



**College of Engineering**

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Date: 2 May 2007

To: Randy Smith  
Vice Provost Academic Affairs

From: Ed McCaul  
Secretary College Committee on Academic Affairs

Subject: Welding Engineering Curriculum Revision Proposal

Attached is a proposal from Welding Engineering requesting a revision to their curriculum. This proposal was unanimously approved by the College of Engineering's Committee on Academic Affairs on the 2<sup>nd</sup> of May. If you have any questions about this proposal please let me know.



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**SUBJECT:** Welding Engineering Curriculum Revision Proposal

**DATE:** April 30, 2007

**FROM:** R. Richardson, WE Undergraduate Studies Chair

The proposed changes to the Welding Engineering (WE) program curriculum in the proposal dated April 2007 are for the purpose of making a number of relatively minor adjustments to the WE curriculum. One purpose of the curriculum revision is to take advantage of some of the opportunities provided by the new engineering core requirements approved by the engineering faculty on October 7, 1999. A previous WE curriculum revision in November 1999 made clerical alignments with the new core requirements but did not change the substance of the WE program curriculum other than the inclusion of the new Engineering 181, 182 Introduction to Engineering courses in place of EG 166 as part of the required engineering core. This proposal takes advantage of the new engineering core structure, as well as the closer linkage with the ISE program due to department consolidation, to improve the content and efficiency of the WE program. This includes the substitution of two ISE service courses for formerly required WE courses that have been dropped. It also includes adoption of ISE 406 in the new engineering core. The revision also accounts for recent changes in college GEC requirements from 38 to 40 credit hours. At this point, the new curriculum as proposed will bring the WE curriculum in line with evolution of the curriculum over the last several years as necessitated by engineering core and GEC changes, faculty retirement, and recommendations from the ABET improvement process.

# **PROPOSAL**

## **Revision of the Curriculum for the Bachelor of Science Degree in Welding Engineering**

**Prepared and Submitted by  
Richard W. Richardson, Undergraduate Studies Committee Chair  
Department of Industrial, Welding and Systems Engineering  
College of Engineering**

**April, 2007**

Comments regarding this proposal should be addressed to  
Richard Richardson at [richardson.11@osu.edu](mailto:richardson.11@osu.edu), 292-2499

## EXECUTIVE SUMMARY

The Welding Engineering Program proposes to revise the Welding Engineering undergraduate curriculum in order to:

- 1.) Strengthen the curriculum in some areas that have been recommended by the ABET continuous improvement process;
- 2.) Capitalize on closer association with the Industrial and Systems Engineering Program since department consolidations in 1995;
- 3.) Make use of flexibility provided in the selection of core engineering courses due to the change to the engineering core requirements in 1999;
- 4.) Formalize some changes that have been necessitated by curriculum revisions in supporting programs; and
- 5.) Address an issue relative to the retirement of one faculty member and the resulting loss of a faculty slot.
- 6.) Add the one additional hour of GEC credit for each of Social Sciences and Arts & Humanities, and include GEC Ethics course requirement, as per college GEC requirement changes.

No change to the total hours of the Welding Engineering Program is proposed other than the addition of two credit hours of GEC to raise the total program hours from 195 to 197. Two required Welding Engineering courses would be eliminated – WE 400(3) Chemistry of Welding in the sophomore year and WE 640(3) Welding Production in the senior year. A situation with teaching the WE 400 course has arisen due to a faculty retirement. Recommendations from critical review have revealed that this course is outdated, has not been of great value, and it is no longer actively taught. It has been determined that the WE 640 course can be replaced by content contributed by ISE courses that are proposed for adoption. In particular, ISE 311(3) Manufacturing Engineering, ISE 504(3) Engineering Economics Analysis and ISE 406(4) Industrial Quality Control are proposed for inclusion in the WE program. The ISE courses also promise to strengthen the program in the overall manufacturing and business area as has been recommended by our ABET assessment processes. Credit hour wise, the ISE 311(3) and 504(3) credit hours will replace the WE 400(3) and 640(3) credit hours. The ISE 406(4) will be adopted as a Selected Engineering Core – Math and Statistics elective for Welding Engineering, and will replace a current WE technical elective requirement for a math and statistics course selected from a list by the student.

Within the WE curriculum, the heavily subscribed WE 641(3) Welding Codes, Specifications and Standards will be changed from a WE technical elective status to a required status. This is also the result of constituency recommendation within the ABET improvement process. These hours will be accommodated by change of the technical elective total elective credit hours from 21 to 14.

Two additional changes are required due to changes in supporting programs. In the case of the Introduction to Engineering courses, the Engineering 182 requirement is changed to the new Engineering 183 number for consistency. Also, MSE has recently revised their curriculum. In consultation with them WE has adopted the new MSE

525(3), 581.04(2) and 543(3) as required courses in place of the previous MSE 541(3), 542(3) and 542.02(2) courses.

The transition from the current to the proposed new curriculum has been substantially accomplished by the process of substitution by petition in all cases except for the WE 641 which is being “highly encouraged” as a technical elective and is being taken by most students.

