Date: 7 December 2010

To: Randy Smith  
Vice Provost, Office of Academic Affairs

From: Ed McCaul  
Secretary, College of Engineering Committee on Academy Affairs (CCAA)

Subject: Semester Conversion Proposal for the BS/MS program and MS degree in Nuclear Engineering as well as withdrawal of Nuclear's Graduate Minor in Nuclear Safety

Attached is a letter from K. (Cheena) Srinivasan, Department Chair of Mechanical and Aerospace Engineering, which discusses their BS/MS program and MS degree in Nuclear Engineering as well as withdrawal of their Graduate Minor in Nuclear Safety.

These proposals were reviewed by a subcommittee of CCAA. After reviewing the proposals and having some changes made to the MS proposal the subcommittee recommended to the full committee that the proposals be approved. After a discussion, CCAA unanimously approved the proposals on the 6th of December 2010 and requested that I forward them to you for consideration by CAA. If you have any questions concerning these proposals please let me know.
To: Office of Academic Affairs

From: K. Srinivasan, ME Department Chair

Date: September 15, 2010

Regarding: Semester Program Proposal for Master of Science in Nuclear Engineering

The review and modification of graduate level courses within the Nuclear Engineering Program are performed by the NE Graduate Studies Committee, which includes all full-time nuclear engineering professors.

The Nuclear Engineering Program faculty has reviewed the requirements for transitioning existing programs from the quarter system to the semester system. There are currently two nuclear engineering graduate degrees offered:

1. PhD in Nuclear Engineering
2. MS in Nuclear Engineering

There are also two non-degree minor programs:

1. Graduate Minor in Nuclear Safety. This program has been inactive and will be cancelled.
2. Undergraduate Minor in Nuclear Engineering. This program will be continued. The revised program proposal is attached.

There is a BS/MS option in which the MS is in Nuclear Engineering. This option will continue to be offered under the semester system subject to the rules of the Graduate School. The Nuclear Engineering program also permits a dual master’s degree, subject to Graduate School rules.

The proposed modifications were presented to the NE Advisory Committee, which is composed of representatives of academia and the nuclear industry. The Advisory Committee strongly opposed participation in the Master of Engineering Leadership program. They were very supportive of a Plan B option that would enable students with considerable undergraduate nuclear engineering experience to graduate in one additional year without a master’s thesis, if they do not intend to continue to the doctoral degree.

The proposed modifications to the MS in Nuclear Engineering program were approved by vote of the Nuclear Engineering faculty who have autonomous responsibility for the academic administration of the program.
I recommend that this proposal be approved.

Signed and approved:

K. Srinivasan
Nuclear Engineering Master of Science (MS) Program

Primary Contact: Tunc Aldemir (Aldemir.1@osu.edu, 292-4627)

1. Name of Program

Nuclear Engineering

2. Name of Degree

Master of Science

3. Responsible Academic Unit

Department of Mechanical Engineering.

4. Type of Program

Graduate degree program

5. Semester Conversion Designation

a. Re-envisioned with significant changes to curricular requirements (core requirements, tracks/options/courses), but no changes in program goals.

6. Program Learning Goals

The objectives of the Master of Science in nuclear engineering are:

1. Graduates with the Master of Science degree will be attractive candidates for employment in the nuclear industry.
2. Graduates with appropriate aptitude will be attracted to undertake the doctoral program in nuclear engineering.
3. Graduates will be informed and involved members of their communities, and responsible engineering professionals.

The outcomes of the Master of Science degree are that a student will attain:

1. An in-depth understanding of the basics of nuclear engineering, reactor physics, radiation protection, nuclear power plant design, and nuclear safety;
2. An ability to work on multi-disciplinary teams;
3. An ability to identify, formulate, and solve engineering problems;
4. An understanding of professional, ethical, security and social issues and responsibilities, particularly as they relate to nuclear risks;
5. An ability to communicate effectively with a range of audiences;
6. A recognition of the need for, and an ability to engage in life-long learning and continuing professional development;
7. An understanding of contemporary issues, particularly related to reactor safety, nuclear proliferation, and the disposal of radioactive waste;
8. An ability to use the techniques, skills and modern engineering tools necessary for practice as a nuclear engineering professional;
9. An ability to apply mathematical foundations and algorithmic principles in the solution of engineering problems;
10. Experience in the performance of research.

