College of Engineering Committee on Academic Affairs
Meeting Minutes 21 November 2013

Attendance:
Aero – Not present (Carl Hartsfield)
AVN – Not present (Seth Young)
BME – Derek Hansford
CHE – Jeff Chalmers - Chair
CIV – Not present (Frank Croft)
CSE – Ken Supowit
ECE – George Valco
ENG PHY – Not present (Richard Hughes)
ENV – John Lenhart
FAB – Not present (Ann Christy)
ISE – Carolyn Sommerich
MSE – Mike Mills
ME – Blaine Lilly: ASAP Rep
WLD – Dave Farson
Graduate Student – not present (Sadie Nasrin & Aveek Mukhopadhyay)
Undergraduate Student – Rachel Warren & Kareem Rasul

Non Voting:
Associate Dean for Undergraduate Education – Dave Tomasko
KSA – Jane Murphy
Committee Secretary – Ed McCaul

Guests – Pat West, Nikki Strader

1. The minutes from the 24 October 2013 meeting were approved as corrected.

2. Blaine Lilly informed the committee that nothing further has been heard from ECE concerning their Graduate Curriculum Proposal.

3. The Integrated Business & Engineering Honors Proposal was discussed by the committee.
3.1. Pat West, Associate Dean of Undergraduate Programs at Fisher, was introduced to the committee. She has been working with Dave Tomasko on this proposal.
3.2. Dave Tomasko informed the committee that he is trying to address the major concerns that have been raised about the proposal. The three most common ones are that it is too aggressive, too narrow, and does not have any flexibility. It is an aggressive program and will fill all of the available space in a student’s curriculum. However, it will be one of three possible honor’s options for our students with the other two being an honor’s contract or honor’s research. It is not too narrow as it will give our students a broad exposure to business. There is no flexibility in the
program as that is how it had to be designed to meet the program’s objectives.

3.3. The question was asked as what the gpa requirements were for the other two honor’s programs as this one has a gpa requirement of 3.5. The response was that the other programs have a gpa requirement of 3.4. The 3.5 was one of Fisher’s requirements as that is what they require for their honor’s program.

3.4. The program is designed as a cohort program, but students will be able to switch from one cohort to another.

3.5. The tables in the proposal showing the degree completion rate for honor students and non honor students were pointed out to the committee. The tables show that our honor students, even when taking a minor, have a high four year completion rate.

3.6. The question was asked as to who will be in charge of the program. The response was that there will be a three person group overseeing the program. Two will be faculty, one from Engineering and one from Fisher, and the third will be the clinical faculty member who will be running the capstone course for the program.

3.7. The program will only have about 30 students per cohort and there are no plans for the program to grow beyond that.

3.8. The question was asked as to whether students will be allowed to double count courses in the program with requirements in their major. The response was yes, but the hours that will double count is up to each major.

3.9. The comment was made that the proposal assumes the each student will have a large number of AP credits when they come to OSU. The comment was made that the students who are in the pilot program this spring average 20-24 hours of useable AP credit.

3.10. The comment was made that it appears that the program will be a lot harder for Engineering students than for Business students. The response was that is not true as Engineering students will be taking one less course in Business than the Business students will be taking in Engineering. Also, Business will not be allowing their students to double count Engineering courses in their major.

3.11. This will be a unique program as there is no other cross college honors program.

3.12. The question was asked as to whether the program requires too many credit hours and may exceed the university’s limit on the hours in a degree program. The response was that there is no official limit, but rather a practical limit. The tables in the proposal shows that many of our honor students graduate in four years even if they have taken a minor.

3.13. The question was asked as to whether the Business students in this program will have priority scheduling for Engineering courses as many of our sections are already over enrolled and we want to make sure that we are servicing our own students. The response was that the students in the program will have the same scheduling priority as any
honor student. However, there will only be about 12-15 Business students in the program and they will be spread out over a number of different Engineering programs. So, their impact will be minimal.

3.14. The comment was made that the total hours to a degree is deceptive on the bingo sheets as it does not include the AP credit the student is supposed to receive. It was suggested that each bingo sheet include two rows, one showing the required hours without AP credit and the second with AP credit.

3.15. The comment was made that there appears to be an AP credit creep in the university. This is a concern as all too often AP credit is not truly equivalent to a college course. However, this is a bigger issue than this proposed program.

3.16. The comment was made that the proposal still needs five concurrences.

3.17. The comment was made that the big role clinical faculty are playing in the proposed program is a concern. The response was that the program is tied to a number of existing FEH courses and the courses that are not part of the FEH program are instructor neutral.

3.18. It was decided that the proposal is not yet ready for a vote by the committee until the concurrences have been received.

4. George Valco made a motion that the Humanitarian Engineering Minor proposal be approved. Derek Hansford seconded the motion. The floor was opened for discussion. (The proposal is attached to the minutes.)

4.1. The committee was informed that the subcommittee met, requested revisions to the proposal, and that all of the revisions have been done.

4.2. While the minor is targeted at engineering students, it is possible for Arts & Science students to take it.

4.3. A question was asked about the prerequisites for the required course in the minor, ENGR 5050. The response was that this course is part of the course proposal handout that will be discussed later.

4.4. The question was asked as to who is pushing for this minor. The response was that Kevin Passino and Bob Gustafson are the two main people behind it. In addition, many of our students are requesting it.

4.5. The comment was made that the minor is not needed as students can take these course without having the minor, the minor adds additional administrative oversight to the college as well as further confusion by creating an additional option. While there may be some benefit to having the minor, the benefits are not sufficient to justify its creation.

4.6. The comment was made that the minor is not being driven by industry, but rather by our students.

4.7. The comment was made that we already have a Humanitarian Engineering Scholars program and so there is no real additional overhead for the program. In addition, our students, once they have completed the minor, will have it on their transcript.
4.8. There being no further discussion a vote was taken: 9 approved, 1 opposed, and 0 abstentions. The motion passed.

5. George Valco made a motion that the proposed change to the CBE curriculum be approved contingent upon addition of the results of the faculty vote and a cover letter from the chair. Mike Mills seconded the motion. The floor was opened for discussion. (The proposal is attached to the minutes.)

5.1. The committee was informed that this is a minor adjustment to their program and is credit hour neutral. The problem was that CBE moved their operations lab to the May term when we switched to semesters, but that compressed the course too much and caused issues for co-ops and internship. CBE’s solution is to make the lab into two 2-hour courses and offer both courses during the autumn and spring semesters.

5.2. The comment was made that the total number of hours shown on the proposal bingo sheet is incorrect. The correction of this mistake was accepted as a friendly amendment to the motion.

5.3. The committee was informed that another reason for the change was so that space in the new CBE building could be better utilized.

