



## ABET 2006 SELF-STUDY REPORT

Humanities and Social Sciences  
(B.4.5.5.1)



The Division of Liberal Arts and International Studies (LAIS) houses all humanities, social sciences (except Economics), communication, foreign language, and performing arts courses at Colorado School of Mines. Its primary contribution to the professional component of engineering education, therefore, is in general education at the undergraduate level. LAIS also houses a graduate program in International Political Economy that is discussed in Section B.4.6.3.

Given its curricular scope, LAIS plays a major role in the “soft side” of engineering education in the development of students as individuals, global citizens, and professionals who are also innovative, creative, critical, and responsible thinkers and leaders.

Humanities and social science courses constitute the majority of the Division’s curriculum and contribute directly to achieving the following ABET Criterion 3 outcomes:

1. 3-f: an understanding of professional ethical responsibility
2. 3-g: an ability to communicate effectively
3. 3-h: the broad education necessary to understand the impact of engineering solutions in a global and societal context
4. 3-i: a recognition of the need for, and an ability to engage in life-long learning
5. 3-j: a knowledge of contemporary issues

They contribute indirectly to:

1. 3-c: an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

### Undergraduate Course Requirements in LAIS

All CSM undergraduates are required to complete the following humanities and social sciences-based curriculum housed primarily in LAIS and secondarily in the Division of Economics and Business (EB) (see Section B.4.5.5.2):

1. Ten (10) credit-hours in three core courses:
  - a. LAIS 100, Nature and Human Values (4 credit-hours; LAIS)
  - b. SYGN 200, Human Systems (3 credit-hours; LAIS)
  - c. EBGN 201, Principles of Economics (3 credit-hours, EB)

2. Nine (9) credit-hours in one of three thematic clusters (mid-level and upper-division courses, including 6 select courses from the Division of Economics and Business and some 55 LAIS courses):
  - a. Humanities
  - b. Public Policy
  - c. International Studies

### LAIS Core Courses and ABET Criterion 3 Outcomes

This section discussed Criterion 3 outcomes in parallel to the CSM Crosswalk chart with reference to the two core courses that LAIS delivers.

#### LAIS 100, Nature and Human Values (NHV)

Course overview. This freshman core course first became required in Fall 1997, has undergone many modifications and revisions subsequently, and continues to be a pedagogical challenge to deliver. In terms of content, NHV is an exploration of the premise that all human activity is embedded in and thus relies on the nature. It uses a multidisciplinary perspective to reflect critically on the complex and dynamic interrelationship between that which is distinctively human and that which is “natural,” wherever it is found, and is informed by studies in ethics, literature, politics, history, and science-technology-society (STS) studies. Further, the course employs the pedagogical premise that students learn composition most effectively by writing to content. Therefore, the course’s 4 credit-hours are structured as follows: one hour per week in large lecture format (about 300 students) delivered by some five to seven humanities and communication faculty, followed by three hours in seminar sections of 20 students which combines additional subject matter content with writing exercises and assignments. Students’ grades are based solely on their performance in the small seminar sections.

#### Criterion 3-f: Professional and Ethical Responsibility (Primary)

NHV is the only required course at CSM in which students receive some instruction in ethics. Case studies are used in the course to teach students about contemporary professional ethics and to help them develop and understanding of engineering responsibility. See “Cross-Campus Curricular Enhancement” below for a discussion of an incipient Ethics Across the Curriculum effort within LAIS.

#### Criterion 3-g: Communicate Effectively (Primary)

CSM and LAIS have devoted significant resources to staffing some 50 sections per year of 20-student seminars with instructors (both full-time lecturers and

adjuncts) who possess expertise in composition. Each student completes about 40 pages' worth of writing assignments during the semester at what is considered a first-year level of difficulty. It should be noted, however, that the emphasis is on general writing skills: this is not a technical writing course.

