



College of Engineering

122 Hitchcock Hall
2070 Neil Avenue
Columbus, OH 43210-1278
Phone 614-292-2651
FAX 614-292-9379
E-mail engosu@osu.edu

Date: 8 October 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 Proposals for the BS/MS, MS, and PhD degrees
in Welding Engineering

Attached is a letter from Rudolph Buchheit, Department Chair of Materials Science and Engineering, as well as semester conversion proposals for their BS/MS, MS, and PhD degree programs in Welding Engineering. It should be noted that Welding's BS/MS program is only discussed in the cover letter as they plan on following the College of Engineering's requirements for this program.

These proposals were reviewed by a subcommittee of CCAA. After reviewing the proposals and having some changes made to them the subcommittee recommended to the full committee that they be approved. After a discussion, CCAA unanimously approved the proposals on the 27th of September 2010 and requested that I forward the proposals to you for consideration by CAA. If you have any questions concerning these proposals please let me know.



Department of Materials Science and Engineering

Rudolph G. Buchheit
Professor and Chair
177 Watts Hall
2041 College Rd.
Columbus, OH 43210
phone: 614-292-6085
fax: 614-292-9857

To: Office of Academic Affairs

From: Rudolph G. Buchheit, MSE Department Chair

A handwritten signature in blue ink that reads 'R.G. Buchheit'.

Date: October 7, 2010

Re: Semester Program Proposals for *MS and PhD in Welding Engineering*

The faculty of the Welding Engineering (WE) program have worked diligently over the past year to develop the attached curriculum revision MS and PhD proposals for the semesters academic calendar. The WE faculty has voted unanimously, with five in favor, zero against and zero abstain, to approve these proposals as our plan for the *MS and PhD in Welding Engineering* and to use the College of Engineering combined BS/MS transition plan for the *Combined BS/MS in Welding Engineering*, and the Materials Science and Engineering faculty has given its assent as well.

As described in the proposals, the transition policy is that no WE graduate student who began the degree program under quarters will have progress toward graduation impeded by the transition to semesters. Graduation requirements beginning Summer 2012 will be those in force for the MS or PhD degree under semesters; but every quarter-credit-hour that would have counted toward the degree under the quarter-based program will count (as 2/3 of a semester-credit-hour) toward the requirements for graduation under the semester-based program. Additional advising support will be provided for WE graduate students to assist in planning course schedules for the last year of quarters (2011-2012) and for at least the first year of semesters (2012-2013). If it is determined that the “normal” conditions covered by the generic degree transition worksheets would result in a particular student facing an unavoidable delay in graduation compared to quarters, due to circumstances related to the change to semesters rather than the student’s failure to make satisfactory progress through the program, then a revision of specific requirements will be worked out for that student by the advising staff with approval by the WE Graduate Studies Committee.

These proposals were presented to the Department of Materials Science and Engineering External Advisory Committee during its Spring Meeting and to the WE graduate students in the Spring WE Graduate Seminar Course. Both groups agreed with the approach of the proposed semester conversion being done with minimal changes to program goals and curricular requirements, and they support these proposals. In view of these affirmations, I recommend approval of the proposals.

MS in Welding Engineering Program Proposal

1. Name of Program

Welding Engineering (WE)

2. Name of Degree

Master of Science in Welding Engineering (MS WE)

3. Responsible Academic Unit

Department of Materials Science and Engineering

4. Type of Program

d. Graduate degree program

5. Semester Conversion Designation

b. Converted with minimal changes to program goals and/or curricular requirements (e.g., name changes, changes in electives and/or prerequisites, minimal changes in overall structure of program, minimal or no changes in program goals or content)

6. Program Learning Goals

Not required at this time for graduate programs

7. Proposed MS WE Semester Program Requirements

The MS in Welding Engineering is the only engineering program of this type in the US. It distinguishes itself by a strong distance learning component. The objective of the Welding Engineering M.S. Degree Program is to provide opportunities for the individual to expand his/her knowledge of welding and materials joining through a coherent program of study that includes a concentration in one of the areas of emphasis and a breadth of understanding in the other areas.