# **Revision of the Curriculum for the Bachelor of Science Degree Program in Welding Engineering**

## **Part A**

### **I. GENERAL INFORMATION**

1. This is a revision of the current welding engineering major that is designed to produce improvements to the program in areas that have been identified by the new ABET accreditation continuous improvement process, and also that have been necessitated by revisions in related programs, especially Materials Science and Engineering.
2. The name of the major is Welding Engineering.
3. The degree title is Bachelor of Science in Welding Engineering.
4. Autumn Quarter 2008 is the proposed implementation date.
5. The major is administered by the Department of Industrial, Welding and Systems Engineering.

### **II. RATIONALE, GOALS, AND OBJECTIVES**

#### **6. Rationale for the proposed revisions**

In order to introduce improvements to the program as dictated by the ongoing ABET continuous improvement process it has been deemed necessary to make some adjustments to courses taken in the required portion of the WE curriculum, both in the pre-engineering core, in supporting programs (ISE and MSE programs), and in the Welding Engineering program itself.

#### **7. General and specific educational goals and objections of the program.**

The mission of the Welding Engineering Program is to educate students in welding engineering, foster interdisciplinary collaboration with allied fields, advance and disseminate state-of-the-art knowledge and technology, and to serve the public, academia, and industrial communities.

In order to accomplish this mission, the Department has identified the following list of specific educational objectives for the undergraduate program:

- a. Welding engineering graduates will be able to utilize the fundamental principles of engineering science and mathematics, and are aware of the underlying historic, social, ethical and aesthetic aspects of engineering.
- b. Welding engineering graduates will have knowledge of the fundamental theory of the process, design, materials and testing aspects of welding.
- c. Welding engineer graduates will be able to apply their fundamental welding engineering knowledge in an integrated fashion to solve diverse practical problems in the welding and joining field.
- d. Welding engineer graduates will be able to communicate effectively in written, oral and informal forms with a variety of audiences.

e. Welding engineer graduates will be able to work effectively in independent and collaborative aspects of their professional activity in an organized and productive fashion.

**8. How the program will help achieve the goals and objectives of the University in terms of its role and mission.**

The revision of the curriculum is in keeping with the University objectives set out in the Functional Mission Statement. The revisions reflect the current needs of welding engineers in industry, government, and society as has been identified by continuous improvement activities. It will improve the ability of the program to provide skilled and educated graduates who are well prepared to become leaders in their field.

**9. Unique characteristics and resources that make it appropriate for Ohio State to offer the program.**

As a large, comprehensive university, Ohio State is well positioned to offer programs in unique areas like welding engineering that provide graduates that are in demand throughout the nation.

**10. Benefits for students, the institution, the region and the state.**

Welding engineering is a diverse profession providing employable graduates to a great diversity of industries. Students benefit from the multifaceted economy of the state and the companies from the region and nation that recruit on our campus. The strong welding engineering program brings recognition to the institution as a unique resource for potential employees as well as creating a successful alumni base that contributes back to the University. Companies in the state and the region benefit by having local access to this unique source of employees.

**11. Similar programs within 50 miles of Ohio State.**

There are no other welding programs in the US accredited to offer the degree Bachelor of Science in Welding Engineering.

**12. Enrollment patterns of similar programs.**

No similar programs.

**13. Job and study opportunities for graduates.**

Because of the demand from a variety of industries job prospects for welding engineering graduates are consistently strong. A small percentage of graduates choose to pursue advanced degrees in engineering directly after graduation. Most continue at Ohio State because of the unique availability of a graduate program in welding engineering offering masters and doctorate degrees.

**14. Licensure requirements for which this program will prepare students.**

Graduates of the welding engineering program are able to initiate the seeking of professional registration by taking the Fundamentals of Engineering exam near the end of their program. They can subsequently obtain a PE registration in

welding engineering from the state of Ohio. This license is honored by a number of other states (Ohio is the only state with a welding engineer exam, which it has largely because of the welding engineering program at Ohio State).

### **III. RELATIONSHIP TO OTHER PROGRAMS**

#### **15. Cooperative arrangements with other institutions and organizations that will be used to offer this program.**

The welding program does have a strong relationship with Edison Welding Institute (EWI) with which a building is shared. Some laboratory work is provided via EWI, and a significant number of students find part-time employment there which is very convenient as well as educational.

#### **16. Articulation arrangements (direct transfer opportunities) with other institutions that will be in effect for the program.**

Students transfer into Welding Engineering from other schools, but due to the diverse nature of related welding programs these are treated more on a case-by-case basis. No articulation arrangements have ever been formalized.

#### **17. Use of consultants or advisory committees in the development of the program.**

No consultants were used in the development of this program.

The program has an Advisory Board and a Program Assessment Board, each meeting annually to comprehensively review the program including curriculum. All changes have been presented to them for discussion and advice.

In addition, input from the current student body was sought through the president of the student chapter of the American Welding Society. A letter summarizing their input is attached.

#### **18. Overlaps with other programs or departments within the University.**

The welding program has close ties with Industrial Systems Engineering (ISE), with whom we share the department of Industrial, Welding and Systems Engineering. A closer association with the ISE department has developed, and some of the curriculum revision involves the adoption of ISE courses to broaden the welding program in several areas. Also, welding engineering has always incorporated a sequence in Materials Science and Engineering (MSE) to prepare students for courses in welding metallurgy. MSE collaborated with WE in their recent curriculum revision in an effort to improve the relevance to welding engineering. The modified MSE course content and course numbering requires that some revisions be made to consistency in the welding program

#### **19. Previously submitted proposals.**

A curriculum proposal was submitted and approved in 1999 for mainly clerical changes resulting from the change to the engineering core that became effective in the 1999-2000 academic year.



