AC 2011-2176: FACILITATING TRANSFER OF STUDENTS FROM 2-YEAR TO 4-YEAR ENGINEERING PROGRAMS

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Facilitating Transfer of Students from 2-Year to 4-Year Engineering Programs

Abstract

Although enrollments in engineering programs have increased slightly in recent years, there continues to be concern about preparing the number of engineers necessary to meet the work force needs of the United States to maintain technological and economic competitiveness. Two-year institutions represent a source of students if a coherent curriculum were available and a seamless articulation process existed that would maximize the credit earned at the two-year institution and potentially decrease the time to a bachelor's degree. Presented in this paper are the basis and methodology used to develop a voluntary transfer and articulation compact for mechanical engineering programs in Texas. As of February 16, 2011, the chancellors or presidents of 14 public universities and 30 public community and technical colleges or districts have agreed to participate in the Voluntary Mechanical Engineering Transfer Compact. The Transfer Compact represents 82 percent of the Texas public universities offering mechanical engineering and 75 percent of the Texas public community or technical colleges offering lower-division engineering courses. By signing this compact, the need for up to 420 separate, institution-to-institution articulation agreements was eliminated.

Introduction

Despite well-established financial benefits to students and institutions, a review of the literature and experience indicate that educational systems are not meeting either the regional or the national demand for an engineering workforce with the necessary knowledge, skills, and attitudes. Two-year institutions of higher education are potentially the single largest untapped regional source of future engineering professionals. In fall 2009, Texas public two-year institutions served approximately 693,000 students and accounted for 75,338 (61.8 percent) of the 2008 to 2009 increase in enrollment in higher education institutions in the state. Indeed, public two-year institutions in Texas contributed 244,847, or 61.0 percent, to the increase in higher education enrollment from 2000 to 2009 (1).

A cohort study of students entering higher education in Texas in fall 2002 was conducted by the Texas Higher Education Coordinating Board (THECB) to examine the educational pathways of these students (2). This study revealed that of the 169,630 students enrolling for the first time in higher education at a public college or university, 65.7 percent enrolled in a community or technical college. Further, only 4.5 percent (7,637 students) graduated with an engineering degree or declared engineering as a major during the next six years. Of that 4.5 percent, 74 percent began their studies at a four-year institution, while only 26 percent began at a two-year institution. Public colleges and universities spent $424.2 million educating these 7,637 students. For this $424.2 million investment, 2,566 students completed bachelor's degrees in engineering;

1,489 students completed bachelor's degrees in non-engineering fields; and 3,582 students did not earn a bachelor's degree in any field.

Across the nation, students at two-year institutions who have the talent and motivation to become engineers are not sufficiently migrating from pre-engineering programs to baccalaureate engineering programs, despite the economic benefit of completing the baccalaureate degree and finding employment as an engineer. One of the predominant reasons for the lack of migration is the absence of a clearly defined and unrestrictive pathway. Currently, students at two-year institutions generally follow one of two routes to a four-year engineering program:

- Through an approved articulation agreement between a two-year institution and a four-year institution; or
- By taking courses, mainly to satisfy core curriculum/general education requirements, which are later transferred to the four-year institution and may or may not be the best selection of courses to serve as the foundation for the student's major.

These two routes are designed to facilitate transfer, because that is what the student typically intends to do: He or she plans to transfer from the two-year institution to the baccalaureate engineering program at the four-year institution. This method of "course" migration has several perceived barriers for the students and for the institutions involved. These perceived barriers may include:

1. Qualified students entering two-year institutions often do not consider engineering careers because no clear pathway to an engineering baccalaureate is visible.
2. An articulation agreement must be developed between each two-year and each four-year institution, which results in a multitude of duplicative articulation agreements between a four-year institution and the various two-year institutions from which students transfer.
3. Where no articulation agreement is in place, determination of course transferability and applicability to the degree is a time-consuming and labor-intensive subjective process.
4. Upon completion of a pre-engineering program at the two-year institution, the student has not necessarily earned an associate's degree and may have only an amalgamation of courses and transcripts to show for his or her efforts.
5. Two-year institutions vary on the nature and quality of pre-engineering programs and advising offered and, because of this variation, students may have to complete as many as seven additional semesters or enroll full-time for approximately three years before obtaining an engineering baccalaureate degree.
6. Students at two-year institutions often take courses to satisfy the core curriculum/general education requirements without knowing that doing so may disadvantage them if they transfer into a baccalaureate engineering program. At four-year institutions, engineering programs spread the core curriculum courses across the four or five years of coursework so that native students take the necessary

prerequisite math and science courses early on, rather than squeezing the entire core curriculum courses into the first two years.