5.4. There being no further discussion a vote was taken: 10 approved, 0 opposed, and 0 abstentions. The motion passed.

6. Course proposals were presented to the committee.

6.1. Carolyn Sommerich made a motion that the course change requests for Aero 5752, 5615, and 8802 be approved. Blaine Lilly seconded the motion. The floor was opened for discussion.

6.1.1. The committee was informed that these are minor changes to each of the courses with the change to 5752 being a change to the title, 5615 a slight change to the prerequisites, and 8802 a correction to the cross listing course number.

6.1.2. There being no further discussion a vote was taken: 10 approved, 0 opposed, and 0 abstentions. The motion passed.

6.2. Carolyn Sommerich made a motion that the course change requests for BME 2700 and 3702 be approved. George Valco seconded the motion. The floor was opened for discussion.

6.2.1. The committee was informed that for both courses additional options are being added to the prerequisites.

6.2.2. There being no further discussion a vote was taken: 10 approved, 0 opposed, and 0 abstentions. The motion passed.

6.3. Carolyn Sommerich made a motion that the course change requests for CBE 3630 and 4630 be approved. Derek Hansford seconded the motion. The floor was opened for discussion.

6.3.1. The committee was informed that these are the two courses that are part of CBE’s proposed curriculum change. They are taking a credit hour out of one course and switching it to the other so that both courses will now be two credit hours.
6.3.2. There being no further discussion a vote was taken: 10 approved, 0 opposed, and 0 abstentions. The motion passed.

6.4. Carolyn Sommerich made a motion that the course change requests for ECE 2560, 3010, 3020, 3040, 3050, 3090, 3561, and 3567 be approved. Blaine Lilly seconded the motion. The floor was opened for discussion.

6.4.1. The committee was informed that 2560, 3010, 3020, 3040, 3050, and 3561 all have a similar minor change to their prerequisites. ECE 3090 is adding new transfer student courses to the prerequisites while 3567 is changing an “and” to an “or” in its prerequisites.

6.4.2. There being no further discussion a vote was taken: 10 approved, 0 opposed, and 0 abstentions. The motion passed.

6.5. Carolyn Sommerich made a motion that the new change request for ENGR 5050 be approved. George Valco seconded the motion. The floor was opened for discussion.

6.5.1. The committee was informed that this is the required course for all students taking the Humanitarian Engineering minor.

6.5.2. There being no further discussion a vote was taken: 9 approved, 1 opposed, and 0 abstentions. The motion passed.

6.6. Carolyn Sommerich made a motion that the course change request for FABE 4900 be approved. Mike Mills seconded the motion. The floor was opened for discussion.

6.6.1. The committee was informed that the prerequisites for this course are being changed to require students to have taken FABE 3150 and be in their last full academic year in FABE.

6.6.2. There being no further discussion a vote was taken: 10 approved, 0 opposed, and 0 abstentions. The motion passed.

6.7. Carolyn Sommerich made a motion that the course change request for ISE 5710 be approved. Derek Hansford seconded the motion. The floor was opened for discussion.

6.7.1. The committee was informed that the prerequisites were being changed so that it would be easier for graduate students to sign up for the course.

6.7.2. There being no further discussion a vote was taken: 10 approved, 0 opposed, and 0 abstentions. The motion passed.

6.8. Carolyn Sommerich made a motion that the course change requests for MSE 6605 and 8000 be approved. Blaine Lilly seconded the motion. The floor was opened for discussion.

6.8.1. The committee was informed that 6605 is being changed to 5605 to better reflect the level of the course and that 8000 is being created to give PhD students an opportunity to have a public review of their PhD research project and receive feedback on it.

6.8.2. There being no further discussion a vote was taken: 10 approved, 0 opposed, and 0 abstentions. The motion passed.

6.9. Carolyn Sommerich made a motion that the course change request for ME 5339 and the course withdrawal for ME 7040 be approved. Derek Hanford seconded the motion. The floor was opened for discussion.
6.9.1. The committee was informed that the title to 5339 is being slightly changed and the 7040 is being withdrawn as it should never have been created.

6.9.2. There being no further discussion a vote was taken: 10 approved, 0 opposed, and 0 abstentions. The motion passed.

6.10. Carolyn Sommerich informed the committee that at the next meeting she would like to discuss what rules should be established to allow the committee secretary to approve selected courses.

7. The meeting was adjourned at 11:40.
Humanitarian Engineering Minor
9/22/2013
Revised 10/16/13
Revised 11/19/13

Background and Content: Humanitarian engineering is the design and creation of products or processes that promote human welfare, especially for the economically disadvantaged or underserved. It is not a discipline of engineering (e.g., electrical, civil, or mechanical engineering), but an application area for all engineering disciplines where engineering principles and methods are used to design solutions to improve the lives of the poor and marginalized, both domestically and internationally.

Examples of humanitarian technologies for developing communities include affordable:
- Technologies for clean water and sanitation,
- Non-polluting lighting, heating, and cooking methods,
- Off-grid electricity generation (e.g., solar or bicycle),
- Agricultural technologies and methods (e.g., aquaponics or irrigation),
- Healthcare technologies, and
- Shelters.

Examples of humanitarianism in the engineering enterprise include:
- Engineer’s involvement in creating profit-generating technological products and processes for the poor (related to the debate over “aid vs. trade”) while respecting social justice (e.g., via local entrepreneurship/business development),
- Engineer’s involvement in a company’s technology transfer to the developing world, including best practices for safety, health impacts, and effectiveness;
- Engineer’s involvement in the design and operation of international manufacturing sites (e.g., “sweatshops”) in ways that respect social justice (e.g., safety, environmental impact, living wage, worker’s rights, and unions); and
- Engineer’s involvement in development and maintenance of socially responsible technology supply-chains.