**20. Minimum requirements for a student to be admitted into the program.**

Students must first be accepted into the College of Engineering. Admission to program is dependent on a student having a cumulative point hour ratio (PHR) of 2.0 and a secondary PHR of 2.0 in the following courses:

Math 151, 152, 153

Chemistry 121, 125

Engineering Graphics 167

Engineering 181, 183

Physics 131, 132

Students apply for admission to the department using a form available for this purpose.

**21. Student sources and estimated mix.**

The vast majority of the students joining this program will “discover” the program and decide to become a pre-major or major after coming to Ohio State. Most will have transferred from Engineering Undecided or from other engineering programs. A relatively small percentage (10-20%) will have chosen the program upon entrance as a freshman. A few students transfer from outside Ohio State, usually from two-year community college programs.

**IV. STUDENT ENROLLMENT**

**22. Indicate the number of students you anticipate will be admitted to the program each year.**

Enrollment for Welding Engineering is capped at 66 per year in order to maintain reasonable student to faculty ratios in the classroom. The program has never reached the level of 66, but class sizes have been gradually increasing over the last several years.

	This Year	Next Year	Year 3	Year 4
Full-time	35	35	35	35
Part-time	2	2	2	2

The program contains no required summer classes.

## **V. DEGREE REQUIREMENTS**

### **23. Courses which constitute the requirements and other components of the program.**

The program requirements can be divided into four components, College of Engineering Core requirements, Core Welding Engineering requirements, Technical Electives, and GEC requirements. The GEC requirements are the same as those for all programs in the College of Engineering.

<b>Department</b>	<b>Title</b>	<b>Credit Hours</b>	<b>Comment</b>
<i>College of Engineering Required Core</i>		<b>82</b>	
<i>Required Central Engineering Core</i>		<i>41</i>	
Mathematics	151, 152, 153, 254 Calculus and Analytic Geometry I-IV	20	Current
Physics	131, 132 Introductory Physics	10	Current
Engineering	181, 183 Introduction to Engineering I-II	6	Current except 183 updated to college change of number from 182).
Chemistry	121 General Chemistry	5	Current
<i>Selected Engineering Core – Additional Science</i>		<i>9</i>	
Physics	133 Introductory Physics	5	Current
Chemistry	125 Chemistry for Engineers	4	Current
<i>Selected Engineering Core – Math and Statistics</i>		<i>8</i>	
Mathematics	415 Differential Equations & Applications	4	Current
ISE	406 Industrial Quality Control	4	Per COE CCAA Hdbk, Oct 2006
<i>Selected Engineering Core – General Engineering</i>		<i>24</i>	
Eng. Graph	EG 167 - Problem Solving through Programming for Eng. Calculations ...	4	Current
Mech. Eng.	ME 410 Static	4	Current
Mech. Eng.	ME 420 Strength of Materials	4	Current
Matl. Sci. & Eng.	MSE 205 Introduction to Matl. Sci. & Eng.	3	Current
Elec. Eng.	EE 300 Electrical Circuits	3	Current
ISE	ISE 504 Engineering Economic Analysis	3	Add – existing ISE service course
ISE	ISE 311 Manufacturing Engineering	3	Add – existing ISE course

<b><i>Welding Engineering Core Requirements</i></b>		<b><i>61</i></b>	
Elec. Eng.	EE 309 Electrical Circuits Laboratory	1	Current
Materials Science and Engineering	MSE 401 Materials Thermodynamics	4	Current
	MSE 525 Phase Diagrams	3	New courses from MSE curr. revision
	MSE 543 Structural Transformations	3	
	MSE 581.04 MSE Lab for Weld. Eng.	2	
Welding Eng.	WE 300 Survey of Welding Engineering	3	
	WE 350, 351 Intro. Welding Lab I,II	2	Current
	WE 489 Industrial Experience	1	Current
	WE 500, 550 Physical Principles in Welding Engineering I and Laboratory	4	Current
	WE 600 Physical Principles in Welding Engineering II	3	Current
	WE 601, 651 Welding Process Applications and Laboratory	4	Current
	WE 610 Introduction to Welding Metallurgy	3	Current
	WE 611, 661 Welding Metallurgy I and Lab	4	Current
	WE 612, 662 Welding Metallurgy II and Lab	4	Current
	WE 620 Engineering Analysis for Design and Simulation	4	Current
	WE 621 Welding Engineering Design	4	Current
	WE 631 Nondestructive Evaluation	4	Current
	WE 641 – Welding Codes, Specifications and Standards	3	Change elective to required
	WE 690, 691, 692 Capstone Welding Design I, II, II	5	Current
<b><i>Technical Electives</i></b>		<b><i>14</i></b>	Reduce from 21
Students choose a total of at least 14 hours for their technical elective program.			
Welding Eng.	WE714,715,701,703,713,723,740, 605,655,656,704,705,706,755, 735,636,681,732,733,641,736,694,795, H783	1,3	Current