A complete list of quarter and semester graduate courses is provided in Attachment 1. A partial list of graduate courses by area is provided below (WE MS students should select concentration (major) in one of those areas of study):

- Processes – 5008, 7001, 7002, 7003, 7012, 7023, 7024, 7025, 8001, 8004
- Materials – 7101, 7102, 7112, 7113, 7115, 7023
- Design – 7201, 7202, 7223, 7240, 8221
- Plastics and Composites – 5008, 7201, 7406, 7407, 8406
- Nondestructive evaluation – 5008, 7301, 7302, 7303

Plan A (Thesis Option)

A minimum of 30 semester credit hours is required for the MS WE. For the thesis option, at least 20 credit hours of course work and at least 10 credit hours of thesis research are required, as summarized below:

- Minimum 20 course credits hours, with at least 10 of these credit hours in WE and at least 6 credit hours from courses at 7000 level or above.
 - Minimum of 8 credits hours of WE courses from one of the following concentration (major) areas: processes, materials, design, nondestructive evaluation, or plastics and composites joining.
 - From the remaining 12 credits hours students must take at least one course in each of other areas of study in WE.
 - Any remaining credit hours may be used for technical elective graduate courses.
- Minimum 10 thesis research (WE 7999) credit hours.
 - WE 7895, Graduate Seminar in every quarter of study except graduation quarter (except for part-time students).
 - Thesis topic summary (1st semester of WE 7999 credit)
 - Approved thesis
 - Master's thesis examination

Plan B (Non-thesis Option)

A minimum of 30 semester credit hours is required for the MS WE. For the non-thesis option, at least 26 credit hours of course work and at least 4 credit hours of individual study project are required, as summarized below:

- Minimum 26 course credits hours, with at least 14 of these credit hours in WE and at least 8 credit hours from courses at 7000 level or above.
 - Minimum of 8 credits hours of WE courses from one of the following concentration (major) areas: processes, materials, design, nondestructive evaluation, or plastics and composites joining.
 - From the remaining 18 credits hours students must take at least one course in each of other areas of study in WE.
 - Any remaining credit hours may be used for technical elective graduate courses.
- Minimum 4 individual study (WE 7193) credit hours.
 - WE 7895, Graduate Seminar in every quarter of study except graduation quarter (except for part-time students).
 - Approved WE 7193 report.
 - Master's examination.

8. Current (quarters-based) and Proposed (semesters-based) Curriculum Advising Sheets

See Attachments 2a and 2b for the current MS WE quarters-based advising sheets and Attachments 3a and 3b are the proposed MS WE semester-based advising sheets.

9. Curriculum Map

Not required at this time for graduate programs

10. Rationale for Proposed Program Changes and a Description of Changes

There are no changes proposed to the educational requirements for the WE MS program for the Q2S transition. Revisions to the educational requirements and courses for the WE MS program were last made during the 2002 -2003 academic year. The program that was put in place at that time has been very effective. In 2006, as part of a WE strategic planning activity, an external committee (Transition Planning Committee) commissioned by then Dean W. A. "Bud" Baeslack and chaired by Dr. Karl Graff, reviewed the graduate program. This committee found that the educational requirements of the WE graduate programs were sound, but recommended that the faculty need to increase both the level of research funding and the number of graduate students. The WE faculty has made significant progress in those directions over the past 3 years.

To plan for the Q2S transition and to assess the MS program needs, the Welding Engineering faculty began meeting in Wi09. During these discussions, WE faculty reviewed input from the Welding Engineering and Department advisory boards over the past decade, the WE strategic plan and the Transition Planning Committee report. The yearly assessments and the TPC report have consistently shown that the structure of the WE MS educational requirements and its courses are sound and well designed with continuous improvement over the years. Therefore, it was determined that it would be best to transition from quarters to semesters with minimal changes in the WE MS Program.