The main learning objective of the Humanitarian Engineering Minor is for engineering students to gain competency in the design and creation of products and processes that promote human welfare, especially for the economically disadvantaged. The key topics to be studied in the Humanitarian Engineering Minor include:
- Social justice, engineering ethics, and professionalism standards as rationale, goals, methods, and constraints for humanitarianism;
- Poverty and international development status, goals, and role of technology;
- Collaborative design and community input to technology design process;
- Appropriate technology and extreme design constraints;
- Sustainability and environment, especially in low resource environments;
- Cultural impact on engineering business, social justice, engineering ethics, and technology;
- Design implementation and iteration and why projects fail/succeed;
- Business, engineering, and development;

Student Interest: Student interest in humanitarian engineering will primarily come from five sources:
1. There has been significant student involvement in OSU student organizations such as Engineers for Community Service (ECOS) since 2004, with both local and international projects. More recently, the Engineers Without Borders (EWB), Engineers for a Sustainable World (ESW) and Solar Education and Outreach (SOLAREO) student organizations have been formed and have been
actively pursuing projects. All these groups, and others (e.g., in architecture), have significant numbers of student members, and very active involvement in projects (e.g., there were three College of Engineering humanitarian engineering project trips in 2012-2013 to Honduras);

2. There is significant student interest and involvement (in steady state about 140 students per year), in the Humanitarian Engineering Scholars Program and these students will likely be interested in the Humanitarian Engineering Minor;

3. There is the “Global Option in Engineering” (GO ENGR) which encourages participation in international experiences/study abroad with a strong engineering focus and enrollment in courses with a global dimension. Courses (e.g., the Humanitarian Engineering course) and projects in humanitarian engineering (viewed as study abroad) will help satisfy the requirements of this option; and

4. OSU Second-Year Transformational Experience Program (STEP) includes a strong emphasis on service-learning, community service, and study abroad. Students from this program will also be prime candidates for the Humanitarian Engineering Minor.

5. Students leaving engineering for another major who may still want to develop foundational knowledge and capacity in humanitarian engineering are likely candidates for the minor.

In summary, these sources of students will ensure significant interest in the Humanitarian Engineering Minor for years to come.

Enhancing Diversity: Research has shown that women pick their career field based on how much they think that they will be able to impact humans and society. Anecdotal evidence with the above OSU engineering student organizations has shown that women participate at higher rates than men do in our humanitarian activities even though there are fewer women than men enrolled in the College of Engineering. Women are also disproportionately represented on engineering service learning trips. Over the history (2005-2013) there have been 141 participants, of which 71 (or 50.4%) have been female.

Hence, prospective women engineering students are likely to find the availability of a Humanitarian Engineering Minor appealing, and it is likely that they will participate in the minor at relatively high rates. Some researchers/practitioners in humanitarian engineering feel that a Humanitarian Engineering Minor may help recruit and retain minorities in engineering, but research has not yet shown this to be the case.

ABET Outcomes: Humanitarian Engineering courses are consistent with and will support the attainment of the expected ABET Student Outcomes. It does this in a natural way, for example design constraints of cultural, political, economic, global/societal, and contemporary issues arise in concrete ways when trying to engineer products and processes for developing communities.

Requirements for the Minor: The Humanitarian Engineering Minor is composed of three parts:

1. Humanitarian Engineering Core course(s),
2. Course(s) that provide an understanding of human welfare, especially for the economically disadvantaged, and
3. Local or international service or design project with focus on humanitarian engineering.

Completion of the Introduction to Engineering sequence is established as a prerequisite to assure students have the design training and fundamental engineering skills for success in the minor.

Requirements for completion of the minor are summarized in the following table.

<table>
<thead>
<tr>
<th>Humanitarian Engineering Minor: Curricular Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Prerequisites for Minor:</strong> ENGR 1181 and 1182, or ENGR 1281 and 1282</td>
</tr>
<tr>
<td><strong>Engineering Courses</strong></td>
</tr>
<tr>
<td>Humanitarian Engineering Core Course (required) ENGR 4194 for Spring 2014; planned permanent course number ENGR 5050 (3 credits) (Draft Syllabus attached.)</td>
</tr>
</tbody>
</table>
**Understanding of Human Welfare**

Courses in social/cultural, development/poverty, sustainability/environment, economics/international business/public policy.

- Course list to be approved by Minor Oversight Committee
- Course may double count as General Education if approved for the student’s major program.
- Courses not listed may be approved by the HE Minor Program Coordinator consistent with the criteria listed in the Appendix to this proposal.

See appendix for criteria and an example course listing.

<table>
<thead>
<tr>
<th>Possible Courses:</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGR 4692.01S Service Learning in Engineering</td>
<td></td>
</tr>
<tr>
<td>ENGR 4901 thru 4903 Multidisciplinary Capstone</td>
<td></td>
</tr>
<tr>
<td>XXXX YY93 Individual Studies in ENGR or Engineering Major</td>
<td></td>
</tr>
<tr>
<td>BUSMHR 5530 Topics in Social Entrepreneurship</td>
<td></td>
</tr>
<tr>
<td>Other Program Based Capstone Programs may qualify</td>
<td></td>
</tr>
</tbody>
</table>

**Total** | 15

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**Humanitarian Engineering Project Work**

Humanitarian engineering project; international (with trip abroad), or local/domestic service project via capstone design, student organization, or individual service. Project Work and Reporting Plan must be preapproved by the HE Minor Coordinator and taken for academic credit. May include Individual Studies. Written reflections journal to be kept throughout service project, and final project report (possibly written by a group), are required and assessed by the HE Minor Coordinator.

**Possible Courses:**
- ENGR 4692.01S Service Learning in Engineering
- ENGR 4901 thru 4903 Multidisciplinary Capstone
- XXXX YY93 Individual Studies in ENGR or Engineering Major
- BUSMHR 5530 Topics in Social Entrepreneurship
- Other Program Based Capstone Programs may qualify

**Administration and Oversight of Minor:** The College of Engineering Humanitarian Engineering Scholars Program Manager will serve as the HE Minor Program Coordinator. The HE Minor Program Coordinator with assistance from a Humanitarian Engineering Minor Oversight Committee and the Engineering Education Innovation Center (EEIC), will be responsible for this minor. Responsibilities include:

1. Answering student, faculty, and staff questions about the Minor;
2. Approving/disapproving of student requests for variations on requirements for the minor (e.g., requests by students to substitute courses in the area of understanding human welfare) with input from the Oversight Committee when appropriate;
3. Interfacing to other similar programs in the university (e.g., the proposed MS professional degree in Humanitarianism in International Studies);
4. Promoting the Minor to students (e.g., via student organizations, GO ENGR, or Humanitarian Engineering Scholars Program) and faculty (to get their involvement in development of new courses, such as a course on sustainable design, or humanitarian engineering projects);
5. Development and management of the web site for the Minor; and
6. Managing updates/modifications of the Minor.

The Oversight Committee shall have at least six members including the Director of the EEIC, Program Director for Engineering Global Studies Office, Humanitarian Engineering Scholars Program Manager (also serves as HE Minor Program Coordinator), at least three faculty, and staff with interest in Humanitarian Engineering, and others as appropriate to oversight of the minor. The Committee shall be chaired by the HE Minor Program Coordinator.

The College Core Curriculum and College Services Committee will act as the curriculum committee for the minor.