There is little question that a better mechanism for facilitating the migration of students from two-year pre-engineering programs is necessary. Timely graduation is dependent on the courses completed at the two-year institutions and the acceptance of those courses into the baccalaureate programs. These observations were reinforced by a review of current literature in this regard.

With grant support from Lumina Foundation for Education, the THECB endeavored to address these concerns by developing and implementing a comprehensive, broadly-accepted statewide transfer compact for mechanical engineering. A single discipline for statewide implementation was selected, as opposed to a number of disciplines for regional implementation, to demonstrate that statewide implementation was possible. In order to form the Mechanical Engineering Articulated Transfer Compact Committee (Committee)—the advisory committee that would assist in this effort—the THECB invited all public universities in Texas offering a bachelor's degree program in mechanical engineering and all public community colleges in Texas offering an associate's degree program in mechanical engineering-related technologies to nominate a committee representative. Seventeen universities and seven community colleges nominated representatives. The final Committee[1] was comprised of 24 engineering, math, or science deans and designees from across the state.

As of February 16, 2011, signatory institutions in the Mechanical Engineering Transfer Compact include 14 universities (representing 82 percent of Texas public universities offering the bachelor's degree in Mechanical Engineering) and 30 community and technical colleges or districts (representing 75 percent of Texas public community or technical colleges offering lower-division engineering courses). Such participation has eliminated the need for potentially up to 420 institution-to-institution articulation agreements among these signatory institutions. Additional institutional Transfer Compact participants are being recruited and are expected over time. Given inquiries, additional participants are likely to include not only public institutions of higher education in Texas, but also independent universities that offer the bachelor's degree in mechanical engineering. The list of current participants is available through the THECB (3).

When developing the transfer compact, the issues that had to be addressed included the following:

[1] The Committee was comprised of engineering deans and designees representing the following institutions: Alamo Community College District-St. Philip's College; Dallas County Community College District-Mountain View College; Dallas County Community College District-Richland College; Houston Community College System; Lamar University; Midwestern State University; San Jacinto College-Central; Tarrant County College-Southeast; Texas A&M University-Corpus Christi; Texas A&M University-Kingsville; Texas State University System; Texas Tech University; The University of Texas at Arlington; The University of Texas at Austin; The University of Texas at Dallas; The University of Texas at El Paso; The University of Texas of the Permian Basin; The University of Texas-Pan American; The University of Texas at San Antonio; The University of Texas at Tyler; Tyler Junior College; University of Houston; University of North Texas; and West Texas A&M University.

- Identification of the courses to be completed at the two-year institution,
- Addressing concerns of content and rigor, and
- Content and transferability of the course "Introduction to Engineering."

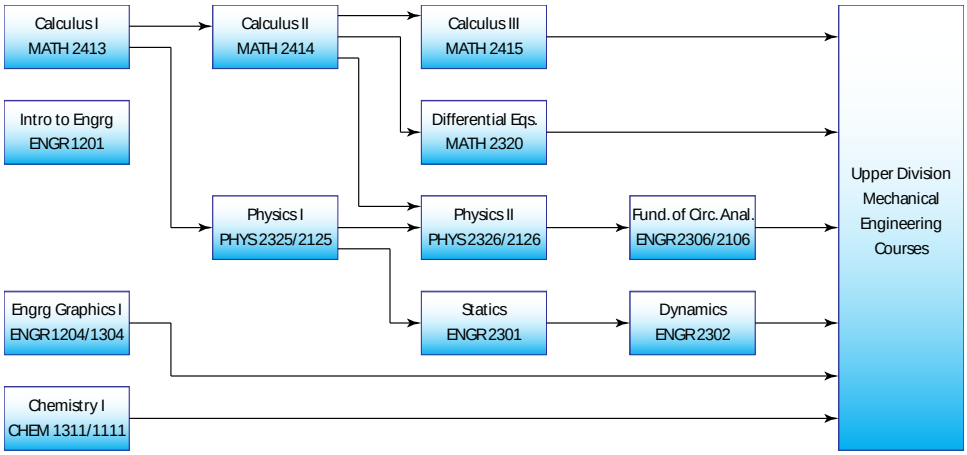
Each of these issues, and the manner in which the Committee addressed them, is discussed in the next sections of this paper.