11. Credit Hour Changes

Program credit hour requirements:	A.) Number of credit hours in current program <i>(Quarter credit hours)</i>	B.) Calculated result for 2/3rds of current quarter credit hours <i>(Multiply the value in column A by 0.667 and round to the nearest tenth of a credit hour)</i>	C.) Number of credit hours required for proposed program <i>(Semester credit hours)</i>
Total credit hours required for completion of program	45	30	30
Prerequisite credit hours required for admission to program which are not counted toward total hours	0	0	0
Required credit hours offered by the unit	45	30	30
Required credit hours offered outside of the unit	0	0	0

12. Rationale for Significant Change in Credit Hours

Nor applicable

13. Transition Policy

No WE MS student who began the degree program under quarters will have progress toward graduation impeded by the transition to semesters. Graduation requirements beginning Summer 2012 will be those in force for WE MS degree under semesters; but *every* quarter-credit-hour that would have counted toward the WE MS degree under the quarter-based WE program will count (as 2/3 of a semester-credit-hour) toward the requirements for graduation under the semester-based WE program. Additional advising support will be provided for WE MS degree to assist in planning course schedules for the last year of quarters (2011-2012) and for at least the first year of semesters (2012-2013). If it is determined that the “normal” conditions covered by the generic WE MS degree transition worksheet would result in a particular student facing an unavoidable delay in graduation compared to quarters, due to circumstances related to the change to semesters rather than the student’s failure to make satisfactory progress through the program, then a revision of specific requirements will be worked out for that student by the advising staff with approval by the WE Graduate Studies Committee.

Rudolph G. Buchheit
MSE Department Chairman

According to the WE MS degree conversion policy, a student who met a requirement in the quarter system will be deemed to meet the corresponding requirement in the semester system. Courses in major and minor areas and the total credit hours taken under the quarter system will be converted using 2/3 rule to meet graduation requirement in the semester system. This conversion will be straight forward since the MS course requirements proposed for the semester system mirrors those for the quarter system.

14. Assessment Practices

Not required at this time for graduate programs

15. Assessment Plan on File with the Office of Academic Affairs (OAA).

Not required at this time for graduate programs

**Attachment 1
Welding Engineering Graduate Courses**

Semester Course (cr. hrs.)	Quarter Course (cr. hrs.)	Comments
5008 Introduction to Ultrasonics (3)	638 Introduction to Ultrasonics (4)	Semester course includes substantial parts of the content and learning goals of the quarter course
7001 Physical Principles in Welding Processes I (3)	500 Physical Principles in Welding Engineering I (3)	3-quarter course sequence becomes a 2-semester course sequence
7002 Physical Principles of Welding Processes II (3)	600 Physical Principles in Welding Engineering II (3)	
	601 Welding Processes and Applications (3)	
7003 Principles of Welding Process Control (3)	605 Principles of Welding Process Control (3)	Semester course includes substantial parts of the content and learning goals of the quarter course and lab
	655 Welding Process Controls I – Laboratory (1)	
7012 Resistance Welding Processes (2)	602 Fundamentals of Resistance Welding Processes (3)	semester course includes substantial parts of the content and learning goals of the two quarter courses
	702 Fundamentals of Resistance Welding (3)	
7021 Solid-State Welding/Joining (3)	701 Solid State Welding (3)	Semester course includes substantial parts of the content and learning goals of the quarter course
7023 Brazing and Soldering (3)	703 Brazing and Soldering (3)	Semester course includes substantial parts of the content and learning goals of the quarter course
7024 High Energy Density Welding Processes (3)	704 High Energy Density Welding Processes (3)	Semester course includes substantial parts of the content and learning goals of the quarter course
7025 Robotic Welding Systems (3)	705 Advanced Welding Process Control Systems (3)	Semester course includes substantial parts of the content and learning goals of the quarter course
7101 Welding Metallurgy I (3)	610 Introduction to Welding Metallurgy (3)	3-quarter course sequence becomes a 2-semester course sequence
7102 Welding Metallurgy II (3)	611 Welding Metallurgy I (3)	
	612 Welding Metallurgy II (3)	
7112 Weldability (3)	714 Weldability (3)	Semester course includes substantial parts of the content and learning goals of the quarter course
7113 Joining of Specialty Materials (2)	713 Joining of Specialty Metals (3)	Semester equivalent of a quarter course