Criterion 3-h: Understanding Engineering Solutions in Global and Societal Contexts (Primary)

NHV's central theme of exploring the human-nature interface both historically and contemporaneously is, by definition, an exercise in understanding the importance of contexts in which human choices and decisions take place, as well as understanding how those contexts in turn influence further actions and reactions on the part of humans. Themes covered in NHV that both directly and indirectly address the global and social contexts in which engineering solutions have been, are, and will be crafted include: a history of landscapes; a study of the Colorado River; the rhetoric of the environmental debate; the development of nuclear weapons; an introduction to professional ethics; bioethics; humanitarian engineering; and engineering cultures.

Criterion 3-i: The Need to Engage in Life-Long Learning (Secondary)

By choosing controversial and provocative topics and issues as the core of NHV's subject matter, NHV contributes to stimulating students' intellectual curiosity and exposes them to new ways of thinking about the world and their future professional lives. Further, it introduces them to basic research skills in non-technical areas that the students must employ in completing a portion of their composition assignments, thereby adding depth to their "intellectual tool box."

Criterion 3-j: Knowledge of Contemporary Issues (Primary)

As is clear from the foregoing description of NHV's contribution to understanding global and societal contexts in which engineering takes place, NHV includes coverage of such humanities-based contemporary issues as the environment, professional ethics and an understanding of engineering responsibility, humanitarian engineering, engineering cultures, and the ongoing, evolving interface between humans and the environment in general.

SYGN 200, Human Systems

Course overview. This 3 credit-hour sophomore core course first became required in Fall 1999 and has undergone some modest revisions since, along with constant updating. The overarching goal of Human Systems is to introduce students to how the world works, how it is put together, and why it works the way it works. Two-thirds of the course's content is historical (the modern era since 1500 on a worldwide scale) and one-third is contemporary (issues related to

globalization). The course is one in a suite of “systems” courses whose original intent was to demonstrate the applicability of a concept like a “system” across a broad spectrum of phenomena, namely, earth systems, engineered systems, and systems (social, political, economic, and cultural) created by humans. SYGN 200 employs the concept of the modern world system (the rise and evolution of capitalism since ca. 1500) as the overarching system it examines. Course instructors draw on many academic disciplines in order to achieve the course’s goal, most notably history, political science, sociology, geography, and international political economy. SYGN 200 is taught in a large lecture format (about 150-160 students per section). Unlike NHV, Human Systems sections are delivered exclusively by one social science faculty member. There are no small recitation or seminar sections, as there are in NHV.

### Criterion 3-g: Communicate Effectively (Secondary)

Human Systems promotes improved communication skills in two ways. One is through the required readings in which students must engage, which contribute to the expanse of social science-based ideas and concepts they have at their disposal, and thus their capacity to articulate their own thoughts and ideas better. The second is through a two-page take-home essay that requires a student to (a) demonstrate that he/she has digested the reading and lecture materials; (b) engage in additional research on the topic of the essay; and (c) craft an essay reflecting both (a) and (b) as expressed in the student’s own way.

While the faculty who deliver Human Systems would like to build even further upon the written communication and research skills that students acquired in NHV, this is feasible from a teaching load standpoint since a given section’s one instructor must do all course grading (with the exception of objective tests that are machine graded by graduate teaching assistants). SYGN 200 instructors also offer optional extra credit work to students that entails reading a monograph or set of articles, or interviewing an expert, then writing a brief essay on the subject.

### Criterion 3-h: Understanding Engineering Solutions in Global and Societal Contexts (Secondary)

The contemporary or globalization portion of Human Systems provides individual instructors with an opportunity to bring their disciplinary expertise to bear in the selection of case studies and topics that contribute to an understanding of global and societal contexts in which engineering takes place. For example, an international political economy professor explores the “impact of engineering solutions” in an integrated societal context through the prism of a variety of industrialization processes found in today’s developing world, such as import-substitution, export promotion, technology licensing, and turnkey industrial models in various economies and societies. A sociologist examines the how multiethnic societies define and implement development models in the face of

ethnic tensions, either successfully or unsuccessfully. A political scientist reveals how wars and corrupt practices impact natural resource production globally. A geographer discusses how the way a natural resource like water is managed can either provoke interstate or inter-community conflicts or help resolve them. All of these and other social science-based topics require students to appreciate a world that is mostly “gray” – not black and white – and to learn how to think through intersecting and complex sets of social, political, economic, cultural, and environmental factors that comprise the context in which engineering is practiced.

