LEVEL II MEMORANDUM

DATE: December 4, 2013

TO: Chief Academic Officers, Montana University System

FROM: Neil Moisey, Deputy Commissioner for Academic, Research, & Student Affairs
John Cech, Deputy Commissioner for Two-Year & Community College Education

RE: Level II Submission Items

The campuses of the Montana University System have proposed new academic programs or changes under the Level II approval process authorized by the Montana Board of Regents. The Level II proposals are being sent to you for your review and approval. If you have concerns about a particular proposal, you should share those concerns with your colleagues at that institution and try to come to some understanding. If you cannot resolve your concerns, you need to raise those concerns at the Chief Academic Officer's conference call on **December 11th**. Issues not resolved at that meeting should be submitted in writing to OCHE by noon on **Friday, December 13th (Friday following CAO call)**. That notification should be directed to Amy DeMato, Assistant to the Deputy Commissioners. If Amy does not hear from you, in writing, by **noon on 12/13/13**, OCHE will assume that the proposals have your approval.

The Level II submissions are as follows:

Flathead Valley Community College:

- Request for authorization to implement an Electronics Technician Associates of Applied Science degree ITEM #162-302-R0114 | Level II Request Form | Curriculum Proposal Form
- Request for authorization to implement an Industrial Machine Technology Associates of Applied Science degree ITEM #162-305-R0114 | Level II Request Form | Curriculum Proposal Form
- Request for authorization to implement a Nondestructive Testing Certificate of Applied Science degree ITEM #162-306-R0114 | Level II Request Form | Curriculum Proposal Form

Montana State University-Bozeman:

- Request for authorization to implement a Optics and Photonics Minor ITEM #162-2007-R0114 | Level II Request Form | Curriculum Proposal Form
- Request for authorization to implement Optics and Photonics Master's of Science degree ITEM #162-2008-R0114 | Level II Request Form | Curriculum Proposal Form

The University of Montana-Missoula:

- Request for authorization to implement a Neural Injury Center ITEM #162-1019-R0914 | Level II Request Form | Curriculum Proposal Form

Montana Tech of The University of Montana:

- Request to implement a Welding Technology Certificate of Applied Science degree ITEM #162-1503-R0114 | Level II Request Form | Curriculum Proposal Form
- Request to implement a machining Technology Certificate of Applied Science degree ITEM #162-1504-R0114 | Level II Request Form | Curriculum Proposal Form

January 8-9, 2014

ITEM 162-302-R0114
Request for authorization to implement Electronics Technician AAS

THAT

The Board of Regents authorizes Flathead Valley Community College to implement an AAS Degree in Electronics Technician.

EXPLANATION

FVCC requests to implement a 72-71 credit AAS program in Electronics Technician. The program will consist of four, stackable certificates and is designed to give students the technical skills, as well as interpersonal skills, that will prepare them for placement into electronics technician positions.

ATTACHMENTS

Level II Request Form
Curriculum Proposal Form

Montana Board of Regents

LEVEL II REQUEST FORM

Item Number: **162-302-R0114** Meeting Date: **January 8 – 9, 2013**

Institution: **Flathead Valley Community College** CIP Code: **47.0105**

Program Title: **Electronics Technician AAS**

Level II proposals require approval by the Board of Regents.

Level II action requested ***(place an X for all that apply and submit with completed Curriculum Proposals Form):***

Level II proposals entail substantive additions to, alterations in, or termination of programs, structures, or administrative or academic entities typically characterized by the (a) addition, reassignment, or elimination of personnel, facilities, or courses of instruction; (b) rearrangement of budgets, cost centers, funding sources; and (c) changes which by implication could impact other campuses within the Montana University System and community colleges. Board policy 303.1 indicates the curricular proposals in this category:

___ **1. Change names of degrees (e.g. from B.A. to B.F.A.)**

___ **2. Implement a new minor or certificate where there is no major or no option in a major;**

X **3. Establish new degrees and add majors to existing degrees; and**

___ **4. Any other changes in governance and organization as described in Board of Regents' Policy 218, such as formation, elimination or consolidation of a college, division, school, department, institute, bureau, center, station, laboratory, or similar unit.**

Specify Request:

FVCC requests to implement a 72-71 credit AAS program in Electronics Technician. The program will consist of four, stackable certificates and is designed to give students the technical skills, as well as interpersonal skills, that will prepare them for placement into electronics technician positions.

Montana Board of Regents

CURRICULUM PROPOSALS

1. Overview

This proposal is for an Electronics Technician AAS degree. Many of the courses in the first semester, titled Technician Track Level I, are common to the first semester of the proposed Industrial Machine Technology AAS program. The courses in the second semester already exist and are taught for various purposes. There are six new electronics courses that would be taught in the third and fourth semesters.

2. Provide a one paragraph description of the proposed program. Be specific about what degree, major, minor or option is sought.

This program is designed to give students the technical skills, as well as interpersonal skills, that will prepare them for placement into electronics technician positions. Students gain theoretical knowledge and hands-on experience with both basic and advanced electronics including circuits, controllers, and the machine to system interface.