**General Guidelines:**
Required for graduation – No

Credit hours required - A minimum of 15

Filing the Minor Program form - Approval of the minor is managed entirely through the Degree Audit Reporting System (DARS). A Minor Program Forms will only be required if a student's DARS does not certify the courses for the minor as prescribed by the Offering Program. The Minor Program Form must be signed the HE Minor Program Coordinator and by the student's advisor in their Major Program. Copies of this form will be retained by the HE Program and the Major Program. To change a Minor after submitting a Minor Program Form, a student must re-file a new Minor Program Form with all the appropriate signatures.

Changing the minor - Once the minor has been filed, any changes must be approved by the Chair of the Minor’s Oversight Committee. A form will be available on the CoE website.

Grades required - No grade below a C- will be permitted in courses comprising the minor.

Course work graded Pass/Non-pass can only count towards the Humanitarian Engineering Project Work category.

Transfer credit hours allowed - No more than 6 hours of transfer credit may be applied to the minor.

Overlap with the GE Permitted.

Overlap Policy - The College of Engineering places no restrictions on the use of a course both in a minor and major program. However, students should consult their major program for any constraints that may be applied there.

Additional Guidelines for ASC Students

Overlap between minors – Each minor completed must contain 12 unique hours.

Existing Programs at Other Institutions: The following four existing related curricular programs of note have somewhat related programs. Although they are focused somewhat differently based on local conditions, they have been instructive in the formation of this proposal.

1. Penn State University, Humanitarian Engineering and Social Entrepreneurship Program (certificate program): http://www.sedtapp.psu.edu/humanitarian/hese_cert.php
3. MIT, D-Lab Development through Dialogue, Design, and Dissemination Program: http://d-lab.mit.edu/
4. University of Colorado, Boulder, Mortenson Center in Engineering for Developing Communities (certificate program): https://meced.colorado.edu/

Assessment Plan
The Oversight Committee and HE Minor Coordinator will be charged with assuring the assessment of the minor. An assessment survey will be administered by the HE Minor Coordinator to students once they complete all requirements of the humanitarian engineering minor. This assessment will address 1) the attainment of the learning objective for the minor, 2) structure, availability, and appropriateness of courses in the minor and 3) the students’ experiences completing the minor. Completion of this assessment will be the students’ last step in successfully finishing the minor.
requirements. This data, along with enrollment data, will be reviewed annually by the Oversight Committee.

**Proposal Authors:**
Robert Gustafson, Director, Engineering Education Innovation Center
Kevin Passino, Professor, Electrical and Computer Engineering
Rachel Tuttle, Program Manager, Humanitarian Engineering Scholars Program
Donald Hempson, Director, Global Studies in Engineering Office
Appendix  - Understanding Human Welfare Coursework: Criteria and Example Approved Course List

Human welfare is a very general topic that applies to individuals as well as groups of a wide variety of sizes, from families to nations and the world. The coursework demands in human welfare are meant to help humanitarian engineers understand their customers/clients, and the context in which they live, so that they can serve more effectively. Courses to be included in the “Understanding Human Welfare” category should support HE Minor students to further their understanding in ways that will be helpful to their HE program with focus on one or more of the following domains:

- Poverty
- Disabilities
- Development
- Environment and sustainability
- Culture and language (of developing countries)
- Social Entrepreneurship
- International political economy

