develop skills in ethical professional behaviour, teamwork, equity, diversity, and inclusion principles, and chemistry-related safety. These skills should be included as part of the program's intended learning outcomes (see 3.11).

3.11 Learning outcomes

The program level learning outcomes, or a plan for developing them, shall be listed, with a mapping of where these outcomes are taught, practiced, and assessed in the program's courses.

Resources and examples for this process are available in the Accreditation section of the CSC website.

[References:

(1) http://oucqa.ca/framework/appendix-1/

(2) https://cagc.alberta.ca/learning-outcomes/

(3) Elmgren, M.; Ho, F.; Åkesson, E.; Schmid, S.; Towns, M. H. Comparison and Evaluation of Learning Outcomes from an International Perspective: Development of a Best-Practice Process. J. Chem. Educ. 2014, 92 (3), 427–432. http://pubs.acs.org/doi/abs/10.1021/ed500542b (see SI for tables of LOs)]

3.12 Pedagogies

The Department shall indicate the types of pedagogies used in each course; ideally the pedagogy shall be aligned with the intended learning outcomes and active pedagogies are encouraged. The Department is encouraged to highlight particularly innovative courses, including laboratories. Additional resources are available in the Accreditation section of the CSC website.

[(1) Waldrop, M. M. Why We Are Teaching Science Wrong, and How to Make It Right. *Nature* **2015**, *523* (7560), 272–274. https://www.nature.com/news/why-we-are-teaching-science-wrong-and-how-to-make-it-right-1.17963

(2) Bradforth, S. E.; Miller, E. R.; Dichtel, W. R.; Leibovich, A. K.; Feig, A. L.; Martin, J. D.; Bjorkman, K. S.; Schultz, Z. D.; Smith, T. L. University Learning: Improve Undergraduate Science Education. *Nature* **2015**, *523* (7560), 282–284. http://www.nature.com/doifinder/10.1038/523282a

(3) Freeman, S.; Eddy, S. L.; McDonough, M.; Smith, M. K.; Okoroafor, N.; Jordt, H.; Wenderoth, M. P. Active Learning Increases Student Performance in Science, Engineering, and Mathematics. *Proc. Natl. Acad. Sci. U. S. A.* **2014**, *111* (23), 8410–8415. http://www.ncbi.nlm.nih.gov/pubmed/24821756

(4) Stains, B. M.; Harshman, J.; Barker, M. K.; Chasteen, S. V; Cole, R.; DeChenne-Peters, S. E.; Eagan Jr, M. K.; Esson, J. M.; Knight, J. K.; Laski, F. A.; *et al*. *Science*, **2018**, *359* (6383), 1468–1470. http://science.sciencemag.org/content/359/6383/1468]

3.13 Equity, Diversity, and Inclusion

The Department must describe what they are doing to make the program(s) under consideration equitable, accessible, and inclusive to all persons, plus foster diversity in enrolment. Some suggestions can be found below, with

additional suggestions and resources in the Accreditation section of the CSC website:

- Activities aimed at involving and including equity-seeking groups.
- A considered selection of faculty and staff who are willing to be an ally for and mentor equity-seeking groups.
- Appropriate training for teaching assistants, faculty, and staff on equity and diversity issues. The departmental leaders are key persons that need to be educated on equity and diversity issues.
- Including a webpage for Equity and Diversity on the Department's website.
- Describe efforts to ensure that students with any range of disabilities can be accommodated in the undergraduate laboratory.
- Describe efforts to ensure that the selection of undergraduate awardees and ranking of scholarship applicants has been an equitable process.

[Resources for the accreditation website:

(1) American Chemical Society Committee on Chemists with Disabilities. *Teaching Chemistry to Students with Disabilities: A Manual for High Schools, Colleges, and Graduate Programs*, 4th ed.; Miner, D. L., Nieman, R., Swanson, A. B., Eds.; The American Chemical Society, 2001.

(2) Science and Engineering Leadership Initiative, U. of D. Resources for Students with Disabilities in STEM Fields | Science & Engineering Leadership Initiative (SELI) https://sites.udel.edu/seli-ud/resources/ (accessed Nov 19, 2018).]