#### Criterion 3-i: The Need to Engage in Life-Long Learning (Secondary)

The core lesson of Human Systems is the age-old dictum that those who fail to learn from the errors of the past will be condemned to repeat them. For this reason, two-thirds of the course focuses on those historical processes of the past half-millennium that have contributed to defining today’s world. The specific historical topics that the course covers help the student identify past successes and failures of the human condition and how the forces of the past are part of an ever-changing continuum of human activity that requires one to accompany in order to have a fulfilling and productive life and career.

#### Criterion 3-j: Knowledge of Contemporary Issues (Primary)

As is clear from the foregoing course description and discussion of the global and societal contexts in which engineering takes place, the main goal of Human Systems is to bring students to an historically informed understanding of today’s world, especially those issues emerging from the ongoing process of globalization. From cultural clashes to war, poverty, pandemic disease, the impact of rapidly changing technologies on social structures and values, and the rise of new economies and economic structures, Human Systems’ most significant contribution to the CSM undergraduate curriculum is the conceptual and factual knowledge it imparts to students about a constant and rapidly changing world, the magnitude of problems it faces, and the resulting challenges it poses to the engineering profession.

#### LAIS Cluster Courses and ABET Criterion 3 Outcomes

After completing LAIS 100 and SYGN 200, students choose one of the thematic clusters noted above in which to complete the remainder of their graduation requirements in the humanities and social sciences. Two of the three courses may be in foreign language study. Courses in communication and the performing arts may only be used for free elective credit, not to satisfy cluster requirements. One of the three courses must be at the 400 level; all 400-level cluster courses are writing-intensive. All cluster courses must contribute to at least one of the ABET Criterion 3 outcomes, as reflected on individual course syllabi.

## LAIS Enhancement Opportunities

Students who wish to pursue course work in LAIS beyond the core and cluster requirements have many opportunities to do so. The following is a brief summary of the highlights of these enhancement opportunities:

### Minors

Undergraduate students are at liberty to devote their 9 free elective hours to the pursuit of one of four defined minors in LAIS, plus an individual undergraduate minor defined on an ad hoc basis. Minor programs are structured so that students can apply their 9 required cluster hours toward the 18 hours required for a minor.

*International Political Economy (IPE) Minor.* The oldest of the LAIS minors, dating to the early 1990s, the IPE program is the outgrowth of a late 1980s grant from the Fund for the Improvement of Post-Secondary Education (FIPSE) and was the first project FIPSE ever funded with an international focus. In keeping with CSM's traditional role and mission, the IPE program focuses on resource-producing regions of the world (Asia, Africa, Latin America, and the Middle East); on global issues such as development, corruption, ethnicity, global corporations, and conflicts based in natural resources; and includes a capstone course in international political risk assessment. The success of the IPE minor was parlayed into a graduate certificate program (one of CSM's combined undergraduate-graduate programs) as of Fall 2000. As of Fall 2005, CSM received approval from the Colorado Commission on Higher Education to offer a Master of International Political Economy of Resources degree (see Section B.4.5.3).

*Humanitarian Studies and Technology Minor.* The newest of the LAIS minors, this program is an optional subset of a more extensive Humanitarian Engineering minor housed in the Division of Engineering. That division and LAIS successfully competed for a grant from the Hewlett Foundation in 2003 to launch the program. Course work in LAIS provides students with an understanding of sociocultural, economic, and political factors at work in other cultures that students must incorporate into their humanitarian engineering design projects.

*Humanities Minor.* This minor combines course work that focuses on the memorial record of the human condition, experience, heritage, imagination, and intellect as informed by the disciplines of philosophy, literature, and history.