The following Table is not comprehensive of all possible courses, but gives a representative sample. Courses will be approved by the HE Oversight Committee to be formed.
<table>
<thead>
<tr>
<th>Offering Unit</th>
<th>Course No.</th>
<th>Course Title</th>
<th>Crds</th>
<th>GE Category(s)</th>
<th>Pre-requisites</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AEDCON</td>
<td>2001</td>
<td>Principles of Food and Resource Economics</td>
<td>3</td>
<td></td>
<td></td>
<td>Microeconomic principles applied to allocation issues in the production, distribution, and consumption of food and natural resource use.</td>
</tr>
<tr>
<td>AEDECO</td>
<td>2500</td>
<td>Introduction to Environment, Economy, Development and Sustainability</td>
<td>3</td>
<td></td>
<td></td>
<td>Introduces students to principles from various disciplines related to social, economic and environmental sustainability. Students will evaluate key concepts and examine tradeoffs that are a part of sustainability action using case studies representing diverse perspectives.</td>
</tr>
<tr>
<td>AEDECO</td>
<td>2580</td>
<td>Feast or Famine: The Global Business of Food</td>
<td>3</td>
<td>soc sci human, nat, and econ resources and diversity global studies</td>
<td></td>
<td>Global and regional trends in food consumption and production are surveyed. Trade, technological change, and other responses to food scarcity are analyzed.</td>
</tr>
<tr>
<td>AEDECO</td>
<td>4532</td>
<td>Food Security and Globalization</td>
<td>3</td>
<td>Econ 2001</td>
<td></td>
<td>Examination of the causes and solutions for food insecurity. Global and local factors that affect access to food are also considered.</td>
</tr>
<tr>
<td>AEDECO</td>
<td>4536</td>
<td>Economic Development in Sub-Saharan Africa</td>
<td>3</td>
<td>Econ 2003</td>
<td></td>
<td>Issues shaping economic development and stagnation in contemporary Africa such as pollution growth, agricultural development, industrialization, trade, structural adjustment and environmental issues.</td>
</tr>
<tr>
<td>AEDECO</td>
<td>4538</td>
<td>Latin American Economic Development</td>
<td>3</td>
<td>Econ 2004</td>
<td></td>
<td>Public policy and other factors influencing economic growth in Latin America are examined.</td>
</tr>
<tr>
<td>ANTHR OP</td>
<td>4597.01</td>
<td>Cultural Conflict in Developing Nations</td>
<td>3</td>
<td>cross-disciplinarian seminar course</td>
<td>JR or SR standing</td>
<td>Analysis of cultural conflict in developing nations resulting from rapid and extensive technological and social change.</td>
</tr>
<tr>
<td>ANTHR OP</td>
<td>4597.02</td>
<td>Women, Culture and Development</td>
<td>3</td>
<td>cross-disciplinarian seminar course</td>
<td>JR or SR standing</td>
<td>An analysis of the dramatic changes occurring in women’s lives in response to development and modernization; developing and developed countries contrasted.</td>
</tr>
<tr>
<td>ANTHR OP</td>
<td>4597.05</td>
<td>The Global Food Crisis</td>
<td>3</td>
<td>cross-disciplinarian seminar course</td>
<td>JR or SR standing</td>
<td>This multidisciplinary course explores the causes, consequences and potential solutions to the global food crisis.</td>
</tr>
<tr>
<td>BUS-MHR</td>
<td>2000</td>
<td>Introduction to International Business</td>
<td>1.5</td>
<td>2001.01</td>
<td></td>
<td>Basic coverage of world trade and investment problems, and introduction to multinational corporation strategies and the various types of environments in which they do business.</td>
</tr>
<tr>
<td>BUS-MHR</td>
<td>3000</td>
<td>Advanced topics in international business</td>
<td>3</td>
<td>BUS-MHR 2000</td>
<td></td>
<td>Advanced topics in international business including strategy, alliances, and exchange</td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Title</td>
<td>Credits</td>
<td>Course Code</td>
<td>Course Title</td>
<td>Credits</td>
<td>Description</td>
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<tr>
<td>BUS-MHR 432</td>
<td>International Labor and Human Resource Management</td>
<td>3</td>
<td>BUSMHR 3100, or 3200, BusMgt 2320, and 2321</td>
<td></td>
<td></td>
<td>Examination of the human resource challenges that emerge in multi-national organizations; emphasis on issues to be considered when preparing oneself and others for international assignments.</td>
</tr>
<tr>
<td>BUS-MHR 553</td>
<td>Value Creation in Social Entrepreneurship</td>
<td>3</td>
<td>BUS_MHR 2500 and ECON 2001.01</td>
<td></td>
<td></td>
<td>Developing a business plan in social entrepreneurship</td>
</tr>
<tr>
<td>COMPST D 286</td>
<td>Modernity and Postmodernity: Issues and Ideas</td>
<td>3</td>
<td>lit and diversity global studies</td>
<td>honors standing and ENGLISH 1100</td>
<td></td>
<td>Examination of some of the defining ideas of modern thought and how those ideas have problematically affected modern life in both developed and developing countries.</td>
</tr>
<tr>
<td>EARTHS CI 341</td>
<td>Water Security in the 21st Century</td>
<td>3</td>
<td>data analy</td>
<td>Soph standing</td>
<td></td>
<td>Examine the major issues that are contributing to the decline in quantity and quality of global freshwater resources and the resultant environmental and societal impacts</td>
</tr>
<tr>
<td>EARTHS CI 442</td>
<td>Energy Resources and Sustainability</td>
<td>3</td>
<td>data analy</td>
<td>Soph standing</td>
<td></td>
<td>An examination of the problem of decreasing supplies of fossil fuel, alternative energy sources, and possible accommodations.</td>
</tr>
<tr>
<td>ECON 456</td>
<td>Cooperation and Conflict in the Global Economy</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>The economic, social, and political bases for and responses to increasing global economic integration.</td>
</tr>
<tr>
<td>GEOG 210</td>
<td>Human Geography</td>
<td>3</td>
<td>soc sci</td>
<td>individuals and groups</td>
<td></td>
<td>Introduces key concepts in human geography: interconnections between people and places; the role of space and place in political, cultural, economic, and social interactions; understanding uneven development.</td>
</tr>
<tr>
<td>GEOG 275</td>
<td>World Regional Geography</td>
<td>3</td>
<td>soc sci</td>
<td>human, natural and economic and diversity global studies</td>
<td></td>
<td>An examination of the human and physical geographic structure of all world regions; defined primarily at the continental scale. Examines regions in global context, including issues of development and underdevelopment.</td>
</tr>
<tr>
<td>GEOG 359</td>
<td>World Urbanization</td>
<td>3</td>
<td>cross-dis</td>
<td>seminar course</td>
<td></td>
<td>An examination of geographic aspects of the urbanization process in the world's major regions; interrelationships between urbanization and economic development.</td>
</tr>
<tr>
<td>GEOG 370</td>
<td>Making of the Modern World</td>
<td>3</td>
<td>soc sci</td>
<td>organizati</td>
<td>ons &amp; polities and diversity:</td>
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<tr>
<td>Course</td>
<td>Credits</td>
<td>Title</td>
<td>Course Code</td>
<td>Module</td>
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<tr>
<td>GEOG 370 2</td>
<td>Life and Death Geographies</td>
<td>3</td>
<td>soc sci human, nat, and ecoin resources</td>
<td>Geographical understanding of interactions between society and environment; how historical and contemporary views of the environment influence people's actions toward the environment and other people.</td>
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<tr>
<td>GEOG 375 2</td>
<td>Geography of Latin America</td>
<td>3</td>
<td></td>
<td>A thematic introduction to the lands and peoples of the region, with emphasis on interconnections between environment and development.</td>
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<tr>
<td>GEOG 380 0</td>
<td>Geographical Perspectives on Environment and Society</td>
<td>3</td>
<td>natural</td>
<td>Geographical understanding of interactions between society and environment; how historical and contemporary views of the environment influence people's actions toward the environment and other people.</td>
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</tr>
<tr>
<td>GEOG 390 0</td>
<td>Global Climate Change: Causes and Consequences</td>
<td>3</td>
<td></td>
<td>Examines the natural and human factors in our climate and environment and explores strategies for a sustainable environment in the future.</td>
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</tr>
<tr>
<td>GEOG 570 0</td>
<td>Geography of Development</td>
<td>3</td>
<td>economics</td>
<td>Political economy of development; development theory; the historical geography of capitalism; development and contemporary development practices and strategies.</td>
<td></td>
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</tr>
<tr>
<td>INSTDS 385 0</td>
<td>Introduction to Globalization</td>
<td>3</td>
<td>human, nat, and econ resources and diversity global studies course</td>
<td>Analysis of globalization in its various aspects, economic, political, environmental and technological, as well as of its extent and desirability.</td>
<td></td>
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</tr>
<tr>
<td>INTSTDS 250 0</td>
<td>Intro. to Development Studies</td>
<td>3</td>
<td>human, nat, and econ resources and diversity global studies course</td>
<td>Examines theories of political economy and development, as well as the historical geography of global capitalism and contemporary issues in international economic development.</td>
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</tr>
<tr>
<td>INTSTDS 453 2</td>
<td>Food Security and Globalization</td>
<td>3</td>
<td>Econ 2001</td>
<td>Examination of the causes and solutions for food insecurity. Global and local factors that affect access to food are also considered.</td>
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<tr>
<td>INTSTDS 453 6</td>
<td>Economic Development in Sub-Saharan Africa</td>
<td>3</td>
<td>Econ 2003</td>
<td>Issues shaping economic development and stagnation in contemporary Africa such as pollution growth, agricultural development, industrialization, trade, structural adjustment and environmental issues.</td>
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</tr>
<tr>
<td>INTSTDS 453 8</td>
<td>Latin American Economic Development</td>
<td>3</td>
<td>Econ 2004</td>
<td>Public policy and other factors influencing economic growth in Latin America are examined.</td>
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<tr>
<td>Course Code</td>
<td>Course Name</td>
<td>Credits</td>
<td>Description</td>
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<tr>
<td>PHILOS 133</td>
<td>Ethics in the Professions: Introduction to</td>
<td>3</td>
<td>An examination of contemporary issues in engineering ethics in the context of major ethical theories</td>
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<td></td>
<td>Engineering Ethics</td>
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<tr>
<td>POLITSC 130</td>
<td>Global Politics</td>
<td>3</td>
<td>Cooperation and conflict in world politics. Covers basic theories of international relations and key issues, including security, political economy, international organizations, and the environment</td>
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<tr>
<td>POLITSC 322</td>
<td>Politics in Developing World</td>
<td>3</td>
<td>A general introduction to the theoretical and substantive literature dealing with the historical development and contemporary characteristics of the new states of Asia and Africa,</td>
<td></td>
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<tr>
<td>POLITSC 344</td>
<td>Political Theories of Justice</td>
<td>3</td>
<td>Focuses on debates among political theorists about the meaning of justice; &quot;What is justice?&quot; and &quot;How might we order our world justly?&quot;</td>
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<tr>
<td>POLITSC 428</td>
<td>The Politics of Income Inequality</td>
<td>3</td>
<td>Introduces fundamental politics of income inequality and redistribution, including social policy development, redistributive policy differences between countries, and popularity of differing welfare programs.</td>
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<tr>
<td>POLITSC 433</td>
<td>Int'l. Environmental Policy</td>
<td>3</td>
<td>Theories and debates over sustainable development, environment, and security, and effectiveness of international regimes with a focus on international fisheries management and global climate change.</td>
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<tr>
<td>PUBHLT H 201</td>
<td>Introduction to Global Public Health</td>
<td>3</td>
<td>Public health concepts examining the philosophy, purpose, history, organization, functions, and results of public health practices domestically and internationally. Presents the pressing global public health concerns of the 21st century.</td>
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<tr>
<td>PUBHLT H 331</td>
<td>Current Issues in Global Environmental Health</td>
<td>3</td>
<td>Fundamental concepts and principles of environmental health are presented through a critical review and discussion of current issues in global environmental health.</td>
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<tr>
<td>RURLSOC 358</td>
<td>Social Groups in Developing Societies</td>
<td>3</td>
<td>Contemporary struggles and experiences of rural social groups in the &quot;Third World&quot; in the context of development and globalization; emphasis on grassroots initiatives and resistance movements.</td>
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<tr>
<td>SOCIOL 330</td>
<td>Technology and Global Society</td>
<td>3</td>
<td>Social aspects of technology, social change, and technological development; underdevelopment and the global economy.</td>
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<tr>
<td>SOCIOL 330</td>
<td>Sociology of Poverty</td>
<td>3</td>
<td>A study of low-income peoples, especially concerning the effect of poverty on them, and their consequent social participation.</td>
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<tr>
<td>Course Code</td>
<td>Title</td>
<td>Credits</td>
<td>Prerequisites</td>
<td>Description</td>
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<tr>
<td>SOCIOL 346</td>
<td>Social Stratification: Race, Class, and Gender</td>
<td>3</td>
<td>soci sci huan, nat, and econ resources</td>
<td>The study of social inequality with a focus on inequalities by class and status, race and ethnicity, and gender.</td>
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</tr>
<tr>
<td>SOCIOL 359</td>
<td>World Problems in Global Context</td>
<td>3</td>
<td>cross-disciplinary seminar course</td>
<td>Sociological analysis of contemporary world societies - non-industrialized, industrializing, and industrialized - with special attention to major social institutions and patterns of social change.</td>
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<tr>
<td>SOCIOL 556</td>
<td>Global Inequality and Poverty</td>
<td>3</td>
<td>Sociology at 2000-3000 level or above</td>
<td>Focus on globalization, world-wide inequalities, and poverty in sociological perspective with particular attention to the causes, correlates, and consequences of global poverty and inequality.</td>
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<tr>
<td>WGSST 353</td>
<td>Women, Environment and Development</td>
<td>3</td>
<td></td>
<td>Interdisciplinary study of women's roles as environmental stewards and in resource-based development in global context. Attention given to gender differences in environmental and rural practices.</td>
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</tr>
</tbody>
</table>
Proposal to modify the format of Unit Operations Lab Courses (CBE 3630/4630)