Materials Science	MSE642,661,662,663	3	Current
Mech. Eng.	ME662,762,628	3	Current
Civil Eng.	CE431	3	Current
Industrial Eng.	ISE617,618,620,640,682,683	3	Current
Nuclear Eng.	NucEng505,606	3	Current
Chem Eng	ChemE773,776	3	Current
<b>GEC Requirements</b>		<b>40</b>	
<i>English &amp; Communication Skills:</i>			
<i>English 110 First Year English Composition</i>		5	Current
<i>2<sup>nd</sup> English course</i>		5	Choose
<i>Writing content in WE550, 690, 691, 692 and MSE 581.04 together fulfill the third English &amp; Communications Skills GEC requirement, 3 of the 13 credits).</i>		(3)	Current
<i>Historical Survey</i>		10	Choose
<i>Social Sciences</i>		10	Choose
<i>Arts &amp; Humanities</i>		10	Choose
<i>Social Diversity in the US (Can combine with another GEC credit)</i>		0	
<i>Ethics (Can combine with another GEC credit)</i>		0	
<b>TOTAL REQUIRED CREDIT HOURS</b>		<b>197</b>	

24. **Minimum number of credits required for completion:** 197

25. **Average number of credits expected at completion:** 200 or more

This is due to the fact that even though the GEC curriculum requires only 9 credits each in the Social Sciences and Arts & Humanities categories, there are in fact very few 4 credit GEC courses available.

26. **Estimated average number of credits taken per quarter by a typical student.**

	Year 1	Year 2	Year 3	Year 4
Full-time	17	16	17	17
Part-time	10	8-12	8-12	8-12

**27. Number of credits a student is required to take in other departments.**

<b>Department</b>	<b>Number of Credits</b>	<b>Level</b>
Chemistry	9	Lower Division
Mathematics	24	Lower Division
Physics	15	Lower Division
Engineering (College)	6	Lower Division
Materials Science and Engineering	15	Lower Division
Mechanical Engineering	8	Lower Division
Electrical Engineering	4	Lower Division
English	10	Lower Division
Other Departments offering GEC courses	30	Lower Division

**28. Number of credits a student might take as an elective in other departments.**

Elective courses are found in two parts of the curriculum: General Engineering Requirements (usually lower division) and Technical Electives (upper division).

<b>Department</b>	<b>Number of Credits</b>	<b>Level</b>
Materials Science and Engineering	12	Upper Division
Mechanical Engineering	9	Upper Division
Industrial Engineering	18	Upper Division
Civil Engineering	3	Upper Division
Nuclear Engineering	6	Upper Division
Chemical Engineering	6	Upper Division

**29. Other degree requirements.**

There are no other requirements for the degree.

**30. Specific methods to be used for evaluating the program.**

The following tools are in place for assuring achievement of program objectives listed in section II-7.

- ◆ *Evaluation of student performance in the classroom:* Course grades based on performance on homework, quizzes, exams, and projects remain an important standard evaluation component. The faculty are confident that course evaluation tools are designed such that grades generally provide an accurate measure of the knowledge and skills learned in the course.

- ◆ *Student evaluations:* The Student Evaluation of Instruction (SEI) is a standardized assessment tool used throughout the university. The SEI consists of ten questions that students answer on a 1 to 5 scale. The usefulness of the SEI is limited, given its restricted format; however, consistently low scores by an instructor over a series of courses signals the need for corrective action. Many professors supplement the SEI by providing additional forms that allow students to give written feedback about aspects of the course that they thought were especially good or that needed improvement.
- ◆ *Peer Evaluation of Teaching:* Evaluation of teaching by faculty peers has been done in the past at the request of the teaching professor, or when the Chair deemed it to be necessary. Beginning 1999-2000, peer evaluation will become a required component in tenure and promotion applications for all assistant and associate professors.
- ◆ *Placement data for B.S. graduates:* The successful placement of B.S. graduates in industrial positions, graduate schools, and other professional positions is a key measure of the quality of the program.
- ◆ *Senior exit survey:* The Welding Engineering Program asks all B.S. graduating seniors to complete a written exit survey. This survey contains several standard sets of questions that are asked in exit surveys performed by other departments in the College, while other questions are specific to welding engineering students. Perhaps the most useful part of the survey is the written comments that students provide. Graduating seniors are also interviewed as a group by the department chairman for verbal feedback in a round table discussion.
- ◆ *Alumni survey:* The OSU College of Engineering conducts yearly alumni surveys of second and sixth year graduates. The intent of this survey is to gauge how well the program has prepared B.S. graduates for positions in industry, graduate school, etc.
- ◆ *Co-op/Intern survey:* The OSU College of Engineering Co-op and Internship Program routinely conducts surveys of both students and employers. All working students are surveyed during the 5<sup>th</sup> week of the quarter ("Mid-quarter Progress Report") and then asked to evaluate their experiences again at the end of the quarter ("Student Evaluation of Work Experience"). A portion of this evaluation is made available to other students who may be considering a position with that particular company. At the end of each work term, students must also submit a written performance appraisal from their supervisor. Most employers choose to use the standard "Employer's Evaluation of Student Performance" form, while other companies prefer to use their own forms. The Co-op and Internship Program also surveys employers during the summer to track down employment information about students who have not reported jobs, to update the database, and to assess employer attitudes towards the candidates and Program's services. Employers are also

asked to complete an "Interview Feedback Form" when conducting on-campus interviews of students for co-op or internship positions. This feedback is used to help students improve their interviewing skills.

