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M E M O R A N D U M

TO: UUPC

FROM: Dr. P. Edgar An, Department of Ocean and Mechanical Engineering

SUBJECT: Proposed Mechanical Engineering Curricular Changes

DATE: January 15, 2020

This memo is to describe the proposed curricular changes in the Mechanical Engineering Program. Overall, three existing courses will be modified, and two technical elective courses created. These changes have been approved by the ME faculty.

Existing Courses to be Modified

1. EGM 4350 (Finite Element Analysis, 3 credit hours)
2. EGM 4045 (Electro-Mechanical Devices, 3 credit hours)
3. EML 4521C (Engineering Design, 3 credit hours)

New Technical Elective Courses to be Created

1. BME 4580 (Introduction to Micro-fluidics and MEMS, 3 credit hours, elective)
2. EML 4450 (Introduction to Energy Conversion Processes and Systems, 3 credit hours, elective)

Rationale for the Changes

EGM 4350 (Finite Element Analysis) currently requires a different pre-req for Mechanical Engineering (Machine Design EML 4500), Ocean Engineering (Structural Analysis EOC 3410C), and Civil Engineering (Analysis of Structures CES 3102C) students. The current course topics only requires EGN 3331 (Strength of Materials) according to the instructor. Since EGN 3331 is a pre-req for these pre-req courses, and adopting Strength of Materials as the pre-req for Finite Element Analysis will provide a consistent path for all students, and streamline their course scheduling and graduation rates. We would like to have EGN 3331 as the only pre-req for EGM 4350.

The pre-reqs for EGM 4045 (Electro-Mechanical Devices) are currently Engineering Math I (MAP 3305), and Physics for Engineers II (PHY 2044). We proposed to add additional topics in basic micro-controllers with hardware interfaces and hands-on lab work in the course. This addition will provide students with skills that are crucial for their senior design projects since all projects are required to have some form of micro-controller interfaces. EOC 4133 (Introduction to Programming for Ocean and

Mechanical Engineers) or EGN 2213 (Computer Applications in Engineering I) will provide students with basic programming skills needed for the course. Thus, we would like to add EOC 4133 or EGN 2213 as a pre-req for EGM 4045.

The pre-reqs for EML 4521C (Engineering Design) are currently Machine Design (EML 4500) and Applied Thermal Fluid Engineering (EML 4127). The instructor commented that these two courses can also be taken as co-reqs for EML 4521C. In addition, having these courses as pre-reqs will hold up the students from getting through the ME program in a timely manner. We would like to change these two courses (EML 4500 and EML 4127) as both pre-reqs and co-reqs for EML 4521C.

We would like to add two technical elective courses titled Introduction to Micro-fluidics and MEMS (BME 4580) and Introduction to Energy Conversion Processes and Systems (EML 4450), both of them are 3 credit hours. This courses have been taught as special topics for the last two years, and there were good enrollments. We would like to change EML 4450 and BME 4580 as permanent courses so that students can continue to have choices taking these courses.

The corresponding course syllabi and course changes/new course forms for these courses are attached.

Course Descriptions – Mechanical Engineering Program

1. Modify the following existing ME core courses

Electro-Mechanical Devices (EGM 4045) 3 credits
Prerequisites: Eng Math I (MAP 3305), Physics for Engineers II (PHY 2044), Intro to Programming for Ocean and Mechanical Engineers (EOC 4133) or Comp Apps I (EGN 2213), all with a grade of C or above
Introduction to basic DC and AC circuits; passive and active filtering; DC and AC motors; and Arduino micro-controller for basic hardware and software interfaces.

Finite Element Analysis for Engineering Design (EGM 4350) 3 credits
Prerequisites: EGN 3331 with grade of "C" or above
Fundamental concepts of finite element software to perform the stress, vibration, and heat transfer analyses of various engineering design problems.

Engineering Design (EML 4521C) 3 credits
Prerequisites: EML 4127, EML 4500, EGM 4350, with minimum grades of "C"
Corequisite: EML 4263C
The design process, including decision theory, creativity concepts, human factors, optimization techniques, reliability, statistics and professional ethics. Engineering economy. Material selection and testing. Fatigue and fracture design.

2. Create the following technical elective courses

Electives

Introduction to Micro-fluidics and MEMS (BME 4580) 3 credit, elective
Prerequisites: EML 3701, MAP 3305 with grade of "C" or above
A comprehensive introduction to microfluidics, micro-electro-mechanical systems (MEMS) and microfabrication techniques. Topics include laminar flow, viscosity, surface tension, dimensionless numbers, Electrokinetics, photolithography, soft lithography, flow control, and flow sensors of micrometer scale.

Introduction to Energy Conversion Processes and Systems (EML 4450) 3 credits, elective
Co-requisites: EML 3701
Introduction to principles, theories, and processes of devices and systems that convert thermal, chemical, solar, biological and electromagnetic energy to electrical, mechanical, and alternative chemical forms. Energy conversion performance characteristics and sources of inefficiencies are explored for a variety of applications that include conventional fossil energy combustion based systems, solar, wind, hydro, biomass, thermoelectric, and geothermal energy systems. Some interesting topics including CO_2 capture and storage and fuel cells are also discussed