*Science, Technology, Society Minor.* This minor examines focuses on science and technology in a social context, examining how science and technology affect society and how society affects science and technology. Key themes pursued in this minor include professional ethical responsibility, intellectual property rights, science and technology policy formation, regulatory regimes, and technological innovation.

### Performing Arts

The performing arts at CSM as housed in LAIS are defined primarily by music and far more modestly by art. These courses may be applied to free elective credits only. Both music and art contribute to the development of creativity, innovative thinking, self-confidence building, and risk-taking in students. They are also “safety valves” that allow students to utilize their mental faculties in ways that are markedly different from the cognitive processes involved in learning engineering.

*Music.* Over the past two years, the LAIS music program has expanded beyond its traditional offerings of band and choral courses to now include formal instruction in strings and jazz. The program also hosts some half-dozen extramural performance groups that appear at events both on campus and throughout the Denver metro area. Some 80 music scholarships are awarded annually, and over the last two years, the program has received a generous \$65,000 from the Office of Student Life for instrument refurbishment, repair, and acquisition. The director of the music program and the LAIS division director are also pursuing the idea of establishing a program in music technology that would incorporate courses from physics, electrical engineering, and computer sciences. Preliminary discussions with professors in these disciplines indicate a strong receptiveness to the concept.

*Art.* As of Spring 2006, LAIS will be offering one course in studio art per semester. In addition, during Fall 2005, LAIS engaged in a preliminary discussion with the Division of Engineering (at its instigation) about the possibility of pursuing a cross-disciplinary initiative that would offer course work that explores the intersections between engineering and the arts.

#### Literary Journal

*High Grade.* LAIS is also pleased to be able to publish an annual literary journal that showcases creative work by students, faculty, and staff alike that runs the gamut from poetry and short stories to full-color photography and art.

### Cross-Campus Curricular Enhancement Programs

#### Writing Program

*Writing across the Curriculum.* CSM and LAIS established a campus-wide Writing across the Curriculum (WAC) program in 1998 as one of the main components of the Division’s Writing Program. Since that time, the WAC program has been educating CSM faculty about how to teach writing more effectively within engineering and science disciplines. All undergraduate degree-granting departments and divisions now require one or more upper division “writing intensive” courses in their programs. The WAC program also extends the same service to the LAIS faculty at large as well.

*LAIS Writing Center.* LAIS also maintains a small (one office) Writing Center to assist all writers on campus (students and faculty) with their writing projects. The Writing Center is not an editorial service; rather, it is predicated on teaching communication skills in the process of working with writers. LAIS believes that the demand for the Writing Center's services is now greater than what the Division can meet with its limited resources.

### Ethics across the Curriculum

For many years, LAIS has hoped to be able to launch an Ethics across the Curriculum program in the same genre as the Writing across the Curriculum program. A lack of faculty resources has largely prevented attainment of this goal. As of Spring 2005, however, the Division was able to free up a modest amount of time for its one professor with expertise in ethics to meet with faculty across campus and evaluate the viability of trying to establish such a program. The upshot of his inquiries was that while there was universal acknowledgment that such a program would be a valuable and desirable addition to the university's curriculum. However, the countervailing message was that faculty are too over-extended as is to devote much if any time to "getting up to speed" in how to incorporate instruction in professional ethics into existing engineering courses.

Armed with this information, LAIS concluded that, for the time being, NHV will have to be the only course taken by all CSM undergraduate students. In light of this reality, the ethics professor noted above, in collaboration with other LAIS faculty, ran a workshop prior to the beginning of the Fall 2005 semester for all NHV instructors (full-time and adjunct) that focused on how to incorporate and teach ethics more effectively in the course. LAIS is planning to repeat the workshop ahead Fall 2006 and is hopeful that a few engineering faculty will be able to join it. In short, the Ethics across the Curriculum initiative is in its infancy and is unlikely to expand beyond its current reach any time soon.