Identification of Courses to be Completed

A number of committee and subcommittee meetings were held from March 2009 through July 2009. At the initial meeting and on behalf of their institutions, all committee members were invited to submit a list of suggested courses that students would normally complete during the first two years of a mechanical engineering degree program. When selecting these courses, consideration had to be given to what could be economically and reasonably offered at the two-year institutions.

On the basis of the courses identified, THECB staff developed a database that included the name and number of each course that advisory committee members included in their institution's suggested list. A matrix was developed that cross-referenced the courses taught by institution. A report was generated through which recommended courses could be identified as being "very common," "fairly common," "fairly uncommon," or "very uncommon" requirements among the institutions. Courses that were identified as "very common" and "fairly common" were selected for in-depth discussion and analysis, and the syllabi for those courses were requested from committee members.

Committee members ultimately came to consensus on two points: (1) the need to develop a mechanical engineering transfer agreement that could be signed by the president or chancellor of an institution or system that wished to participate voluntarily in the agreement, and (2) the need to revise course descriptions and develop course-level learning objectives for 17 courses (12 lecture courses and 5 laboratory courses) that students should take in their freshman and sophomore years in order to be successful in and on-track for upper-division engineering courses. These courses, when prerequisite requirements are fulfilled, will provide the necessary academic foundation to integrate a student from a two-year institution seamlessly into any mechanical engineering program at a four-year institution participating in the transfer agreement. The courses and required sequences of courses in the Voluntary Mechanical Engineering Transfer Compact that was developed are presented below.



After the courses to be aligned were identified, subcommittees were formed so that subject matter experts in the areas of mathematics, chemistry, physics, and engineering could review the courses as offered by multiple institutions and develop a common description and student learning outcomes. The process used by each subcommittee was:

1. Gather syllabi for a given course;
2. Review syllabi;
3. Identify common and uncommon content elements for each course;
4. Draft a course description that includes all of the common elements;
5. Draft learning objectives that include all of the common elements;
6. Debate the "leftover" uncommon elements to determine their importance for student preparation and success in subsequent courses;
7. Finalize the "consensus" course description and learning objectives; and
8. Seek feedback from content area colleagues at the institutions.

A more detailed description of the procedure used for this process is presented in Appendix A.

Concerns of Content and Rigor

During meetings of the Committee, concerns were expressed about the content and rigor of the courses taught at the two-year institutions, based on legitimate concern for the welfare of students transferring to four-year institutions. In subsequent classes, transfer students would be expected to be as prepared as native students with respect to prerequisite material in both content and depth.

The issue of "content" clearly means the coverage of topics by the instructor and the emphasis placed on those topics. Guidance as to what content is expected to be taught in a given lower-division academic course at a two-year institution is provided in the *Lower-Division Academic Course Guide Manual* (ACGM), created and maintained by the THECB Academic Affairs and Research Division through a standing committee composed of representatives of two-year and four-year institutions in Texas. With regard to content, there was surprisingly little detail in the ACGM. For example, for the entire calculus sequence (courses offered as Calculus I through Calculus IV), the ACGM (4) stated content was this:

Functions, limits, continuity, differentiation, integration, applications, sequences and series, vector analysis, partial differentiation, and multiple integration. This course may include topics in analytic geometry.

