

Executive Summary Revised 2/28/16

UK College of Engineering

First-Year Engineering Curriculum and Course Change Proposal

The nine Bachelor of Science degree programs in the UK College of Engineering propose a First-Year Engineering curriculum to increase retention through hands-on laboratory courses, improve preparation for discipline specific coursework and recruit students as undeclared engineering students while they make an informed decision about the degree program best suited to their interests and career goals. Elements of the proposal include:

- Rationale for the First-Year Engineering curriculum
- Three new First-Year courses
 - EGR 101 Engineering Exploration I (1 credit)
 - EGR 102 Fundamentals of Engineering Computing (2 credits)
 - EGR 103 Engineering Exploration II (2 credits)
- One new introductory course for transfer students
 - EGR 112 Engineering Exploration for Transfer Students (1 credit)
- UK Core Arts & Creativity request
- Structure, oversight and assessment of the First-Year Engineering curriculum
- Curriculum Change Forms
 - All nine degree programs incorporating the new EGR courses
 - Additional curriculum revisions in some degree programs
 - Updated Engineering Standing criteria
 - Acknowledgment by departments whose courses will be dropped or added
 - New course and course change applications in eCats

Rationale:

First-Year Engineering (FYE) curricula representing multiple engineering disciplines are several decades old and range from a single seminar course to sequences of courses differentiated for pre-calculus to honors students. High school students who are unsure of which type of engineering is most appealing are drawn to schools with broader freshman year experiences with the opportunity to delay the selection of a major. In addition, exposing first year students to hands-on engineering experiences while they are taking their math, chemistry and physics classes not only develops engineering skills early on but increases retention and graduation rates by keeping the students actively engaged in the engineering disciplines. Within the Southeastern Conference engineering schools, five institutions offer FYE courses and none are as comprehensive as the proposed UK FYE content. For example, Vanderbilt University students choose three five-week modules and an optional seminar rather than exposure to all degree programs. University of Tennessee offers Engineering Fundamentals courses which focus on Physics for Engineers for calculus ready students. Texas A&M, University of Alabama and University of Arkansas FYE opportunities are fewer credit hours when compared to the UK COE curricula with some disciplinary specific coursework. Engineering schools that have adopted a FYE curriculum have reported improved retention and graduation rates. For example, the University of Tennessee demonstrated an increase in 1st year retention from 60% to 80% and an increase in 6-year graduation rate from 40.5% to 46.6%. Their 6-year graduation rate for females showed a dramatic increase from 39.7% to 51.6%.

Ohio State also adopted a similar curricula and reported an increase in 6-year graduation rate from 37% to 60% and a first year retention rate of 80%. Tennessee also reported that the grades obtained by their students in higher-level courses increased after adopting the FYE curriculum.

The College of Engineering is proposing a FYE curriculum where all incoming freshmen engineering students will be admitted as an undeclared engineering student and will change to the pre-major of their choice during the spring registration cycle for their 2nd year classes. No additional admission criteria or enrollment limits will prevent students from declaring a major. Each program already has Engineering Standing criteria in place to ensure students are making satisfactory progress toward their degree. All students will be required to complete three Engineering courses EGR 101, 102, 103 during the first year while completing CIS/WRD, science and math classes.

Transfer students will be admitted directly to a pre-major program and enrolled in EGR 112 with other transfer students rather than EGR 101. Both 101 and 112 emphasize study skills and university resources available to help them become successful engineering students. Specific technical skills covered in EGR 101 as modules will also be used in EGR 112, however, transfer students will only need to complete the modules that fill gaps from their previous coursework. Students will not be allowed to earn credit for both EGR 112 and 101 (one or the other). If a student has AP credit or transfer credit for the programming language taught in EGR 102, they will not need to take EGR 102. We do expect everyone to take EGR 103 for the teamwork and design process experience. Transfer students will not be prevented from going forward with coursework in their major and can take the EGR courses simultaneously.

The College of Engineering section of the UK Bulletin has some inconsistencies in the way in which each degree program has presented its Pre-Major Requirements, Major Requirements and criteria for Engineering Standing. Entries in the Curriculum Change forms reflect the current information as it appears in the Bulletin, however, we would like to present a more consistent set of descriptions going forward. For example, the Pre-Major Requirements will now be the courses listed in the first three semesters of each degree program. Engineering Standing criteria are determined by the faculty in each program and calculated based on a subset of the Pre-Major courses in that program. The Major Requirements are now the required courses in semesters four through eight. As a result of these clarifications, it will be much easier for prospective students to compare and contrast their options as part of their decision to choose the UK College of Engineering and subsequently choose their major at the end of the First-Year experience.