The current format for Unit Operations requires students to complete CBE 3630 (1 credit) during spring semester followed by CBE 4630 (3 credits) during May session. The material and background content for the labs as well as safety standards are covered in a two-hour lecture once a week in the spring. Each student then completes four full lab experiences/experiments and is given a walk-through of the remaining eight available experiments during the May session course.

The proposed change would eliminate the May session course and instead include two-2 credit courses (3631 in spring; 3632 in autumn). Students would complete two experiments along with presentations during each semester along with a walk through of four experiments. They would be divided so that a particular student group would meet in the lab every fourth Friday to complete the experiment and would also meet weekly in class to cover the material and safety standards for the labs.

Reasons for the proposed change

1) Requiring students to complete the lab portion of the course in May session limits their ability to acquire work experiences through co-ops and internships due to the shortened summer. Employers are looking for students to complete 12-14 week work terms but there are only 10 weeks remaining in the summer following May session. Moving the course to the regular academic year would open up an additional summer for these work experiences.

2) With the increase in enrollment in the department, the enrollment in Unit Operations has also increased dramatically (115 students in Su12; 180 students in Su13). Condensing the lab portion of the course in four weeks during May session has required the addition of Saturdays to the weekly class schedule which causes strain on both the students and instructors/TAs. Department enrollment continues to increase so we can expect even larger future enrollment in these courses.

3) Condensing the course into four weeks during May session, as well as the increase in enrollment, has forced the instructor to remove the student presentations that were formerly required. These presentations provide further reinforcement of the class material and allow students to build and reinforce their communication and presentation skills.

Curricular changes

The required hours to degree would remain at 132. The only change would be a modified course schedule as shown on the attached bingo sheet which would be effective for the 2014-15 academic year (CBE 3631 will first be offered in spring 2015). The current bingo sheet for 2013-14 has also been attached for comparison purposes.

Additional notes

Students who had last completed the Unit Operations sequence in Sp13/Su13, were surveyed and the consensus was that they were in favor of the change due to the ability for future students to have more opportunity for work experiences. CBE faculty are also in favor of the change due to the benefits to the students.
### Suggested Curriculum
This should be used as a **guide** only. Semester offerings are subject to change.