7. Semester Course Requirements

The MS degree has a requirement of 24 course credit hours out of a total graduation requirement of 30 credit hours.

The student must take NE 4505, Introduction to Nuclear Science and Engineering (3 cr.hr.), as a graduate student, if that course or equivalent was not taken as an undergraduate. It does not, however, count against the credit hour requirements. All full-time students are required to participate in the one credit hour seminar series, NE 6881. This credit hour does not count against the credit hour requirements.

The following core courses are required:

- NE 5606, Radiological Safety (3 cr.hr.)
- NE 5742, Nuclear Radiations and Their Detection (3 cr.hr.)
- NE 6708, Reactor Theory (3 cr.hr.)
- NE 6708, Reactor Theory (3 cr.hr.)
- NE 6708, Reactor Theory (3 cr.hr.)
- NE 6536, Nuclear Reactor Systems and Analysis (3 cr.hr.)
- NE 6725, Reactor Dynamics (2 cr. hr.)
- NE 6726, Reactor Dynamics Laboratory (2 cr. hr.)
- NE 6766, Nuclear Engineering Design (2 cr. hr.)

In addition to the core courses, the student must take:

- A 5000-level mathematics course in the area of partial differential equations or linear algebra (3 cr. hr.). If the student has previously taken these courses, another mathematics, statistics, or computer science course can be substituted with the approval of the GSC.
• An additional NE course at the 6000 level or higher (3 cr. hr.).

• A student is permitted to include 6 credit hours of thesis (NE5999) in satisfying the 30 cr. hr. minimum.

8. **Current and Proposed Advising Sheets**

See Attachment #1.

9. **Curriculum Map**

Not required at this time for graduate program.

10. **Rationale for Program Changes and Description of Changes**

Although there are some significant changes in the program structure, the scope of material provided is very similar, and in some cases enhanced. Other than changes in the Reactor Physics course (division into two classes), which occurred two years ago, the core program has not changed in more than a decade. Within the current program a total of 45 credit hours is required for a Master’s degree. In the semester program this will become 30 credit hours. In general, the semester courses have been developed by combining quarter courses. The course numbers for the semester program reflect the old quarter numbers from which most of the semester course was developed. In a few cases, the quarter courses have been expanded where appropriate. In the process, we were able to reduce some overlap that existed in the quarter courses. Overall, the material taught is essentially the same as in the quarter course. Some improvements are: an enhancement of the material in the radiological safety course (NE 5606) bringing it closer to the requirements of a health physics program, some expansion of the nuclear reactor systems and analysis course (NE 6536), an expansion of the reactor dynamics course (NE 6725) and a direct link between that course and the reactor laboratory course (NE 6726). The principal drawback in the change is less flexibility to take optional courses. However, this is not a major problem because a large fraction of our graduate students have taken some of the core courses as undergraduates. To the extent that students have taken required graduate level courses as undergraduates at OSU or another institution, they can petition the Graduate Studies Committee to substitute other courses.

The proposed modifications were presented to the NE Advisory Committee, which is composed of representatives of academia and the nuclear industry. The Advisory Committee strongly opposed participation in the Master of Engineering Leadership program. They were very supportive of a Plan B option (See Attachment 1) that would enable students with considerable undergraduate nuclear engineering experience to
graduate in one additional year without a master’s thesis, if they do not intend to continue to the doctoral degree.

11. **Credit Hour Changes**

<table>
<thead>
<tr>
<th>Program credit hour requirements</th>
<th>A). Number of credit hours in current program</th>
<th>B). Calculated result for 2/3rds of current quarter credit hours</th>
<th>C). Number of cr. hours required for proposed program</th>
<th>D). Change in credit hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total minimum credit hours required for completion of program</td>
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<td>30</td>
<td>30</td>
<td>0</td>
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<tr>
<td>Required credit hours offered by the unit</td>
<td>Minimum</td>
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<td>24</td>
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<tr>
<td></td>
<td>Maximum</td>
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<td>26</td>
<td>27</td>
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<tr>
<td>Required credit hours offered outside the unit</td>
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<td>4</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Maximum</td>
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<td>Required prerequisite credit hours not incl above</td>
<td>Minimum</td>
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<td>0</td>
</tr>
<tr>
<td></td>
<td>Maximum</td>
<td>3*</td>
<td>2*</td>
<td>3*</td>
</tr>
</tbody>
</table>

*No graduate credit

12. **Rationale for Significant Changes in Credit Hours**

The changes are not considered significant.