EGR Courses:

EGR 101 Engineering Exploration I

1 credit

Lecture

Major Revision

Arts & Creativity

Course Description: Engineering Exploration I introduces students to the creativity inherent in how engineers and computer scientists approach innovation, design and problem solving from blue sky brainstorming to implementing a solution. Students will work in teams, practice with tools of the trade (modeling, analysis and visualization), provide peer reviews and discuss ethical implications of creative endeavors. This class is also a process of personal discovery where students explore a variety of traditional and non-traditional study and learning methods, reflect on the results of using different

methods and determine what work best for their individual learning styles and personality type. The final individual artifact is a Create Your Future project describing the student's exploration of their own talents and aptitudes, discovery process for identifying a specific discipline and a visual presentation of their career goals. Open to students enrolled in the College of Engineering.

Prerequisites: Enrolled in the College of Engineering or MA ACT of at least 23 or equivalent.

EGR 102 Fundamentals of Engineering Computing

2 credits Lecture and Lab New course

Course Description: Fundamentals of Engineering Computing introduces students to the practice and principles of computer programming and computational problem solving. Students will engage in hands-on project-based problem solving using modern computer software and hardware, with a particular emphasis on problems and techniques commonly appearing in various domains of engineering. Open to students enrolled in the College of Engineering.

Prerequisites: Enrolled in the College of Engineering or MA ACT of at least 23 or equivalent.

EGR 103 Engineering Exploration II

2 credits Lecture and Lab New course Arts & Creativity

Course Description: Engineering Exploration II focuses on a semester long creative engineering design project with students working in teams to apply the skills and tools introduced in EGR 101 (or EGR 112) and EGR 102. Topics and assignments include more in depth engagement with engineering tools for modeling, analysis, visualization, programming, hardware interfacing, team development, documentation and communication. Students gain experience in project management, identifying constraints, accepting and providing critical analysis, iterating to refine their work, and technical report writing.

Prerequisites: Prereq: EGR 102 or equivalent; Prereq or concur: MA 113

EGR 112 Engineering Exploration for Transfer Students

1 credit Lecture New course Arts & Creativity

Course Description: Engineering Exploration for Transfer Students welcomes transfer students to the College of Engineering and introduces them to the creativity inherent in how engineers and computer scientists approach innovation, design and problem solving from blue sky brainstorming to implementing a solution. Students will work in teams, practice with tools of the trade (modeling, analysis and visualization), provide peer reviews and discuss ethical implications of creative endeavors. This class is also a process of personal discovery where students explore a variety of traditional and non-traditional study and learning methods, reflect on the results of using different methods and determine what work best for their individual learning styles and personality type. The final individual artifact is a

Create Your Future project describing the student's exploration of their own talents and aptitudes, discovery process for identifying a specific discipline and a visual presentation of their career goals. Students who received credit for EGR 101 are not eligible for EGR 112..

Prerequisites: Enrolled in the College of Engineering or MA ACT of at least 23 or equivalent. Students who received credit for EGR 101 are not eligible for EGR 112.

UK Core Arts & Creativity Request:

Credit for Intellectual Inquiry – Arts & Creativity is requested for EGR 101, 103 and 112 to provide students with a total of 3 credit hours from two courses. EGR 101 for freshmen and EGR 112 for transfer students include personal reflection assignments, peer feedback and an individual design project on their plans for becoming a successful engineering student. The technical tools used in all three courses are different approaches which can be used independently or simultaneously to design and solve engineering problems. Students will be introduced to disciplinary practices from all engineering degree programs, appropriate resources from each discipline and opportunities for co-curricular involvement with student organizations and local professional societies. The semester-long design project in EGR 103 will involve identifying constraints and requirements, preliminary design reviews and a critical design review where their creative output will be evaluated and feedback into refining their product. The final product will include written and graphical documentation, a working prototype and demonstration of the prototype accomplishing the goals defined at the start of the project.

Active learning methods will be used in EGR 101 and 112 to stimulate small group discussion and peer review of student success strategies, problem solving methods and team teaching of technical skills. The Design Your Process project on individual student success is a fulfillment-focused creative process encouraging students to set academic and professional goals, take personal responsibility for their progress and enjoy time on task in rigorous challenging courses. The team design projects in EGR 103 will be more constraint-focused and product-focused creative endeavors working with a somewhat limited set of materials. Risk-taking will be encouraged in the safer virtual domains of software, simulation, visualization and optimization before committing to the real world assembly of the prototype. Tools including hardware and software, and information literacy on the many aspects of design will be presented and quizzed on a weekly basis. In addition to getting involved in student organizations, students in EGR 101 will be expected to attend a minimum of four Engineering Information Sessions and reflect on the information in preparation for the Change of Major and registration for discipline specific courses.