<table>
<thead>
<tr>
<th>Year</th>
<th>Autumn</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CHEM 1210 <em>(Gen Chem I)</em>...................... 5 hr</td>
<td>CHEM 1220 <em>(Gen Chem II)</em>..................... 5 hr</td>
</tr>
<tr>
<td></td>
<td>MATH 1151 <em>(Calculus I)</em>...................... 5 hr</td>
<td>MATH 1172 <em>(Engineering Math A)</em>............. 5 hr</td>
</tr>
<tr>
<td></td>
<td>ENGR 1181.xx <em>(Fundamentals of ENGR I)</em>..... 2 hr</td>
<td>ENGR 1182.xx <em>(Fundamentals of ENGR II)</em>..... 2 hr</td>
</tr>
<tr>
<td></td>
<td>ENGR 1110.04 <em>(Engineering Survey I)</em>....... 0.5 hr</td>
<td>ENGR 1120.04 <em>(Engineering Survey II)</em>....... 0.5 hr</td>
</tr>
<tr>
<td></td>
<td>General Education................................ 3 hr</td>
<td>Engr 1221 or CSE 1222*(Programming)*........ 2-3 hr</td>
</tr>
<tr>
<td>2</td>
<td>CHEM 2510 <em>(Organic Chemistry I)</em>............ 4 hr</td>
<td>CHEM 2520 <em>(Organic Chemistry II)</em>............ 4 hr</td>
</tr>
<tr>
<td></td>
<td>PHYSICS 1250 <em>(Mechanics, Thermal, Waves)</em>  5 hr</td>
<td>PHYSICS 1251 <em>(E&amp;M, Optics, Modern Phys)</em>... 5 hr</td>
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<tr>
<td></td>
<td>MATH 2177 <em>(Mathematical Topics for Engineers)</em>  4 hr</td>
<td>CBE 2420 <em>(Transport Phenomena I)</em>............ 4 hr</td>
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<td>CBE 2200 <em>(Process Fundamentals)</em>............. 4 hr</td>
<td>CBE 2523 <em>(Separation Processes)</em>.............. 3 hr</td>
</tr>
<tr>
<td>3</td>
<td>CHEM 4300 <em>(Physical Chemistry I)</em>.......... 3 hr</td>
<td>CBE 3610 <em>(Kinetics and Reactor Design)</em>..... 4 hr</td>
</tr>
<tr>
<td></td>
<td>Math or Stats Technical Elective............. 3 hr</td>
<td>CBE 3631 <em>(Unit Operations Lab I)</em>............ 2 hr</td>
</tr>
<tr>
<td></td>
<td>CBE 3508 <em>(Thermodynamics)</em>................... 4 hr</td>
<td>CHEM 2540 <em>(Organic Chemistry Lab I)</em>........ 2 hr</td>
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<td></td>
<td>CBE 3521 <em>(Transport Phenomena II)</em>.......... 4 hr</td>
<td>General Education................................ 4 hr</td>
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<tr>
<td></td>
<td>General Education................................ 3 hr</td>
<td>Technical Elective................................ 3 hr</td>
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<td></td>
<td>General Education................................ 3 hr</td>
<td>General Education................................ 3 hr</td>
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<tr>
<td>4</td>
<td>CBE 4624 <em>(Process Dynamics and Control)</em>.... 3 hr</td>
<td>CBE 4764 <em>(Process Sim &amp; Product Eng)</em>........ 4 hr</td>
</tr>
<tr>
<td></td>
<td>CBE 4760 <em>(Process Design, Econ, &amp; Strategy)</em> 4 hr</td>
<td>Technical Elective................................ 3 hr</td>
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<td>Technical Elective................................ 3 hr</td>
<td>BIOLOGY 2100 <em>(Biological Analysis)</em>........ 4 hr</td>
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<td>General Education................................ 3 hr</td>
<td>General Education................................ 3 hr</td>
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<td></td>
<td>General Education................................ 3 hr</td>
<td>General Education................................ 3 hr</td>
</tr>
<tr>
<td></td>
<td>CBE 3632 <em>(Unit Operations Lab II)</em>.......... 2 hr</td>
<td>CBE 3632 <em>(Unit Operations Lab II)</em>.......... 2 hr</td>
</tr>
</tbody>
</table>

Total Hours to complete the degree program = 132

### Program Options
Students wishing to complete the biomolecular focus will substitute Biochemistry 4511 in place of Chemistry 2520.

### Acceptance Criteria
Acceptance into this program is based on the eligibility point hour ratio (EPHR) of Math 1151, 1172; Engineering 1181.xx, 1182.xx; and Chemistry 1210, 1220. A minimum 2.0 cumulative point hour ratio (CPHR) and EPHR is required and admission is competitive. Applications are accepted during Autumn Term and Spring Term.
Technical and Other electives
Students have the option to complete a biomolecular, environmental, or polymer focus for their technical elective plan. Each focus will require the completion of two approved courses in CBE plus one additional course in CBE or in another department. All students will also be required to complete one math or statistics technical elective.

___CBE XXXX…………………………..(3 hr)
___CBE XXXX…………………………..(3 hr)
___Math/Stat XXXX…………………..(2-4 hr)
___Additional Course XXXX ……..(2-4 hr)
___Total Hours (minimum of 12 are required)

General Education Requirement

Writing and Communication
English 1110.xx 3 hr
Second Writing Course 3 hr

Social Science
Only one course per Social Science group may count.

Literature 3 hr

Visual and Performing Arts 3 hr

Historical Study 3 hr

Second Historical Study or Cultures and Ideas 3 hr

Social Diversity in the United States
Course may overlap with another general education category.

Ethics
Ethics courses listed below may overlap with their corresponding general education category.
Social Science, Individual & Groups sub-category: Economics 3048.
Social Science, any sub-category: Sociology 3302, Sociology 3464.
Cultures & Ideas: Comparative Studies 2341, Philosophy 1332.

Foreign Language
Pre-approved substitutions
A. Substitution A: Completion through enrollment in a foreign language sequence through 1103, or enrollment in a foreign language course with a prerequisite of 1103, can be substituted for one Gen Ed course requirement as a Cultures & Ideas.
B. Substitution B: Completion of a foreign language minor can be substituted for two Gen Ed courses: one course as a Social Science, (Individuals & Groups or Organizations & Polities subgroups only) and one course as either a Literature or a Cultures & Ideas.

Parameters: These substitutions are permitted when the credit is earned through successful completion of the course at OSU. Credit earned at another institution (K credit), or credit by examination (EM credit) is not applicable. Students must choose either Substitution A OR Substitution B. Both substitutions cannot be applied simultaneously.