- ◆ *Local student chapter of the American Welding Society (AWS).* The Welding Engineering Program has a very active undergraduate student AWS chapter. This provides students an opportunity to be part of a professional organization. The student AWS organization provides important feedback to the faculty in a number of areas. In addition, by monitoring the level of student involvement in AWS activities, the department is able to evaluate its efforts in promoting and encouraging participation of undergraduates in a professional organization.

**31. Specialized professional associations from which accreditation will be sought.**

The Bachelor of Science program in Welding Engineering is accredited by the Accreditation Board for Engineering and Technology (ABET). Currently this accreditation comes under the Engineering Accreditation Commission (EAC) of ABET and this is where future accreditation will be sought.



**32. Number and qualifications of full-time and part-time faculty.**

<b>Name</b>	<b>Area of expertise</b>	<b>Professorial Rank</b>	<b>Graduate Faculty Category</b>	<b>Full or Part-Time</b>
Charles Albright	Welding processes	Associate	P	Full
William Baeslack	Welding metallurgy	Full	P	Part-Time
Avraham Benatar	Welding design	Associate	P	Full
David Dickinson	Welding processes	Full	P	Full
Dave Farson	Welding processes	Associate	P	Full
John Lippold	Welding metallurgy	Full	P	Full
Richard Richardson	Welding processes	Associate	P	Full
Stanilov Rokhlin	Nondestructive evaluation	Full	P	Full
Chon Tsai	Welding design	Full	P	Full

**VI. PROGRAM DESCRIPTION**

**33. Program description as it would appear in the appropriate college bulletin.**

The welding engineer is concerned with all of the activities related to the design, production, performance, and maintenance of welded products. Interest is primarily in the manufactured product, including materials selection, tooling, operator training, quality control, performance evaluation, sales, and service. The broad range of welded products with which welding engineers deal includes structures, such as bridges and buildings; pressure vessels and heat exchangers, such as nuclear systems, boilers, chemical processing equipment, storage vessels, and transmission and distribution piping; transportation vehicles for water, land, air, and space travel; and production and processing machines of all types.

It is the objective of welding engineering to apply the principles of science to ensure the compatibility of product design, materials, processes and reliability.

The welding engineering program provides basic liberal studies and the engineering training needed to function effectively in the manufacturing industries. Welding engineering courses combine work in several engineering fields. Four academic areas are treated:

- design, including work in engineering mechanics, stress analysis, structures, and machine and production design;
- the materials used in manufacture, with course work in physical metallurgy, metallography, and physical chemistry;
- manufacturing processes including electrical equipment and control; and

- fitness for service including nondestructive testing.

Course work in these four areas is taken in departments in addition to welding engineering to give the student a perception of other engineering fields. Subsequent studies in the Welding Engineering Program utilize this background information to provide in-depth training in welding materials, design, processes, and nondestructive evaluations. This is designed to prepare the student for complex research, production, and applications work in modern industry.

The following curriculum and list of minimum requirements for the degree Bachelor of Science in Welding Engineering are effective for all students entering the University without prior college credit.

**Year 1**

Quarter	Course (Department, Number, Title)	Course Credits	Total Credits
AU	Eng 100 or UVC 100 <i>Survey'</i>	(1)	
	Math 151 <i>Calculus and Analytical Geometry I</i>	5	
	Chem 121 <i>General Chemistry</i>	5	
	English 110 <i>First Year English Composition</i>	5	
	<i>Total Quarter Credits</i>		<i>15</i>
WI	Math 152 <i>Calculus and Analytical Geometry II</i>	5	
	Chem 125 <i>Chemistry for Engineers</i>	4	
	Eng 181 <i>Introduction to Engineering I</i>	3	
	Physics 131 <i>Introductory Physics: Part. &amp; Motion</i>	5	
	<i>Total Quarter Credits</i>		<i>17</i>
SP	Math 153 <i>Calculus and Analytical Geometry III</i>	5	
	Physics 132 <i>Introductory Physic: Elec. and Mag.</i>	5	
	Eng 183 <i>Introduction to Engineering II</i>	3	
	En Graph 167 <i>Problem Solving and Programming</i>	4	
	<i>Total Quarter Credits</i>		<i>17</i>
	<i>Total First Year Credits</i>		<i>49</i>