Semester Course (cr. hrs.)	Quarter Course (cr. hrs.)	Comments
7115 Special Topics in Welding Engineering (2)	715 Special Topics in Welding Engineering (3)	Semester course includes substantial parts of the content and learning goals of the quarter course
7193 Individual Studies in Welding Engineering (1-15)	793 Individual Studies in Welding Engineering (1-15)	Semester equivalent of a quarter course
7201 Engineering Analysis for Design and Simulation (4) 7202 Welding Design (3)	620 Engineering Analysis for Design and Simulation (4) 621 Welding Engineering Design (4) 641 Welding Codes, Specifications and Standards (3)	3-quarter course sequence becomes a 2-semester course sequence
7223 Analysis of Welding Systems (2)	723 Analysis of Welding Systems (3)	Semester equivalent of a quarter course
7240 Fitness-for-Service of Welded Structures (2)	740 Fitness-for-Service of Welded Structures (3)	Semester equivalent of a quarter course
7301 Nondestructive Evaluation (3)	631 Nondestructive Evaluation (4)	Semester course includes substantial parts of the content and learning goals of the quarter course
7302 Industrial Radiography (3)	635 Fundamentals of Radiography (4)	Semester course includes substantial parts of the content and learning goals of the quarter course
7303 Ultrasonic Nondestructive Testing (3)	732 Ultrasonic Nondestructive Evaluation (4)	Semester course includes substantial parts of the content and learning goals of the quarter course
7406 Welding of Plastics and Composites (3)	706 Welding of Plastics and Composites (3)	Semester course includes substantial parts of the content and learning goals of the quarter course
7407 Adhesive Bonding and Mechanical Joining of Plastics (2)	707 Adhesive Bonding and Mechanical Joining of Plastics (3)	Semester equivalent of a quarter course
7540 Welding Production (2)	640 Welding Production (3)	Semester equivalent of a quarter course
7595 Topics in Welding Engineering (2)	695 Topics in Welding Engineering (3)	Semester equivalent of a quarter course
7611 Welding Metallurgy Laboratory I (1)	661 Welding Metallurgy I Laboratory (1)	Semester course includes substantial parts of the content and learning goals of the quarter course
7612 Welding Metallurgy Laboratory II (1)	662 Analysis of Non-Ferrous and High Alloy Welds (1)	Semester course includes substantial parts of the content and learning goals of the quarter course

Semester Course (cr. hrs.)	Quarter Course (cr. hrs.)	Comments
7895 Graduate Seminar	795 Graduate Seminar	Semester equivalent of a quarter course
7999 MS Research in Welding Engineering (1-18)	999 Research in Welding Engineering (1-18)	Semester equivalent of a quarter course
8001 Welding Arc Physics (2)	801 Welding Arc Physics (3)	Semester course includes substantial parts of the content and learning goals of the quarter course
8004 Theory of Laser Welding (2)	804 Advanced Laser Material Processing (3)	Semester course includes substantial parts of the content and learning goals of the quarter course
8193 Individual Studies in Welding Engineering (1-15)	793 Individual Studies in Welding Engineering (1-15)	Semester equivalent of a quarter course
8221 Residual Stresses and Distortion in Weldments (2)	821 Residual Stresses and Distortion in Weldments (3)	Semester equivalent of a quarter course
8406 Advanced Welding of Plastics and Composites (3)	806 Advanced Welding of Plastics and Composites (3)	Semester course includes substantial parts of the content and learning goals of the quarter course
8999 PhD Research in Welding Engineering (1-18)	999 Research in Welding Engineering (1-18)	Semester equivalent of a quarter course

PhD in Welding Engineering Program Proposal

1. Name of Program

Welding Engineering (WE)

2. Name of Degree

Ph.D. Degree in Welding Engineering (PhD WE)

3. Responsible Academic Unit

Department of Materials Science and Engineering

4. Type of Program

d. Graduate Ph.D degree program or major

5. Semester Conversion Designation

b. Converted with minimal changes to program goals and/or curricular requirements (e.g., name changes, changes in electives and/or prerequisites, minimal changes in overall structure of program, minimal or no changes in program goals or content)

6. Program Learning Goals

Not required at this time for graduate programs

7. Proposed PhD WE Semester Program Requirements

The objective of the Welding Engineering Ph.D. Program is to provide opportunities for the individual to attain a high level of scholarly achievement and contribution to the discipline through advanced study and research. It is expected that an expanded knowledge base will be acquired through 1) a coherent pattern of advanced course work and informal study in welding engineering and allied fields, 2) strong emphasis on one particular area of welding engineering, and 3) significant coverage of one or more additional areas outside that of emphasis. This study will culminate in research on, and publication of, a Ph.D. dissertation that will advance the scientific base of the field.