Well-intentioned instructors at two-year institutions would have no guidance whatsoever from the ACGM as to what topics needed to be covered in one of the courses in the calculus sequence. Two-year institutions, however, did on their own create comprehensive and detailed lists of student learning outcomes for each of the courses in the calculus sequence and, in fact, for all courses offered. Frequently these outcomes were thoroughly discussed with four-year institutions to which many of their students transferred. But uniformity was lacking, even with respect to a minimal subset of topics that could be expected from any course taught with a given course name. In this framework, four-year institutions could often cite examples of transfer students woefully unprepared in course content by their sending institution, giving rise to more general and legitimate concerns relative to the content of courses for which they were asked to give transfer credit.

In addition to content, the rigor of transferred courses was a concern. A course would be said to have intellectual "rigor" if the course is challenging and the students achieve the student learning outcomes. This implies that an instructor should teach the subject matter at the appropriate depth and at a pace necessary to adequately cover all required course material by the end of the semester. This also means that assigned work must be challenging, requiring that students do an appropriate amount of work outside the classroom. Since the amount of homework required of students varies widely in high schools across the state, students often have to be taught in these lower-division courses what level of homework, i.e., self-instruction, will be needed to succeed in an engineering program. One example of insufficient rigor cited was that of a student transferring a programming class from a community college in which three small programs were written. In the same programming course at the four-year institution, native students had written 10 programs, each building on the preceding one. While the content of these two courses was ostensibly the same, the rigor was vastly different. In that case, the loser was the student.

The often expressed comment was, "It does a student a disservice to allow him or her to take a course for which he/she is not prepared," i.e., the student should first repeat the prerequisite course in order to be at the same level as native students. While this may be the best course of action for an individual student, it is not appropriate from a broader statewide point of view that a student should have to repeat a course that he or she successfully passed at one institution if that course has been identified as equivalent for the purposes of transfer and program applicability across institutions. And, while the student may share responsibility for a lack of preparation, there is work to be done in the system, at least at the content level, to try to improve the situation.

With this in mind, an effort was undertaken to develop a set of expected student learning outcomes for the set of courses identified. Below is an example of a course in the Transfer Compact with its original course description, the revised course description, and the newly developed learning objectives.[2]

Differential Equations

Original Course Description (from the *Lower-Division Academic Course Guide Manual*, fall 2009):

Solutions of ordinary differential equations and applications.

Revised Course Description:

Ordinary differential equations, including linear equations, systems of equations, equations with variable coefficients, existence and uniqueness of solutions, series solutions, singular points, transform methods, and boundary value problems; application of differential equations to real-world problems. Prerequisite: MATH 2414: Calculus II

Newly Developed Learning Objectives for Differential Equations:

Upon successful completion of this course, students will:

1. Identify homogeneous equations, homogeneous equations with constant coefficients, and exact and linear differential equations.
2. Solve ordinary differential equations and systems of equations using:
   a) Direct integration
   b) Separation of variables
   c) Reduction of order
   d) Methods of undetermined coefficients and variation of parameters
   e) Series solutions
   f) Operator methods for finding particular solutions
   g) Laplace transform methods
3. Determine particular solutions to differential equations with given boundary conditions or initial conditions.
4. Analyze real-world problems in fields such as Biology, Chemistry, Economics, Engineering, and Physics, including problems related to population dynamics, mixtures, growth and decay, heating and cooling, electronic circuits, and Newtonian mechanics.

The phrase "closing the loop" is often used to indicate the repeating sequence of assessment, analysis, and adjustment. Facilitating this process is an additional benefit for students that comes from the formal recognition by the Compact of the sequence of courses (shown above) through

[2] The full list of courses, course descriptions, learning objectives, the Memorandum of Understanding signed by participating institutions, and the list of signatory institutions in the Voluntary Mechanical Engineering Transfer Compact can be found here: www.thecb.state.tx.us/mechanicalengineeringtransfercompact.

the freshman and sophomore years. The consistent sequence of courses will make it possible to track and analyze student success, so weaknesses or problems in specific courses can be identified and addressed throughout the curriculum. Further, an assessment can be made to gauge how well the high schools are preparing students, how well the prerequisites are preparing students, and how well the community colleges are preparing students for junior- and senior-level work, and appropriate corrective action can be taken.