**Year 2**

Quarter	Course (Department, Number, Title)	Course Credits	Total Credits
AU	Math 254 <i>Calculus and Analytical Geometry IV</i>	5	
	Phys 133 <i>Intro. Physics: Particles and Motion</i>	5	
	ME 410 <i>Statics</i>	4	
	WE 300 <i>Survey of Welding Engineering</i>	3	
	WE 350 <i>Introductory Welding Laboratory I</i>	1	
	<i>Total Quarter Credits</i>		18
WI	Math 415 <i>Differential Equations</i>	4	
	EE 300 <i>Electrical Circuits</i>	3	
	EE 309 <i>Electrical Circuits Lab</i>	1	
	MSE 205 <i>Intro. to Materials Sci and Eng</i>	3	
	WE 351 <i>Introductory Welding Laboratory II</i>	1	
	<i>Total Quarter Credits</i>		12
	ME 420 <i>Strength of Materials</i>	4	
	ISE 311 <i>Manufacturing Engineering</i>	3	
	2 <sup>nd</sup> <i>English Course</i>	5	
	<i>Total Quarter Credits</i>		12
	<i>Total Second Year Credits</i>		42

**Year 3**

Quarter	Course (Department, Number, Title)	Course Credits	Total Credits
AU	WE 500 <i>Physical Principles in Welding Eng.I</i>	3	
	WE 550 <i>Physical Principles in Weld. Eng. I Lab*</i>	1	
	MSE 401 <i>Materials Thermodynamics</i>	4	
	WE 620 <i>Eng. Analysis for Design and Simulation</i>	4	
	GEC (Arts & Humanities 1) <sup>2</sup>	5	
	<i>Total Quarter Credits</i>		<i>17</i>
WI	MSE 525 <i>Phase Diagrams</i>	3	
	MSE 581.04 <i>MSE Laboratory for WE's</i>	2	
	WE 600 <i>Physical Principles in Weld. Eng. II</i>	3	
	WE 621 <i>Welding Engineering Design</i>	4	
	GEC (Social Sciences 1) <sup>2</sup>	5	
<i>Total Quarter Credits</i>		<i>17</i>	
SP	WE 610 <i>Introduction to Welding Metallurgy</i>	3	
	WE 601 <i>Welding Process Applications</i>	3	
	WE 651 <i>Welding Process Applications Laboratory</i>	1	
	MSE 543 <i>Structural Transformations</i>	3	
	WE 631 <i>Nondestructive Evaluation</i>	4	
	Technical Elective <sup>3</sup>	3	
<i>Total Quarter Credits</i>		<i>17</i>	
	<i>Total Third Year Credits</i>		<i>51</i>

## Year 4

Quarter	Course (Department, Number, Title)	Course Credits	Total Credits
AU	WE 611 <i>Welding Metallurgy I</i>	3	
	WE 661 <i>Welding Metallurgy I Laboratory</i>	1	
	WE 489 <i>Industrial Experience</i>	1	
	WE 690 <i>Capstone Welding Design I</i> <sup>*</sup>	1	
	ISE 406 <i>Industrial Quality Control</i>	4	
	Technical Elective <sup>3</sup>	1	
	Technical Elective <sup>3</sup>	3	
	GEC (Historical Survey 1) <sup>2</sup>	5	
	<i>Total Quarter Credits</i>		<i>19</i>
WI	WE 612 <i>Welding Metallurgy II</i>	3	
	WE 662 <i>Welding Metallurgy II Lab</i>	1	
	ISE 504 <i>Engineering Economic Analysis</i>	3	
	WE 692 <i>Capstone Welding Design II</i> <sup>*</sup>	2	
	Technical Elective <sup>3</sup>	3	
	GEC (Historical Survey 2) <sup>2</sup>	5	
	<i>Total Quarter Credits</i>		<i>17</i>
SP	WE 692 <i>Capstone Welding Design III</i> <sup>*</sup>	2	
	WE 641 <i>Welding Codes, Specifications and Stds.</i>	3	
	Technical Elective <sup>3</sup>	1	
	Technical Elective <sup>3</sup>	3	
	GEC (Social Sciences 2) <sup>2</sup>	5	
	GEC (Arts & Humanities 2) <sup>2</sup>	5	
	<i>Total Quarter Credits</i>		<i>19</i>
	<i>Total Fourth Year Credits</i>		<i>55</i>
	<b>Total Credits in Program</b>	<b>197</b>	

<sup>1</sup> Eng 100 (or UVC 100) is a survey course required by the University. Credit is not included in overall hours for degree.

<sup>2</sup> See Welding Engineering Major Sheet, Side 2 for complete list of GEC courses. Particular order in which these courses are taken varies from student to student.

<sup>3</sup> Technical electives (see below for details)

\* These five courses (WE 550, 690, 691, 692, MSE 581.04) *together* fulfill the third three-hour equivalent English & Communications Skills GEC requirement.

### **Technical Elective Courses**

Students enrolled in welding engineering at The Ohio State University are required to complete 14 hours credit in technical elective courses. Approved technical elective courses are listed in the tables below. Courses other than those listed may count towards this requirement with approval of the student's faculty academic advisor and approval from the Program Undergraduate Studies Committee.

This program is designed to require that students select technical electives for depth in

two areas. These two areas may be chosen from processes, design, materials or evaluation segments of the program. Students may also propose areas drawing on electives from other disciplines like materials science, industrial engineering, and the like.

## **Additional Documents**

Department Head Letter – Faculty Approval

Student Organization Letter – Student Concurrence

Statement on Facilities and Expenses

Comparison of Old and New Curriculum by Quarter

Concurrence from Materials Science and Engineering

Concurrence from Industrial, Welding and Systems Engineering

Conversion Plan from old to new curriculum



**Julia L. Higle**  
IWSE Department  
210 Baker Systems

(614) 292-8100  
higle.1@osu.edu

Date: February 7, 2007

To Whom it May Concern:

From: J.L. Higle, Chair

A handwritten signature in cursive script that reads "Julia L. Higle".