13. **Transition Policy**

No MS student who began the program prior to the transition will have progress toward the MS degree impeded. The NE program does not offer service courses, so only students in the Nuclear Engineering program will be affected. The total credit hour requirement post-transition will be 30 credit hours. Credits received prior to the transition will be multiplied by the factor 0.67 in determining the total. In general, a student will be required to have taken a course having the substance of a required course. However, if the change to semester system would result in the extension of the student’s program by a semester, alternative courses will be identified to replace the requirement to preclude a student having to extend his/her education. The student will work with his/her faculty advisor to assure that the student’s tenure at OSU is not unduly affected by the transition.

14. **Assessment Practices**

Not required at this time.

15. **Assessment Plan on File with OAA**

Not required at this time.
Attachment 1. Advising Sheets

A copy of a current (quarter advising sheet) and a proposed (semester) advising sheet are provided for comparison.

Quarter Advising Sheet

Graduate Coursework shall include the following components:
(1) Core Curriculum
(2) Two additional advanced courses (700-level or above) in nuclear engineering
(3) Courses selected for an area of specialization (these courses may also fulfill (2) depending on the area selected—cf., Section 7.6)
(4) Math 512 and 568 or 571 or equivalent must be completed prior to completion of the MS program. This can be a part of the student's BS program or MS program. One additional course (500-level or above) must be taken from one of the following areas: (i) Mathematics, (ii) Statistics, (iii) Computer Science, (iv) Engineering Analysis. This requirement is in addition to the requirement of Item 2.

The core curriculum covers the fundamentals of nuclear engineering and is designed to develop both laboratory and communication abilities. The core consists of NE 505 (Introduction to Nuclear Science and Engineering), 704 (Reactor Theory I), 606 (Radiological Safety), 736 (Nuclear Power Plants), 742 (Nuclear Radiations and Their Measurements), 743 (Nuclear Radiations and Their Shielding), 744 (Nuclear Reactor Laboratory), and 766 (Nuclear Engineering Design).

Core Course requirements are waived if equivalents have been completed at the undergraduate level. Consult the Nuclear Engineering Program Chair to determine equivalency. All full time students are required to participate in the one credit hour seminar series (NE 881) given in the fall and spring quarters.

The prerequisites for entry into the core curriculum are:
1) an introductory course in nuclear science and engineering
2) engineering mathematics through differential equations,
3) engineering thermodynamics, fluid dynamics, and heat transfer.
4) interactive computer-based analyses and design methodology.

There are two master's degree program plans: Thesis (Plan A) and non-thesis (Plan B). Students may pursue either plan subject to the following procedures of the Nuclear Engineering GSC. The student is encouraged to complete all of his/her work for the MS within a five year time period. Students requiring longer than five years must petition the Nuclear Engineering GSC for approval prior to the end of the five year period.

Plan A. Under the Thesis Option, an acceptable MS thesis must be submitted based upon individual research supervised by the student's adviser. It is the student's responsibility to develop an acceptable research topic in consultation with his/her
adviser. A final oral examination of two hours duration must also be passed. This examination will stress the thesis but may range over the academic work of the student.

In addition, a student must have completed a total of 45 hours of approved graduate course work, with a cumulative point-hour ratio of 3.0 or better. Thesis research may be used to earn credit under NE 999, but no more than twelve hours may be included in the overall 45 hours required to complete a graduate program.

Plan B. Under the non-thesis option, an acceptable Task Report must be submitted based upon individual contributions to a special Task Study supervised by the student's adviser. A final written comprehensive examination must also be passed. This examination will cover the academic work of the student. The non-thesis option is designed primarily for students planning to pursue the PhD degree. The Task Report typically is selected to contribute to the student's PhD Research Program and the PhD Qualifier Exam may serve as the non-thesis comprehensive exam.