Introduction to Engineering Course

The Issue

The course typically entitled "Introduction to Engineering" appears to be a major stumbling block in the development of a coherent statewide transfer and articulation agreement between two-year and four-year institutions for mechanical engineering or, for that matter, any engineering discipline. This course is generally taught during the first semester of enrollment in an engineering degree program. The stumbling block appears to be the intended purpose of the course. In some curricula, the course is intended to assist students in determining whether they want to pursue a career in engineering. In other curricula, the course is intended to provide an overview of engineering and to begin developing skills necessary for success in engineering studies. Finally, in other curricula, the course is designed to provide an overview of engineering and also serve as the beginning of study in a particular field of engineering, such as mechanical or civil engineering. Such different intentions make it very difficult for two-year institutions to develop a course that can be incorporated into a statewide transfer and articulation agreement and for four-year institutions to offer a course that can transfer and apply to programs at other four-year institutions.

These different purposes are at the heart of the problem when trying to agree upon a single introductory course. A single course cannot serve all three purposes, as they tend to be mutually exclusive. A course intended to help students determine whether they want to study engineering is different from a course designed to expose students who already know they want to study engineering to the different fields of engineering. And that course is yet again different from a course intended to develop knowledge, skills, and attitudes necessary for study in a particular field of engineering, knowledge, skills, and attitudes that may or may not be applicable to a different field of engineering.

A Proposed Solution

An apparent solution is the development of three independent courses, each intended to serve a particular purpose and a particular audience. The three courses are:

- An overview of engineering and science,
- An introduction to engineering and development of fundamental skills, and
- Development of fundamental discipline-specific skills.

The broad content of each of these courses is discussed in the following sections. The first two courses could be offered by both two-year and four-year institutions. The latter course would be specific to each institution offering a baccalaureate engineering degree, if the institution chooses to offer such a course. Discipline-specific courses would likely not be offered by two-year institutions because multiple courses would be needed and because of the variability among the four-year institutions.

Overview of Engineering and Science: This one credit-hour course introduces the student to the broad disciplines in engineering and science and to the possible career paths following study in each. This course would not be considered part of an engineering degree program; it is intended only as an exploratory course for those who are not sure whether they want to study engineering and want to know more. The expectation is that a number of students who take the course will not go on to become engineers or scientists; they decide on a different career.

Introduction to Engineering: This two credit-hour course is offered by both two-year and four-year institutions, with agreed upon content and learning outcomes. It is the introduction to the fields of engineering and career paths within engineering, as well as the development of study, writing, and thinking skills common in all introductory courses, be they discipline-specific or otherwise. The expectation is that all engineering students will take this course; some students may elect to change to a different major in engineering after completing this course.

Introduction to a Specific Engineering Discipline: Programs that want to have content specific to a discipline included in the introductory course would develop a free-standing, one credit-hour course that focuses on topics and problems specific to a particular engineering discipline. This one credit-hour course can be taken in parallel with the general Introduction to Engineering course or as a follow-on course. In essence, the current three credit-hour discipline-specific introductory courses would be split into a two credit-hour and a one credit-hour course, with the discipline-specific content included in the one credit-hour course.

A similar one credit-hour course could be developed by four-year institutions that expect all students to develop skills beyond those proposed in the two credit-hour introductory course. This course could be taken in conjunction with or as a follow-on course to the common Introduction to Engineering course.

Impact on Curricula and the Student

Availability of the Introduction to Engineering course, as outlined above, at the beginning of pre-engineering coursework at a two-year institution would provide the student with the greatest flexibility and provide direction for the two-year institutions offering introductory engineering course work. The two-year institutions would be able to offer a single course that would be accepted by a breadth of institutions, rather than offering multiple courses, that each serves specific institutions.

From the perspective of the four-year institution, engineering programs that currently have a two credit-hour introductory course would adopt the common course with agreed upon content. Programs that have a three credit-hour introductory course with discipline-specific content would adopt the two credit-hour introductory course and then develop a new one credit-hour discipline specific introductory course. In each case, the number of credit hours in the program would remain the same.

Conclusion and Looking Ahead

The Voluntary Mechanical Engineering Transfer Compact, established in 2009, provided the needed first step in the State of Texas toward a seamless migration process from two-year to four-year institutions for engineering students studying mechanical engineering. The development model is currently being applied to other engineering disciplines in an effort to generate the same benefits for a larger number of students.