Re: Concurrence with WE Curriculum Change

The faculty of the IWSE Department voted unanimously on April 2, 2004 to support adoption of the proposed welding engineering curriculum.

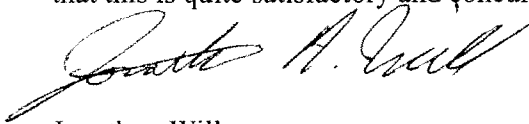
Please contact me if you have any questions.



Subject: WE Curriculum Proposal Concurrence

Date: January 23, 2007

The American Welding Society (AWS) student chapter at Ohio State has reviewed the proposal for the new WE curriculum. The students have observed that the new curriculum matches the current curriculum as it is being taught. The students feel that this is quite satisfactory and concur with the curriculum as proposed.

A handwritten signature in black ink, appearing to read "Jonathon Will". The signature is written in a cursive style with a large, sweeping initial "J".

Jonathon Will  
AWS Student Chapter President

## **Statement on Facilities and Expenses**

The impact of proposed curriculum changes on facilities and expenses is minimal. From an expense standpoint, the primary effect of the proposed changes is to eliminate two currently required courses in welding engineering. The two courses, WE 400 and 640, will be replaced by the adoption of ISE courses 311, 406 and 504 that are already taught as service courses to a broad audience. The elimination of the two courses will adjust the WE program to the loss in 2000 of a WE faculty (Howden) by retirement. This slot has been given up to budget reallocation and is not to be refilled. One WE course, WE 641 will be changed from elective to required status.

## Comparison of Current and Proposed New WE Curriculum

Year 1 – New in bold type; parentheses – removed from old program.

Quarter	Course (Department, Number, Title)	Course Credits	Total Credits
AU	Eng 100 or UVC 100 <i>Survey'</i>	(1)	
	Math 151 <i>Calculus and Analytical Geometry</i>	5	
	Chem 121 <i>General Chemistry</i>	5	
	English 110 <i>First Year Composition</i>	5	
	<i>Total Quarter Credits</i>		<i>15(15)</i>
WI	Math 152 <i>Calculus and Analytical Geometry</i>	5	
	Chem 125 <i>Chemistry for Engineers</i>	4	
	Eng 181 <i>Introduction to Engineering I</i>	3	
	Physics 131 <i>Introductory Physics</i>	5	
	<i>Total Quarter Credits</i>		<i>17(17)</i>
SP	Math 153 <i>Calculus and Analytical Geometry</i>	5	
	Physics 132 <i>Introductory Physics</i>	5	
	Eng 183 <i>Introduction to Engineering II</i> *	3	
	En Graph 167 <i>Engineering Problem Solving</i>	4	
	<i>Total Quarter Credits</i>		<i>17(17)</i>
	<i>Total First Year Credits</i>		<i>49(49)</i>

\*Note: Clerical change of number for Eng 182 to Eng 183.

Year 2– New in bold type; parentheses – removed from old program.

Quarter	Course (Department, Number, Title)	Course Credits	Total Credits
AU	Math 254 <i>Calculus and Analytical Geometry</i>	5	
	Phys 133 <i>Particles and Motion</i>	5	
	ME 410 <i>Statics</i>	4	
	WE 300 <i>Survey of Welding Engineering</i>	3	
	WE 350 <i>Introductory Welding Laboratory</i>	1	
	<i>Total Quarter Credits</i>		18(18)
WI	Math 415 <i>Ordinary &amp; Partial Diff. Equation</i>	4	
	EE 300 <i>Electrical Circuits</i>	3	
	EE 309 <i>Electrical Circuits Lab</i>	1	
	MSE 205 <i>Intro. To Materials Sci and Eng.</i>	3	
	WE 351 <i>Introductory Welding Laboratory</i>	1	
	<i>Total Quarter Credits</i>		12(12)
SP	ME 420 <i>Strength of Materials</i>	4	
	<b>ISE 311 <i>Manufacturing Engineering</i></b>	3	
	(WE 400 <i>Chemistry of Welding</i> )	(3)	
	2 <sup>nd</sup> <i>English Course</i>	5	
	<i>Total Quarter Credits</i>		12(12)
	<i>Total Second Year Credits</i>		42(42)

Year 3 – New in bold type; parentheses – removed from old program.