Program Requirements

- Minimum of 60 credit hours beyond the M.S. degree
- Minimum of 30 credit hours of course work with GPA of 3.0 or better
- Minimum of 30 credit hours of dissertation research (WE 8999)
- Minimum of 16 credit hours of 7000/8000 level courses in Welding Engineering

Course Requirements: Minimum of 30 credit hours of course work; from those a minimum of 16 credit hours of 7000/8000 level courses in Welding Engineering.

A complete list of quarter and semester graduate courses is provided in Attachment 1. A partial list of graduate courses by area is provided below:

- Processes – 5008, 7001, 7002, 7003, 7012, 7023, 7024, 7025, 8001, 8004
- Materials – 7101, 7102, 7112, 7113, 7115, 7023
- Design – 7201, 7202, 7223, 7240, 8221
- Plastics and Composites – 5008, 7201, 7406, 7407, 8406
- Nondestructive evaluation – 5008, 7301, 7302, 7303

WE PhD students should select major area of concentration in WE, a minor area of concentration in WE, and a minor area of study from outside WE, as described below:

- Major area of concentration in Welding Engineering (minimum of 9 credit hours of course work) from the following: Processes, Materials, Design, Plastics and Composites Joining, or Nondestructive Evaluation.
- Minor area of concentration in Welding Engineering (minimum of 6 credit hours of course work) in one of the areas other than major area.
- Minor area of study from the field of study outside the Welding Engineering (minimum 6 credits hours).
- Additional 9 credit hours of course work, to complete 30 credit hours requirement, are selected to support a Ph.D. dissertation research.
- Participation in WE 8895, Graduate Seminar is mandatory during each semester except for semester of graduation.

Dissertation and Other Requirements: Minimum of 30 credit hours of PhD dissertation research (WE 8999). Below is a list of the other requirements with a timeframe for each:

<u>Requirements</u>	<u>Timeframe</u>
1. Plan of Study (1)	Submit in 1 st Semester
2. Qualifying Examination (1)	Complete by end of 2nd Semester
3. Candidacy Examination (2)	After completion of minimum 30 cumulative hours of coursework
4. Dissertation Committee Mtgs (1)	At least 1 meeting per calendar year after candidacy
5. Approved Dissertation (2)	Semester of Graduation
6. Final Oral Examination (2)	Semester of graduation

(1) Department requirement
(2) Graduate School requirement

8. Current (quarters-based) and Proposed (semesters-based) Curriculum Advising Sheets

See Attachment 2 for the current PhD WE quarters-based advising sheet, and Attachment 3 for the proposed PhD WE advising sheet.

9. Curriculum Map

Not required at this time for graduate programs

10. Rationale for Proposed Program Changes and a Description of Changes

There are no changes proposed to the educational requirements for the WE PhD program for the Q2S transition. Revisions to the educational requirements and courses for the WE PhD program were last made during the 2002 -2003 academic year. The program that was put in place at that time has been very effective. In 2006, as part of a WE strategic planning activity, an external committee (Transition Planning Committee) commissioned by then Dean W. A. "Bud" Baeslack and chaired by Dr. Karl Graff, reviewed the PhD program. This committee found that the educational requirements of the PhD program were sound, but recommended that the faculty need to increase both the level of research funding and the number of PhD students. The WE faculty has made significant progress in those directions over the past 3 years.