As of February 16, 2011, Transfer Compact signatory institutions are 14 universities (representing 82 percent of Texas public universities offering the bachelor's degree in Mechanical Engineering) and 30 community and technical colleges or systems (representing 75 percent of Texas public community or technical colleges offering lower-division engineering courses). Such participation has eliminated the need for potentially up to 420 institution-to-institution transfer articulation agreements among these signatory institutions. Additional institutional Transfer Compact participants are being recruited and are expected over time. Given inquiries, additional participants are likely to include not only public institutions of higher education in Texas, but also independent universities that offer the bachelor's degree in mechanical engineering.

Even though a coherent set of courses, common descriptions, and student learning outcomes for each of those courses have been developed, at present each institution is expected to conduct its own assessment as to the achievement of the learning outcomes. Although this is a significant improvement over the past situation, concerns of the receiving institutions regarding content and rigor still remain. These concerns can be eliminated through external certification/accreditation review by an external recognized body, such as that conducted of accredited engineering programs by ABET, Inc.

To address this final unresolved concern, a model academic associate's degree program in engineering science could be developed. The associate's degree would be accredited by the Applied Science Accreditation Commission of ABET, Inc., and would represent a statewide standard of achievement for pre-engineering programs that could be implemented throughout the state. The intention is that the accredited associate's degree would be recognized by engineering programs at four-year institutions as a sufficient admission criterion to their baccalaureate engineering programs. Although more difficult to implement than the Mechanical Engineering Articulation Compact discussed in this paper, such a program is believed to alleviate several of the remaining concerns identified above by ensuring that associate's degree programs at two-

year institutions, through appropriate accreditation, meet the same standards as four-year institutions.

The fundamental thrust of the development process for the associate's degree at two-year institutions should be to develop a degree that will be "universally" accepted by four-year institutions for entry into their baccalaureate engineering degree programs. Each four-year institution would develop a "completion curriculum" to be completed on its campus that would culminate in the award of a baccalaureate engineering degree. The completion curriculum would depend upon the baccalaureate program entered and the curriculum for that program at the institution. An important consideration when developing the completion curriculum is that it be based on the body of knowledge developed in the associate's degree program and how that body of knowledge fits with the overall baccalaureate curriculum; the completion curriculum should not be based on the transfer of courses. Nevertheless, the curricular content of the engineering science associate's degree program can be developed to provide students with increased flexibility in selecting an appropriate engineering program at the four-year institution and to minimize the time to completion of the baccalaureate degree for all participating students. To be fully effective and to be recognized as having the same rigor and content as ABET-accredited engineering programs at four-year institutions, the associate's degree must be accredited/certified using the same standards as programs at four-year institutions. The expectation is that students completing the program of study and graduating with the associate's degree from the two-year institution can be immediately accepted into a four-year institution of their choice (space permitting, meeting GPA requirements, etc.) to complete the baccalaureate engineering degree.

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Appendix A—Horizontal Alignment Process

Procedures Used for Achieving Horizontal Alignment of Lower-Division Courses Across Institutions for the Voluntary Mechanical Engineering Transfer Compact

Step 1: Set Up Voluntary Advisory Committee

1. Identify through CIP code the four-year institutions that offer a bachelor's degree program in the discipline of interest.
2. Identify through CIP code the two-year institutions that offer an associate's degree program or certificate in disciplines closely related to the discipline of interest.
3. Send a notification/invitation letter and e-mail to the provost and chief instructional officer of these four- and two-year institutions inviting them to nominate a representative to serve on the voluntary articulated transfer committee for that discipline.
4. Secure a nomination form and one- to two-page vitae for each nominated representative.
5. Make necessary meeting arrangements for the first meeting of the advisory committee.
6. Send a notification/invitation letter and travel reimbursement form to all selected nominees inviting them to participate on the advisory committee and attend the initial committee meeting.
7. Determine the committee's convening co-chairpersons (one from a participating four-year institution and one from a participating two-year institution).
8. Contact the anticipated convening co-chairpersons to determine interest and willingness to serve.
9. Develop a draft agenda for the initial advisory committee meeting, and send it via e-mail to the convening co-chairpersons for final approval.
10. Send out the final agenda via e-mail to all participating committee members.

