MEMORANDUM

TO: Darryll Pines  
    Dean, A. James Clark School of Engineering

FROM: Elizabeth Beigel  
       Associate Provost for Academic Planning and Programs

SUBJECT: Proposal to modify the curricula of the PhD in Mechanical Engineering and Reliability Engineering (PCC log no. 10006)

At its meeting on September 17, 2010, the Senate Committee on Programs, Curricula and Courses approved your proposal to modify the curricula of the PhD in Mechanical Engineering and Reliability Engineering. A copy of the approved proposal is attached.

The changes are effective Spring 2011. The School should ensure that the changes are fully described in the Graduate Catalog and in all relevant descriptive materials, and that all advisors are informed.

MDC/

Enclosure

cc: David Salness, Chair, Senate PCC Committee  
    Sarah Bauder, Office of Student Financial Aid  
    Reka Montfort, University Senate  
    Erin Howard, Data Administration  
    Donna Williams, Institutional Research & Planning  
    Anne Turkos, Archives  
    Linda Yokoi, Office of the Registrar  
    Thomas Castonguay, Graduate School  
    William Fourney, A. James Clark School of Engineering  
    Balakumar Balachandran, Mechanical Engineering
THE UNIVERSITY OF MARYLAND, COLLEGE PARK
PROGRAM/CURRICULUM/UNIT PROPOSAL

- Please email the rest of the proposal as an MSWord attachment to pcc-submissions@umd.edu.
- Please submit the signed form to the Office of the Associate Provost for Academic Planning and Programs, 1119 Main Administration Building, Campus.

College/School:
College/School Unit Code-First 8 digits: 01203200
Unit Codes can be found at: https://hvp.prod.umd.edu/Html_Reports/units.htm

Department/Program: Mechanical Engineering, ENME & ENRE Programs
Department/Program Unit code-Last 7 digits: 1322101

Type of Action (choose one):

☐ Curriculum change (including informal specializations) ☐ New academic degree/award program
☐ Renaming of program or formal Area of Concentration ☐ New Professional Studies award iteration
☐ Addition/deletion of formal Area of Concentration ☐ New Minor
☐ Suspend/delete program x Other

Italics indicate that the proposed program action must be presented to the full University Senate for consideration.

Summary of Proposed Action: Reduction in the coursework credit requirement from 42 to 36 for ENME PhD program and from 43 to 36 for ENRE PhD program

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APPROVAL SIGNATURES - Please print name, sign, and date. Use additional lines for multi-unit programs.

1. Department Committee Chair  Bala Balachandran, Chair, Graduate Committee
   
2. Department Chair  Avi Bar-Cohen, Chair, Department of Mechanical Engineering
   
3. College/School PCC Chair  David Bigio, Department of Mechanical Engineering
   
4. Dean  Darryll Pines, A. James Clark School of Engineering
   
5. Dean of the Graduate School (if required)  
   
6. Chair, Senate PCC  David Fadnes 9/17/10
   
7. University Senate Chair (if required)  
   
8. Vice President for Academic Affairs & Provost  9/30/2010
The Graduate Committee of the Department of Mechanical Engineering recently completed a review of the current requirement of a minimum of 42 semester credits (43 semester credits) for a ME (RE) doctoral coursework plan. This review was conducted with the following aims: i) to re-evaluate this minimum coursework requirement in the context of the changes that have occurred over the years in the Department’s multi-disciplinary research programs and ii) to examine if this coursework requirement best served the current educational needs of the doctoral students in the Department. In the discussion that follows, although the discussion is made with in the context of the ME doctoral program, the spirit of the findings apply to the RE doctoral program as well.

Following discussions that started in the Graduate Committee, about a year ago, a subcommittee comprising of faculty representatives from the four Divisions was formed. This committee consisted of Professors Dasgupta (Chair), Duncan, Modarres, and Solares. They conducted a study to determine whether the minimum coursework requirement for a doctoral student needed to be modified from its current level. As a part of this study, the subcommittee interacted with different faculty in the Department and collected verbal opinions from faculty on the Graduate Committee as well as from different subsets of the Departmental faculty (e.g., faculty in the Mechanics and Materials Division). Although most of the faculty that the subcommittee interacted with supported a reduction from the current minimum number of 42 semester credits, there was also a minority opinion opposed to a reduction from the current minimum number of 42 semester credits. The subcommittee also compiled data pertaining to other Departments in the A. James Clark School of Engineering and different Departments of Mechanical Engineering at peer and leading institutions in the country. The data collected by the subcommittee are presented below along with their findings and recommendation:

1. Opinions in support of reducing the 42 credit coursework requirement (majority opinion amongst polled faculty):
   a. The Department’s research programs are now highly multi-disciplinary. A number of faculty are of the opinion that the most effective way for their doctoral students to gain the knowledge needed for contemporary research is not through formal in-class courses that are structured along traditional disciplinary boundaries, but rather, through hands-on cross-disciplinary experience gained in the laboratory and on the job. Therefore, the proposed credit reduction will allow students to spend more time conducting thesis research or interning at external laboratories. We anticipate that most students will sign up for 6 additional credit hours of thesis research. It’s instructive to note that there are other well-known educational models that require far less formal course work. In fact, there are some, which do not require any for doctoral students.
   b. Currently, many Graduate Assistants take 5 to 7 semesters to complete the minimum coursework requirement. Streamlining the course requirements to a leaner, less cumbersome, and more effective level can significantly enhance the ability of the faculty in the Department to graduate cross-disciplinary doctoral students in a more efficient and effective manner.
   c. Some U.S. institutions have already ‘modernized’ their curriculum and reduced the mandatory coursework requirements and the Department needs to reassess its own needs, in light of this changing climate.

2. Opinions opposed to reduction of the 42 credit coursework requirement (minority opinion amongst polled faculty):
   a. Ph.D. students require a corpus of core fundamental disciplinary knowledge in order to have a firm educational foundation. Without this foundation they will lack the ability to continually re-tool and adapt their research programs, as the research funding and research needs of the community continue to evolve in future. Any modified coursework plan requirement should take this into consideration.
   b. A formal coursework requirement is one of the hallmarks that distinguish the U.S. model for engineering education from competing models in many other countries. This model has helped the U.S. model
compete well over the years in the international arena and has helped attract the best students from
around the world. Any drastic departure from this model may be counter-productive.
c. Our current requirement is in line with some of our aspirational peers (in fact, a few of our peers require
even more coursework). Any drastic reduction in coursework requirements may place our Ph.D.
graduates at a competitive disadvantage compared to their students, especially, for academic positions.

3. Coursework requirement in other Departments of the Clark School of Engineering:

In Figure 1, the current minimum coursework requirements for formal in-class credits in other
Departments within the A. James Clark School of Engineering are presented. It is pointed out that the
coursework requirement in the Department of Mechanical Engineering is one of the highest in the
College.

4. Coursework requirement in other Departments of Mechanical Engineering at peer institutions and leading
institutions in the U. S:

In Figure 2, the formal coursework requirements are shown for the different Departments of Mechanical
Engineering at peer institutions and leading institutions in the U. S. To the best of the subcommittee’s
knowledge, a minimum of 14 semester course requirement in the Department appears to place it in a
group of schools with a higher minimum course requirement.

[Caveats: Much of this data was gleaned from websites of the Departments in question. In some cases, the
language on a website left some ambiguity about the precise course requirements, and to the extent feasible,
clarifications were sought through phone conversations with relevant Departmental representatives. In view of
these uncertainties, the data presented here may have a small margin of error in a few cases. Some of the
Departments polled have no formal course requirements at all. In such cases, we have presented data that were
reported to be historically typical, rather than mandated requirements.]
Recommendation for reduction from a minimum of 42 to 36 coursework credits:

After due consideration to the body of data compiled and the spectrum of opinions expressed, the subcommittee has arrived at the conclusion that in the contemporary multi-disciplinary engineering educational climate, the Department’s current Ph.D. programs and students will benefit by a slight reduction in the mandated minimum in-class coursework requirement. However, a very drastic reduction or radical changes such as elimination of coursework requirement will be counter-productive at this time. The subcommittee therefore recommends a modest reduction from a minimum of 42 credits (14 courses) to a minimum of 36 credits (12 courses). A broader discussion within the Graduate Committee is also in support of these recommendations.

6. Department Faculty Vote: During the Faculty Assembly of March 2nd, the Department faculty considered the proposal to reduce the minimum number of coursework credits to 36 credits for doctoral students in the ME and RE programs, and the faculty present voted unanimously in favor of this proposal.