If the PhD Qualifying Exam has been chosen for the comprehensive exam, and passed, (thus demonstrating that the student is pursuing the PhD degree), then a peer-reviewed article which has been accepted, with the student as the first author, may replace the student's Task Report. The student's adviser will probably be a co-author of the article and must approve the article as being worthy of submission.

In addition, a student must have completed a total of 50 hours of graduate course work, with a cumulative point hour ratio of 3.0 or better. The Task report work may be used to earn credit under NE 793, but no more than six hours may be included in the overall 50 hours required.

One approved, typed copy of the task report must be presented to the student's adviser. The student is responsible for preparing typed copies of the task report and the expenses incurred. Students should consult their advisers for departmental requirements on the task report format. Although designed for students planning to continue their studies to obtain a PhD, historically the potential disadvantages of this option have outweighed the advantages, and only a few students have selected this option rather than Plan A.
Semester Advising Report

Graduate Coursework shall include the following components:

(1) Core Curriculum
(2) One additional advanced course (6000-level or above) in nuclear engineering
(3) A mathematics course at the 5000 level in the area of partial differential equations or linear algebra. If the student has taken these courses, another mathematics, statistics or computer science course can be substituted with the approval of the GSC.

The student must take NE 4505, Introduction to Nuclear Science and Engineering (3 cr.hr.), as a graduate student, if it or an equivalent course, was not taken as an undergraduate. This course does not count toward the fulfillment of credit hour requirements, however.

The following additional core courses are required:

- NE 5606, Radiological Safety (3 cr.hr.)
- NE 5742, Nuclear Radiations and Their Detection (3 cr.hr.)
- NE 6708, Reactor Theory (3 cr.hr.)
- NE 6536, Nuclear Reactor Systems and Analysis (3 cr.hr.)
- NE 6725, Reactor Dynamics (2 cr. hr.)
- NE 6726, Reactor Dynamics Laboratory (2 cr. hr.)
- NE 6766, Nuclear Engineering Design (2 cr. hr.)

Core Course requirements are waived if equivalents have been completed at the undergraduate level. Consult the Nuclear Engineering Program Chair to determine equivalency.

The prerequisites for entry into the core curriculum are:
1) an introductory course in nuclear science and engineering
2) engineering mathematics through differential equations,
3) engineering thermodynamics, fluid dynamics, and heat transfer.
4) interactive computer-based analyses and design methodology.

There are two master's degree program plans: Thesis (Plan A) and non-thesis (Plan B). Students may pursue either plan subject to the following procedures of the Nuclear Engineering GSC. The student is encouraged to complete all of his/her work for the MS within a five year time period. Students requiring longer than five years must petition the Nuclear Engineering GSC for approval prior to the end of the five year period.

Plan A. Under the Thesis Option, an acceptable MS thesis must be submitted based upon individual research supervised by the student's adviser. It is the student's responsibility to develop an acceptable research topic in consultation with his/her
adviser. A final oral examination, with emphasis on the content of the thesis, of up to two hours duration must also be passed,

In addition, a student must have completed a total of 30 hours of approved graduate level work, with a cumulative point-hour ratio of 3.0 or better. Thesis research may be used to earn credit under NE 6999, but no more than eight hours may be included in the overall 30 hours required to complete a graduate program.

Plan B. The non-thesis option is intended for students who do not plan for research to be a major aspect of their career and do not plan to continue to obtain a PhD. It is expected that these students will not be supported by GRAs, GTAs or fellowships. For students who have completed the undergraduate minor in nuclear engineering, an additional year of course work would be sufficient to fulfill the course requirements and to broaden their nuclear engineering and mathematics backgrounds beyond the bachelor's level. Students who have not taken undergraduate nuclear engineering courses would not be precluded from this option but might require more time because of course sequencing. Within the non-thesis option, the student would undertake a special project under the direction of the student’s advisor, leading to the preparation of a project report. The format of the project report may be a comprehensive literature review, a research problem, a data analysis, or other format acceptable to the GSC. A final presentation is also required followed by oral examination questions on the report content.