Step 2: Hold First Meeting of the Advisory Committee

1. Convene the first meeting of the advisory committee.
2. Invite committee members to introduce themselves.
3. Hold the election of the chairperson and the co-chairperson.
4. Follow the meeting agenda, provide information, encourage discussion, etc.
5. Invite all members to submit a list of suggested courses that students would normally complete during the first two years of a mechanical engineering degree program via e-mail to the staff person(s) who organized the initial meeting.
6. Determine next steps, including the date and arrangements for the next meeting of the committee.

Step 3: Identify Common and Uncommon Courses

1. Create a database with the following column headings: Course Title (i.e., one "text" field), Course Common Number (i.e., one "text" field), Names of Institutions (i.e., multiple Y/N Fields for each institution that has submitted a suggested list of courses).

2. Enter into the database the name and course number for each course that advisory committee members included in their institution's list.
3. For each entered course, indicate via Yes/No field whether or not a given institution has included that course in that institution's suggested list.
4. Create and print a report that includes as column headers the name of each course, the common course number for each course, and the name of each institution. The rows will then be the name and number of each course, with check marks indicating whether or not a given institution has included that course in the institution's suggested list. For example:

Course Title	Course #	Institution 1	Institution 2	Institution 3
Physics I	PHYS 1234	✓	✓	✓
Physics II	PHYS 1235	✓		
Calculus I	MATH 1230	✓	✓	✓

5. On the basis of the report, identify among the institutions that submitted a suggested list those courses that are: 1) very common, 2) fairly common, 3) fairly uncommon, and 4) very uncommon.
6. Request course syllabi from committee members for the very common and fairly common courses.
7. Set up subcommittees to review the course syllabi.

Step 4: Identify for Each Course Proposed, the Course Description, Co-requisites, Prerequisites, and Learning Objectives

1. Create a one- to two-page report that includes: 1) the name of each course; and 2) the name of those institutions that submitted a course syllabus for that course.
2. Print one copy of each course syllabus.
3. Retain each course syllabus on a flash drive in an electronic folder.
4. Secure a computer and projector for the purpose of projecting course syllabi and the comparison template.
5. Secure one or more professors who teach the to-be-analyzed courses for the purpose of gaining their expertise in the subject matter (e.g., math, physics, etc.).
6. Have a subcommittee member from a two-year institution review and compare the syllabi from the two-year institutions, and have a subcommittee member from a four-year institution review and compare the syllabi from the four-year institutions.
7. On the basis of syllabi comparisons and subcommittee member expertise, select the most comprehensive course description from the two-year institutions and the most comprehensive course description from the four-year institutions as the "base" course descriptions (including co-requisites and prerequisites) for the two- and four-year institution respectively.
8. Using the computer and projector:

a. Cut and paste into the comparison template under "Common Elements – Two-year Institutions" and "Common Elements – Four-year Institutions" the most comprehensive course descriptions from the course syllabi of the two-year and four-year institutions respectively.
b. Cut and paste common and non-common elements into the template as appropriate. For example, if the "base" course description contains non-common elements, cut these out of "Common Elements" and paste these into "Uncommon Elements;" if a non-base course description contains non-common elements, type these into "Uncommon Elements" to be sure to capture them.
c. Draft a consensus course description on the basis of common elements (and any uncommon elements that the course professor feels are essential for inclusion). Paste this description into the Draft Consensus Catalog Description box in the comparison template.

9. Repeat steps 8a, 8b, and 8c above for Course Outcomes (i.e., learning objectives).
10. Ensure consistency in formatting and language within the completed comparison template, paying particular attention to the action verbs used for the Draft Consensus Course Outcomes.
11. Have subcommittee members conduct a final review and edit of the completed comparison template, paying particular attention to the Draft Consensus Catalog Description and Draft Consensus Course Outcomes.
12. Submit the completed comparison template for each course to the full committee for review (including review by their campus leaders and faculty), discussion, and final approval of the consensus course descriptions and consensus course outcomes.

Step 5: On the Basis of State Statutes and Rules, Secure through Appropriate Channels Final Approval of the Advisory Committee's Recommended Transfer Compact.