7. Graduate Student and Industry Support: An informal survey of graduate students and industrial sponsors has indicated overwhelming support for the coursework reduction plan. Many students felt that this would give them more flexibility to acquire the specialized knowledge they needed for conducting more multidisciplinary research, while industrial sponsors had similar sentiments. Both groups also felt it would lead to a faster completion of the PhD program without compromising the depth or quality of the educational experience.
8. Implementation: The plan will be implemented the semester following its approval. Students who have submitted coursework plans under the old requirements will be given the option of submitting revised plans under the new requirements. Since the change is in the minimum requirements, there are no problems with students maintaining their current coursework plans. The coursework plans will continue to be developed by the student in conjunction with their advisor, and then approved by the departmental Graduate Studies Committee and Director of Graduate Studies.
PhD requirements for ME

Current Requirements: PhD students must pass a qualifying exam, present a PhD dissertation proposal, and complete a Coursework Plan containing a minimum of 42 credits of graduate coursework. A minimum of 18 credits of coursework must be taken at the University of Maryland. Students with a Master’s degree from another accredited institution may, upon approval of the student’s advisor and the Graduate Committee, transfer and include up to 24 credits of graduate coursework. Plans that include graduate work completed at other academic institutions must be accompanied by appropriate documentation to verify the level of work and to confirm that the work will not be duplicated by the courses that will be taken at the University of Maryland. All credits must be derived from courses taken at the 600-level or above; 400-level courses are allowed only if taken in accordance with the advisor’s recommendation and as graduate courses when no graduate equivalents exist. Coursework plans that include such courses must be accompanied by a statement from the advisor justifying the recommendation and by a statement from the instructor that the course was taken at the graduate level. No ENME or ENRE 400-level course can be part of the plan of study. Interdisciplinary programs will be given favorable consideration.

The coursework plan should contain as minimum of 6 credits of courses in mathematics. Courses that satisfy this requirement are:

1. MATH, STAT or AMSC 600-level and higher
2. Any one of the following:
   i. ENME 605: Advanced Systems Control: Linear Systems
   ii. ENME 610: Engineering Optimization
   iii. ENME 625: Multidisciplinary Optimization
   iv. ENME 673: Energy and Variational Methods in Applied Mechanics
   v. ENRE 620: Mathematical Techniques of Reliability Engineering
   vi. ENRE 655: Advanced Methods in Reliability Modeling
   vii. ENRE 643: Bayesian Analysis

New Requirements: Under the proposed changes, students will now be required to complete a minimum of 36 credits of graduate coursework. No changes will be made to the qualifying exam, PhD dissertation proposal, or required math courses. Instead, students will be required to take 2 fewer courses as technical electives in their Coursework Plan.
PhD requirements for RE

Current Requirements: Students must pass a qualifying exam, present a PhD dissertation proposal, and complete a Coursework Plan containing a minimum 43 semester hours of courses with at least 30 semester hours at the 600 level or above (this includes all required courses for the MS plus 12 additional 600 level credits, at least six of the courses in a student's coursework plan must be in ENRE). These 43 semester hours of courses may not include any doctoral research credit (ENRE899). Students entering into the program with an MS degree will be given credit for the courses taken in that program up to 24 credits with the approval of the student's advisor and the Department of Mechanical Engineering Graduate Committee. The coursework plan must contain the following Reliability Engineering core courses:

1. ENRE 600 Fundamentals of Failure Mechanisms
2. ENRE 602 Reliability Analysis
3. ENRE 607 Reliability Engineering Seminar
4. ENRE 620 Mathematical Techniques of Reliability Engineering
5. ENRE 624 Failure Mechanisms and Effects Laboratory (COURSE CURRENTLY ON HOLD STUDENTS MUST SUBSTITUTE ELECTIVE IN PLACE OF ENRE624) and
6. ENRE 653 Advanced Reliability Engineering or ENRE 655 Advanced Methods in Reliability Modeling

Students may not register for more than a total of six credits of ENRE 648: Special Problems in Reliability Engineering, no more than three credits in a single semester. For each registration of ENRE648 an approved scholarly paper must be submitted to the Graduate Office. Research completed for ENRE648 may not overlap with a student’s thesis or dissertation topic. Furthermore, under no circumstances will students be permitted after the completion of the semester in which the credits were taken to convert ENRE648 credit to thesis (ENRE799) or dissertation (ENRE899) credits. Students should have a GPA of 3.5 to be eligible for a required oral qualifying exam.

New Requirements: Under the proposed changes, students will now be required to complete a minimum of 36 credits of graduate coursework and the core courses will be ENRE600 and ENRE602. No changes will be made to the qualifying exam requirements and PhD dissertation proposal.