To plan for the Q2S transition and to assess the PhD program needs, the Welding Engineering faculty began meeting in Wi09. During these discussions, WE faculty reviewed input from the Welding Engineering and Department advisory boards over the past decade, the WE strategic plan and the Transition Planning Committee report. The yearly assessments and the TPC report have consistently shown that the structure of the WE PhD educational requirements and its courses are sound and well designed with continuous improvement over the years. Therefore, it was determined that it would be best to transition from quarters to semesters with minimal changes in the WE PhD Program.

11. Credit Hour Changes

Program credit hour requirements:	A.) Number of credit hours in current program <i>(Quarter credit hours)</i>	B.) Calculated result for 2/3rds of current quarter credit hours <i>(Multiply the value in column A by 0.667 and round to the nearest tenth of a credit hour)</i>	C.) Number of credit hours required for proposed program <i>(Semester credit hours)</i>
Total credit hours required for completion of program	135	90	90
Prerequisite credit hours required for admission to program which are not counted toward total hours	0	0	0
Required credit hours offered by the unit	126	84	84
Required credit hours offered outside of the unit	9	6	6

12. Rationale for Significant Change in Credit Hours

Nor applicable

13. Transition Policy

No WE PhD student who began the degree program under quarters will have progress toward graduation impeded by the transition to semesters. Graduation requirements beginning Summer 2012 will be those in force for WE PhD degree under semesters; but *every* quarter-credit-hour that would have counted toward the WE PhD degree under the quarter-based WE program will count (as 2/3 of a semester-credit-hour) toward the requirements for graduation under the semester-based WE program. Additional advising support will be provided for WE PhD degree to assist in planning course schedules for the last year of quarters (2011-2012) and for at least the first year of semesters (2012-2013). If it is determined that the “normal” conditions covered by the generic WE PhD degree transition worksheet would result in a particular student facing an unavoidable delay in graduation compared to quarters, due to circumstances related to the change to semesters rather than the student’s failure to make satisfactory progress through the program, then a revision of specific requirements will be worked out for that student by the advising staff with approval by the WE Graduate Studies Committee.

Rudolph G. Buchheit
MSE Department Chairman

According to the WE PhD degree conversion policy, a student who met a requirement in the quarter system will be deemed to meet the corresponding requirement in the semester system. Courses in major and minor areas and the total credit hours taken under the quarter system will be converted using 2/3 rule to meet graduation requirement in the semester system. This conversion will be straight forward since the PhD course requirements proposed for the semester system mirrors those for the quarter system.

14. Assessment Practices

Not required at this time for graduate programs

15. Assessment Plan on File with the Office of Academic Affairs (OAA).

Not required at this time for graduate programs

Attachment 1 Welding Engineering Graduate Courses

Semester Course (cr. hrs.)	Quarter Course (cr. hrs.)	Comments
5008 Introduction to Ultrasonics (3)	638 Introduction to Ultrasonics (4)	Semester course includes substantial parts of the content and learning goals of the quarter course
7001 Physical Principles in Welding Processes I (3) 7002 Physical Principles of Welding Processes II (3)	500 Physical Principles in Welding Engineering I (3) 600 Physical Principles in Welding Engineering II (3) 601 Welding Processes and Applications (3)	3-quarter course sequence becomes a 2-semester course sequence
7003 Principles of Welding Process Control (3)	605 Principles of Welding Process Control (3) 655 Welding Process Controls I – Laboratory (1)	Semester course includes substantial parts of the content and learning goals of the quarter course and lab
7012 Resistance Welding Processes (2)	602 Fundamentals of Resistance Welding Processes (3) 702 Fundamentals of Resistance Welding (3)	semester course includes substantial parts of the content and learning goals of the two quarter courses
7021 Solid-State Welding/Joining (3)	701 Solid State Welding (3)	Semester course includes substantial parts of the content and learning goals of the quarter course
7023 Brazing and Soldering (3)	703 Brazing and Soldering (3)	Semester course includes substantial parts of the content and learning goals of the quarter course
7024 High Energy Density Welding Processes (3)	704 High Energy Density Welding Processes (3)	Semester course includes substantial parts of the content and learning goals of the quarter course
7025 Robotic Welding Systems (3)	705 Advanced Welding Process Control Systems (3)	Semester course includes substantial parts of the content and learning goals of the quarter course
7101 Welding Metallurgy I (3) 7102 Welding Metallurgy II (3)	610 Introduction to Welding Metallurgy (3) 611 Welding Metallurgy I (3) 612 Welding Metallurgy II (3)	3-quarter course sequence becomes a 2-semester course sequence
7112 Weldability (3)	714 Weldability (3)	Semester course includes substantial parts of the content and learning goals of the quarter course
7113 Joining of Specialty Materials (2)	713 Joining of Specialty Metals (3)	Semester equivalent of a quarter course