Quarter	Course (Department, Number, Title)	Course Credits	Total Credits
AU	WE 500 <i>Physical Principles in Welding Eng.</i>	3	
	WE 550 <i>Physical Principles in Weld. Eng. Lab</i>	1	
	MSE 401 <i>Materials Thermodynamics</i>	4	
	WE 620 <i>Eng. Analysis for Design and Simulation</i>	<b>4(5)</b>	
	GEC (Arts & Humanities 1) <sup>2</sup>	5	
	<i>Total Quarter Credits</i>		<i>17(18)</i>
WI	<i>(MSE 542.01 Materials Structure II)</i>	<i>(3)</i>	
	<i>(MSE 542.02 Materials Structure Laboratory)</i>	<i>(2)</i>	
	<b>MSE 525 Phase Diagrams</b>	<b>3</b>	
	<b>MSE 581.04 MSE Laboratory for WE's</b>	<b>2</b>	
	WE 600 <i>Physical Principles in Weld. Eng. II</i>	3	
	WE 621 <i>Welding Engineering Design</i>	4	
	GEC (Social Sciences 1) <sup>2</sup>	5	
<i>Total Quarter Credits</i>		<i>17(17)</i>	
SP	WE 610 <i>Introduction to Welding Metallurgy</i>	3	
	WE 601 <i>Welding Applications</i>	3	
	WE 651 <i>Welding Applications Laboratory</i>	1	
	MSE 543 <i>Structural Transformations</i>	3	
	WE 631 <i>Nondestructive Evaluation</i>	4	
	Technical Elective <sup>3</sup>	3	
<i>Total Quarter Credits</i>		<i>17(17)</i>	
	<i>Total Third Year Credits</i>		<i>51(52)</i>

Year 4 – New in bold type; parentheses – removed from old program

Quarter	Course (Department, Number, Title)	Course Credits	Total Credits
AU	WE 611 <i>Welding Metallurgy I</i>	3	
	WE 661 <i>Welding Metallurgy Laboratory</i>	1	
	WE 489 <i>Industrial Experience</i>	1	
	WE 690 <i>Capstone Welding Design I</i>	1	
	<b>ISE 406 Industrial Quality Control</b>	<b>4</b>	
	(Technical Elective)	(4)	
	Technical Elective	3	
	Technical Elective	1	
	GEC (Historical Survey 1) <sup>2</sup>	5	
	<i>Total Quarter Credits</i>		<i>19(19)</i>
WI	WE 612 <i>Welding Metallurgy II</i>	3	
	WE 662 <i>Welding Metallurgy Lab</i>	1	
	(WE 640 <i>Welding Production</i> )	(3)	
	WE 692 <i>Capstone Welding Design II</i>	2	
	<b>ISE 504 Engineering Economics Analysis</b>	<b>3</b>	
	Technical Elective	3	
	GEC (Historical Survey 2) <sup>2</sup>	5	
	<i>Total Quarter Credits</i>		<i>17(17)</i>
SP	(WE 692 <i>Capstone Welding Design III</i> ) <sup>1</sup>	<b>2(1)</b>	
	(Technical Elective)	(3)	
	<b>WE 641 Welding Codes, Standards and Specs.</b>	<b>3</b>	
	Technical Elective	1	
	Technical Elective	3	
	GEC (Social Sciences 2) <sup>2</sup>	5(4)	
	GEC (Arts & Humanities 2) <sup>2</sup>	5(4)	
	<i>Total Quarter Credits</i>		<i>19(16)</i>
	<i>Total Fourth Year Credits</i>		<i>55(52)</i>
	<b>Total Credits in Program</b>	<b>197</b>	<b>197(195)</b>

<sup>1</sup> Eng 100 (or UVC 100) is a survey course required by the University. Credit is not included in overall hours for degree.

<sup>2</sup> Timing of these courses varies from student to student.



**Materials Science  
and  
Engineering**

177 Watts Hall  
2041 College Rd.  
Columbus, OH 43210  
phone: 614-292-6085  
fax: 614-292-9857

January 22, 2007

Professor Richard Richardson  
Department of Industrial Systems and Welding Engineering  
210 Baker Systems Engineering Bldg.  
1971 Neil Ave.  
Columbus, OH 43210

Dear Professor Richardson:

The MSE Department supports the revision of the WE Curriculum Revision as it pertains to MSE courses required for students in the WE major. The following MSE courses will be taken by WE students:

Year 3, AU Qtr	MATSCENG 401	Thermodynamics (4)
Year 3, WI Qtr	MATSCENG 525	Phase Diagrams (3)
	MATSCENG 581.04	MSE Lab for Welding Engineering
Year 3 SP Qtr	MATSCENG 543	Phase Transformations (3)

Sincerely,

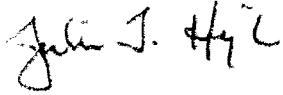
Rudolph G. Buchheit  
Professor and Chair - Materials Science and Engineering

cc: MSE File (C. Lottie)  
R. Wagoner, Chair MSE Undergraduate Studies Committee  
M. Daniels, MSE Undergraduate Academic Advisor



**Julia L. Higle**  
IWSE Department  
210 Baker Systems

(614) 292-8100  
higle.1@osu.edu

Date: January 19, 2007  
To: Dr. Richard Richardson  
From: J.L. Higle, Chair   
Re: Concurrence with WE Curriculum Change

Dear Dr. Richardson,

The IWSE Department is fully in concurrence with the proposed Welding Engineering curriculum change. Specifically, we endorse the requirement of ISE 311, 406, and 504 in the new WE curriculum.



## **Conversion Plan from Old to New Proposed WE Curriculum**

The proposed new WE curriculum requires no formal conversion plan at this juncture since all of the proposed changes have been put in place over the last several years by necessity via substitution petitions and in some cases by advising of students in their technical elective choices.