### LAIS Assessment Activities

LAIS has a standing assessment committee chaired by the Director of the Writing Program with additional membership drawn from the full spectrum of humanities, social sciences, and communication full-time faculty. An assessment cycle for the Division was devised and implemented in 1998. As of Fall 2005, the Assessment Committee had more collected data on its hands than it could evaluate in as timely a fashion as it would like.

Highlights of recent assessment activities and potential major changes that may be in the offing are as follows:

*LAIS 100 and SYGN 200.* Assessment data that have been collected over several years, along with input from faculty members who deliver these two courses, have led LAIS to consider reversing the order in which students would take these two core courses. In

other words, SYGN 200 may become the freshman course and LAIS 100 the sophomore course. The main driver behind this consideration has to do with the content of the two courses: assessment data strongly suggest that freshmen are not sufficiently mature intellectually to fully appreciate the importance of the subject matter that the course treats. The Division is spending AY 2005-06 investigating whether it would be possible to make this shift from a resources standpoint. In essence, LAIS 100 has reached “stability” in terms of staffing it vis-à-vis the significant increase in incoming freshmen class sizes that CSM has experienced in recent years. By contrast, SYGN is currently understaffed relative to need and demand for the course.

*Clusters.* The LAIS clusters were originally devised in the mid-1990s to respond to ABET concerns that there was no “coherence” in students’ humanities and social sciences course work. At the time, undergraduate simply took whatever courses fit into their schedules. Recently, LAIS faculty members have been expressing increasing dissatisfaction with the clusters as a model for delivering humanities and social sciences courses beyond the core to CSM’s undergraduates. Therefore, during AY 2004-05, LAIS conducted an assessment of the clusters to determine how students themselves perceived the clusters. Only seniors who were completing their last cluster course requirement were allowed to respond, and were asked to respond only once in the event that they were taking more than one cluster course during the survey semester.

The survey results indicate that, on balance, students are indeed perceiving connections across their cluster courses and are finding that the courses contribute to their understanding of the broader contexts in which engineering takes place. Although the complete results of this survey will be available in the Division for ABET reviewers, a few of the more salient results here will serve to make the point. All of the following percentages represent a combination of “agree” and “strongly agree” responses (most in the “agree” category):

- § I was able to make conceptual connections across my cluster courses (62%)
- § My cluster courses contributed to my understanding of the role humanities and social sciences play in engineering (64%)
- § My cluster courses fostered an understanding of the broader non-technical impacts of technical/engineering solutions (70%)
- § My cluster courses introduced me to ideas and concepts I will continue to learn about after graduation (75%)

While these results are clearly gratifying, one must also ask whether the good results of the last three questions might not also be obtained outside of the structure of the clusters. In essence, the LAIS faculty perceive the ABET 2000 outcomes criteria that relevant to the humanities and social sciences to be “liberating” in terms of how this Division chooses to achieve those outcomes. Therefore, LAIS will continue its study of how it might “package” humanities and social sciences course work differently and still achieve these kinds of positive results, or, indeed, improve upon them. Much of the devil in

undertaking any such restructuring will be in the mechanistic details of faculty resources and scheduling challenges.

*Assessment of Senior Design in Engineering Programs.* During AY 2005-06, LAIS is testing to what degree students are actually incorporating what they learn in their humanities and social sciences into their senior design projects. While the results of the clusters survey suggest that students are making clear connections between engineering design and broader non-technical contexts by the time they are completing the final semester of their undergraduate degree, the Division would also like to have evidence one way or the other that they have actually been able to apply that knowledge upon entering their senior design courses. To that end, LAIS devised a survey of students in senior design that is being conducted during AY 2005-06.

*Ongoing Assessment Activities.* As of AY 2003-04, LAIS implemented two simple ongoing assessment activities: (a) collection of “best” and “worst” writing samples from all 400-level senior seminars as a means of evaluating the quality of student writing at the end of their undergraduate careers; and (b) collection of one paragraph “faculty reflections” each course they teach during the academic year.