3.14 Indigenous students

Departments shall describe progress or plans in response to the Calls for Action of the Truth and Reconciliation Commission of Canada (http://www.trc.ca) and can include information such as: (i) Working with Indigenous peoples, what have departments done or planned to improve indigenous student enrollment, education attainment levels and success rates? (ii) What have departments done or planned to support indigenous students to ensure their long-term success? (iii) How might Departments, in consultation and collaboration with Survivors, Indigenous peoples and educators, integrate indigenous knowledge and teaching methods into the classroom? Suggestions for activities in which departments can work with Indigenous communities to ensure success of indigenous students are provided on the CSC accreditation website.

[Suggestions for website:

- Recognizing that many indigenous students coming from remote communities do not have the same opportunities for learning STEM disciplines due to the difficulties associated with attracting and retaining qualified STEM instructors, departments should be open to offering preparatory courses to small groups of indigenous students prior to their first-year studies to assist in the transition to university-level STEM courses. Alternatively, the department, with the university, should make designated student teaching assistants available to indigenous students and funded using allocated university funds. Volunteer-driven learning communities can also be used to provide needed assistance to 1st year Indigenous students.
- Ensure access to elders, mentors (senior "cousins") for indigenous students to aid in the transition from small communities to the university environment.
- Offer/participate in summer workshops for indigenous students and teachers employed at schools within indigenous communities.
- Offer/Participate in programs where a TA or instructor work with the community to provide a meaningful lab experience to indigenous students with the goal of training

the teachers to improve and sustain the quality of STEM instruction.
Provide personal, social, and cultural support to ensure the academic and personal success of indigenous students.]

3.15 Learning environment

Departments shall describe the physical and social spaces used in the program and how they contribute to the learning environment. A student-run chemistry club (or science club in the case of a smaller institution/program) with a faculty advisor is required or a plan to implement one; students should be allocated space for this club. All students in CSC accredited programs can obtain complimentary Young Professionals membership with the CSC.

4. The Report

4.1 At the end of the visit, the Site Visit Team will meet to discuss their preliminary opinion on the basis of which the team will prepare a written report of the program being assessed, underlining both strengths and weaknesses. After a consensus has been reached, the Chair of the Site Visit Team will send the draft to the Chair/Head of the Department in order to ensure factual accuracy. After correction of any factual errors, the final report is submitted to the Chair of the Accreditation Committee. The Accreditation Committee will then review the final report, and will submit its recommendations to the CSC Board.

4.2 The site visit report must include the following components:

- i an introductory statement recording the dates of previous surveys and the names of the current visiting team members; a list of the previous visiting team's recommendations and accreditation decision should be appended;
- ii a description of the curriculum, teaching and research facilities and any observations as to how curriculum changes are effected within the department;
- iii a statement describing the faculty and their qualifications, and other relevant information;
- iv a statement regarding student achievement standards, as reflected in the data provided by the institution, and as determined by the team based on direct observation;
- v a statement describing library facilities, and observations on those by students and faculty.
- vi a statement of the RECOMMENDATIONS and SUGGESTIONS, the former referring to areas of critical deficiencies and the latter to non-critical deficiencies.

5. CSC Board Action

5.1 The CSC Accreditation Committee shall consider the recommendations made by the Site Visit Team and will decide upon one of the following classifications for the program in question.

Preliminary Approval. On the basis of an institutionally prepared prospectus, a new program is granted year by year Preliminary Approval if it appears to meet the minimum requirements for approval as established by the Board, and until such time as students are enrolled in the final year and/or the program has been

recommended for Full Approval after a site visit.

Provisional Approval. This classification is granted to a program which has been found to have deficiencies or weaknesses in one or more specific areas, and signifies the seriousness of the deficiencies or weaknesses, which are considered to be of such magnitude that, if not corrected, withdrawal of the program's accreditation status will result. Evidence of significant progress must be demonstrated within one year.

Full Approval. This classification indicates that the program achieves or exceeds the minimum requirements for approval, and specifies that the program has no serious deficiencies or weaknesses, although recommendations or suggestions relating to program enhancement will generally be included in the evaluation report. The Accreditation Committee reserves the right to place term- or other conditions upon any category of accreditation status.

The CSC Board of Directors shall review the recommendations of the Accreditation Committee and ratify its decision.

The Board will normally announce the decision after one of its meetings.

The list of accredited programs is posted on the CSC's Web site.

[Approved by CSC Board, November 23, 2018]