Semester Course (cr. hrs.)	Quarter Course (cr. hrs.)	Comments
7115 Special Topics in Welding Engineering (2)	715 Special Topics in Welding Engineering (3)	Semester course includes substantial parts of the content and learning goals of the quarter course
7193 Individual Studies in Welding Engineering (1-15)	793 Individual Studies in Welding Engineering (1-15)	Semester equivalent of a quarter course
7201 Engineering Analysis for Design and Simulation (4) 7202 Welding Design (3)	620 Engineering Analysis for Design and Simulation (4) 621 Welding Engineering Design (4) 641 Welding Codes, Specifications and Standards (3)	3-quarter course sequence becomes a 2-semester course sequence
7223 Analysis of Welding Systems (2)	723 Analysis of Welding Systems (3)	Semester equivalent of a quarter course
7240 Fitness-for-Service of Welded Structures (2)	740 Fitness-for-Service of Welded Structures (3)	Semester equivalent of a quarter course
7301 Nondestructive Evaluation (3)	631 Nondestructive Evaluation (4)	Semester course includes substantial parts of the content and learning goals of the quarter course
7302 Industrial Radiography (3)	635 Fundamentals of Radiography (4)	Semester course includes substantial parts of the content and learning goals of the quarter course
7303 Ultrasonic Nondestructive Testing (3)	732 Ultrasonic Nondestructive Evaluation (4)	Semester course includes substantial parts of the content and learning goals of the quarter course
7406 Welding of Plastics and Composites (3)	706 Welding of Plastics and Composites (3)	Semester course includes substantial parts of the content and learning goals of the quarter course
7407 Adhesive Bonding and Mechanical Joining of Plastics (2)	707 Adhesive Bonding and Mechanical Joining of Plastics (3)	Semester equivalent of a quarter course
7540 Welding Production (2)	640 Welding Production (3)	Semester equivalent of a quarter course
7595 Topics in Welding Engineering (2)	695 Topics in Welding Engineering (3)	Semester equivalent of a quarter course
7611 Welding Metallurgy Laboratory I (1)	661 Welding Metallurgy I Laboratory (1)	Semester course includes substantial parts of the content and learning goals of the quarter course
7612 Welding Metallurgy Laboratory II (1)	662 Analysis of Non-Ferrous and High Alloy Welds (1)	Semester course includes substantial parts of the content and learning goals of the quarter course

Semester Course (cr. hrs.)	Quarter Course (cr. hrs.)	Comments
7895 Graduate Seminar	795 Graduate Seminar	Semester equivalent of a quarter course
7999 MS Research in Welding Engineering (1-18)	999 Research in Welding Engineering (1-18)	Semester equivalent of a quarter course
8001 Welding Arc Physics (2)	801 Welding Arc Physics (3)	Semester course includes substantial parts of the content and learning goals of the quarter course
8004 Theory of Laser Welding (2)	804 Advanced Laser Material Processing (3)	Semester course includes substantial parts of the content and learning goals of the quarter course
8193 Individual Studies in Welding Engineering (1-15)	793 Individual Studies in Welding Engineering (1-15)	Semester equivalent of a quarter course
8221 Residual Stresses and Distortion in Weldments (2)	821 Residual Stresses and Distortion in Weldments (3)	Semester equivalent of a quarter course
8406 Advanced Welding of Plastics and Composites (3)	806 Advanced Welding of Plastics and Composites (3)	Semester course includes substantial parts of the content and learning goals of the quarter course
8999 PhD Research in Welding Engineering (1-18)	999 Research in Welding Engineering (1-18)	Semester equivalent of a quarter course