Structure, Oversight and Assessment of the First-Year Engineering Curriculum:

The FYE Curriculum is under the leadership of the Director, Dr. Janet Lump. In the development phase, the Department Chairs and Directors of Undergraduate Studies have provided input as well as a committee of representatives from each degree program defining the technical content appropriate for each EGR course. Regular Title Series Faculty, Lecturers, Staff and Special Title Series Faculty will teach the multiple sections of EGR 101, 102, 103 and 112, along with graduate and undergraduate teaching assistants. In anticipation of a Fall 2016 launch of the new courses, the College of Engineering plans to

hire 4 or 5 additional Lecturers and/or Special Title Series Faculty with academic appointments in departments and effort assigned by the Dean of Engineering to the FYE Curriculum. An Advisory Committee will be formed with one tenured Associate or Full Professor representative from each engineering degree program. The Advisory Committee will conduct annual performance reviews of the Lecturers and STS Faculty, review student course evaluations and evaluate progress toward goals set by the Dean for recruitment, retention and graduation. In addition, the Advisory Committee will help identify discipline specific content for EGR course assignments and assess how the EGR content is impacting the students and courses during the sophomore, junior and senior years. As part of the annual review process, the Director will solicit input from all of the faculty teaching sections of the EGR 101, 102, 103 and 112 courses and present the results to the Advisory Committee. The Advisory Committee may recommended changes which will then be taken to the FYE Faculty and Associate Dean for Administration and Academic Affairs for consideration. Changes will be subject to the appropriate College and University approval procedures which may include review by the College of Engineering Faculty as the faculties of record.

College of Engineering Process and Faculty Approval

Beginning Spring 2014, Dean John Walz and Associate Dean Kim Anderson visited a number of Universities that currently have a Freshman Engineering Program. These included Ohio State, Purdue, University of Michigan and Michigan State. On July 17, 2014, the proposal to adopt a First Year curriculum was discussed with the Chairs and Associate Deans at an all-day retreat. During Fall 2014 and Spring 2015, the Directors of Undergraduate Studies in the College of Engineering and a working group of interested faculty worked on both the First Year Engineering curriculum and the engineering courses that would be offered as part of the program. Each group met at least once a month during this time. On April 28, 2015, a College of Engineering Faculty meeting was held where the proposed curriculum was presented to the faculty in attendance. The PowerPoint slides were then circulated to the entire faculty for their review. Also in Spring 2015, a search for the Director of the First-year Engineering Curriculum was conducted, resulting in the selection of Dr. Janet Lumpp and 50% appointment. On May 12, 2015 a mandatory meeting with the Chairs and Directors of Undergraduate Studies was conducted with Dean Walz, Associate Dean Anderson and Dr. Lumpp to further discuss the curriculum. At this meeting, it was decided to move forward with the plans. Dr. Lumpp met at least once a month with various stakeholders over the spring and summer of 2015 including the Directors of Undergraduate Studies to develop and revise the original two-course sequence into a three-course sequence and a pathway for transfer students. Another debriefing meeting was held with the Chairs and Directors of Undergraduate Studies on July 10, 2015. During faculty retreats and meetings in August and September of 2015, the faculty in each department reviewed the course descriptions and voted to endorse the curriculum. The Directors of Undergraduate Studies then worked to revise their curricula and faculty again voted as recorded on the Curriculum Change forms. In October 2015, the entire package including the changes in the curricula, new courses and change in courses were reviewed by the College of Engineering Undergraduate Education Team and the College of Engineering faculty prior to being sent to the Undergraduate and Graduate Councils. In addition to College approval, the proposed Freshman Engineering curriculum was discussed with the Dean's Advisory Council at both Spring and Fall meetings beginning in Spring, 2014 and was very well received by members of the Council.

Biosystems Engineering

Voted at faculty meeting on August 18-19, 2015. Passed unanimously. All active faculty were present at retreat.

Chemical and Materials Engineering

Voted at faculty meeting on August 26, 2015. Passed unanimously. 18 Chemical faculty members (4 Paducah) voted. 7 Materials faculty voted.

Civil Engineering

Voted on August 20, 2015. The count was 18-1.

Electrical and Computer Engineering

Voted at faculty meeting on September 29, 2015. Passed unanimously. 17 faculty members voted.

Computer Science

Voted on August 24, 2015. The count was 18-0.

Mechanical Engineering

Voted at faculty meeting on September 24, 2015. 22 in favor and 2 against.

Mining Engineering

Voted at faculty meeting on September 2, 2015. 6 approved and 1 abstained.