University Capstone (Cross-Disciplinary Seminar)
Pre-approved substitutions
Completion of a Social Science 3597 or 4597 can be substituted for a Social Science general education course in any group.
Completion of an Arts & Humanities 3597 or 4597 can be substituted for a Visual/Performing Arts general education course. See the list of approved general education courses for additional details: www.engineering.osu.edu/major.
**B.S. Chemical Engineering 2013-2014 Academic Year**

**Student Information**
Name: ___________________ OSU ID: ___________ OSU Admit Term: _________
Phone: ___________________ Email (name.number@osu.edu): ___________________

**Suggested Curriculum**
This should be used as a guide only. Semester offerings are subject to change.

<table>
<thead>
<tr>
<th>Year</th>
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<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CHEM 1210 <em>(Gen Chem I)</em>, 5 hr</td>
<td>CHEM 1220 <em>(Gen Chem II)</em>, 5 hr</td>
</tr>
<tr>
<td></td>
<td>MATH 1151 <em>(Calculus I)</em>, 5 hr</td>
<td>MATH 1172 <em>(Engineering Math A)</em>, 5 hr</td>
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<td></td>
<td>ENGR 1181.xx <em>(Fundamentals of ENGR I)</em>, 2 hr</td>
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</tr>
<tr>
<td></td>
<td>ENGR 1110.xx <em>(Engineering Survey I)</em>, 0.5 hr</td>
<td>ENGR 1120.xx <em>(Engineering Survey II)</em>, 0.5 hr</td>
</tr>
<tr>
<td></td>
<td>General Education, 3 hr</td>
<td>Engr 1221 or 1222 <em>(Programming)</em>, 2 or 3 hr</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CHEM 2510 <em>(Organic Chemistry I)</em>, 4 hr</td>
<td>CHEM 2520 <em>(Organic Chemistry II)</em>, 4 hr</td>
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<td></td>
<td>PHYSICS 1250 <em>(Mechanics, Thermal, Waves)</em>, 5 hr</td>
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<td>MATH 2177 <em>(Mathematical Topics for Engineers)</em>, 4 hr</td>
<td>CBE 2420 <em>(Transport Phenomena I)</em>, 4 hr</td>
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<td></td>
<td>CBE 2200 <em>(Process Fundamentals)</em>, 4 hr</td>
<td>CBE 2523 <em>(Separation Processes)</em>, 3 hr</td>
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<td>3</td>
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<td>CHEM 4300 <em>(Physical Chemistry I)</em>, 3 hr</td>
<td>CBE 3610 <em>(Kinetics and Reactor Design)</em>, 4 hr</td>
</tr>
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<td></td>
<td>Math or Stats Technical Elective, 3 hr</td>
<td>CBE 3630 <em>(Unit Operations Lab I)</em>, 1 hr</td>
</tr>
<tr>
<td></td>
<td>CBE 3508 <em>(Thermodynamics)</em>, 4 hr</td>
<td>CHEM 2540 <em>(Organic Chemistry Lab I)</em>, 2 hr</td>
</tr>
<tr>
<td></td>
<td>CBE 3521 <em>(Transport Phenomena II)</em>, 4 hr</td>
<td>BIOLOGY 2100 <em>(Biological Analysis)</em>, 4 hr</td>
</tr>
<tr>
<td></td>
<td>General Education, 3 hr</td>
<td>Technical Elective, 3 hr</td>
</tr>
<tr>
<td></td>
<td>General Education, 3 hr</td>
<td>General Education, 3 hr</td>
</tr>
</tbody>
</table>

**Summer:** CBE 4630 *(Unit Operations Lab II)*, 3 hr

| 4    |        |        |
|      | CBE 4624 *(Process Dynamics and Control)*, 3 hr | CBE 4764 *(Process Sim & Product Eng)*, 4 hr |
|      | CBE 4760 *(Process Design, Econ, & Strategy)*, 4 hr | Technical Elective, 3 hr |
|      | Technical Elective, 3 hr | General Education, 3 hr |
|      | General Education, 3 hr | General Education, 3 hr |
|      | General Education, 3 hr | General Education, 3 hr |

Total Hours to complete the degree program = 132-133

**Program Options**
Students wishing to complete the biomolecular focus will substitute Biochemistry 4511 in place of Chemistry 2520.

**Acceptance Criteria**
Acceptance into this program is based on the eligibility point hour ratio (EPHR) of Math 1151, 1172; Engineering 1181.xx, 1182.xx; and Chemistry 1210, 1220. A minimum 2.0 cumulative point hour ratio (CPHR) and EPHR is required and admission is competitive. Applications are accepted during Autumn Term and Spring Term.
**Technical and Other electives**
Students have the option to complete a biomolecular, environmental, or polymer focus for their technical elective plan. Each focus will require the completion of two approved courses in CBE plus one additional course in CBE or in another department. All students will also be required to complete one math or statistics technical elective.

____CBE XXXX……………………..(3 hr)
____CBE XXXX……………………..(3 hr)
____Math/Stat XXXX………………..(2-4 hr)
____Additional Course XXXX ……..(2-4 hr)
____Total Hours (minimum of 12 are required)

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**General Education Requirement**

**Writing and Communication**

- **English 1110.xx** 3 hr
- **Second Writing Course** 3 hr

**Social Science**

*Only one course per Social Science group may count.*

- 3 hr
- 3 hr

**Literature**

- 3 hr

**Visual and Performing Arts**

- 3 hr

**Historical Study**

- 3 hr

**Second Historical Study or Cultures and Ideas**

- 3 hr

**Social Diversity in the United States**

*Course may overlap with another general education category.*

- 0 / 3 hr

**Ethics**

*Ethics courses listed below may overlap with their corresponding general education category.*

- Social Science, Individual & Groups sub-category: Economics 3048.
- Social Science, any sub-category: Sociology 3302, Sociology 3464.
- Cultures & Ideas: Comparative Studies 2341, Philosophy 1332.

- 0 / 3 hr

**Foreign Language**

*Pre-approved substitutions*

A. Substitution A: Completion through enrollment in a foreign language sequence through 1103, or enrollment in a foreign language course with a prerequisite of 1103, can be substituted for one Gen Ed course requirement as a Cultures & Ideas.

B. Substitution B: Completion of a foreign language minor can be substituted for two Gen Ed courses: one course as a Social Science, (Individuals & Groups or Organizations & Polities subgroups only) and one course as either a Literature or a Cultures & Ideas.

Parameters: These substitutions are permitted when the credit is earned through successful completion of the course at OSU. Credit earned at another institution (K credit), or credit by examination (EM credit) is not applicable.

Students must choose either Substitution A OR Substitution B. Both substitutions cannot be applied simultaneously.

**University Capstone (Cross-Disciplinary Seminar)**

*Pre-approved substitutions*

Completion of a Social Science 3597 or 4597 can be substituted for a Social Science general education course in any group.

Completion of an Arts & Humanities 3597 or 4597 can be substituted for a Visual/Performing Arts general education course. See the list of approved general education courses for additional details: [www.engineering.osu.edu/major](http://www.engineering.osu.edu/major).