3. Need

A. To what specific need is the institution responding in developing the proposed program?

FVCC applied for, and was awarded, a second round TAACCCT grant with a focus on a set of interconnected, stackable credential training programs directed toward developing workers for northwest Montana's advanced manufacturing industry. Our process included the development of an industry advisory committee to provide insight into educational needs within the manufacturing industry. This advisory committee included representatives from 20 different businesses. At the several meetings, there were robust discussions aimed at identifying competency voids in the local workforce, and then how to design training programs and curriculum tracks that would effectively address those voids. We repeatedly heard about the same voids. Although worker training is not typically addressed by these businesses, we certainly received input regarding needed training. And of course, an awareness of what is missing points toward solutions.

B. How will students and any other affected constituencies be served by the proposed program?

The stackable credentials allow participants (students) multiple points of entry and exit, depending on their individual career needs, and the recommendations of their employer, to reach higher wages. A person may graduate with a certificate upon completion of any of levels I, II, III, and IV. Alternatively, a person may graduate with the proposed AAS degree upon completion of all four levels.

Montana Board of Regents
CURRICULUM PROPOSALS

C. What is the anticipated demand for the program? How was this determined?

Data in the following table came from research FVCC conducted as part of the initial process prior to submission of the round II TAACCCT grant. The source of the data is EMSI.

Factor (Advanced Manufacturing): **Evidence of Employer Demand in Flathead and Lincoln County, MT**			
Current Employment Opportunities (Sources: Economic Modeling Systems, Inc. data for Lincoln and Flathead Counties)			
Targeted Occupations (for SOC codes listed above):	**Projected New Job Openings**		**Local Employer Demand** (Industry representatives helped FVCC identify workforce demand in these occupations during a series of conversations addressing where voids existed in the local training system)
	2012-2015	**2012-2020**	
Machinist	143	379	All employers engaged in outreach indicated a growing need for dependable workers with technical skills in this range. Plum Creek, for instance indicated a need for 50-100 workers in this range of competencies.
Manufacturing Technician	34	88	
Industrial Machinery Mechanic	95	241	At least three large employers (Defiance, Applied Materials and Plum Creek) indicated a growing need for mechanics/millwrights.
Industrial Electronics Technician	19	46	Our two largest employers in manufacturing, Plum Creek and Applied Materials each indicated a need for 10-20 electronics specialist in the next few years.
First Line Supervisors – Manufacturing	26	65	Applied Materials and Neptune Aviation have continued to highlight the need for general leadership skills amongst their supervisors, putting demand for training at 5-10 worker per year.

Total Projected New Jobs (Industry)	Total Overall Industry Annual Openings	Total Projected New Jobs (Industry)	Total Overall Industry Annual Openings
Present – 7/1/2015 (short-term window)		**Present – 7/1/2020 (10 year window)**	
EMSI Labor Statistics projections			
317	106	819	102
Local Employer Projections (*for next "4" and "10" years*)			
339	85	985	99

Montana Board of Regents

CURRICULUM PROPOSALS

4. Institutional and System Fit

A. What is the connection between the proposed program and existing programs at the institution?

Level I, titled Technician Track Level I, is nearly the same for the proposed AAS degree in Electronics Technician and also Industrial Machine Technology. There is a difference in the math requirement and also two of the technical skills courses.

B. Will approval of the proposed program require changes to any existing programs at the institution? If so, please describe.

No.

C. Describe what differentiates this program from other, closely related programs at the institution (if appropriate).

N/A

D. How does the proposed program serve to advance the strategic goals of the institution?

FVCC has four core themes; these are transfer preparation, workforce preparation, developmental education, and community education. The proposed program directly addresses workforce preparation, and it is a component of community education.

E. Describe the relationship between the proposed program and any similar programs within the Montana University System. In cases of substantial duplication, explain the need for the proposed program at an additional institution. Describe any efforts that were made to collaborate with these similar programs; and if no efforts were made, explain why. If articulation or transfer agreements have been developed for the substantially duplicated programs, please include the agreement(s) as part of the documentation.

Missoula College has an electronics program. Two of our three new courses for the third semester are taught at Missoula College, but not the third one, a course in programmable logic controllers. Nor do they teach the Electrical Fundamentals II course. In the fourth semester, they only teach the capstone electronics course, but not the other three. Our program will primarily serve local place-bound students. We don't anticipate that it would directly compete with Missoula's program.

Montana Board of Regents
CURRICULUM PROPOSALS

5. Program Details

A. Provide a detailed description of the proposed curriculum. Where possible, present the information in the form intended to appear in the catalog or other publications. NOTE: In the case of two-year degree programs and certificates of applied science, the curriculum should include enough detail to determine if the characteristics set out in Regents' Policy 301.12 have been met.

Electronics Technician

Associate of Applied Science Degree

This program is designed to give students the technical skills, as well as interpersonal skills, that will prepare them for placement into electronics technician positions. Students gain theoretical knowledge and hands-on experience with both basic and advanced electronics including circuits, controllers, and the machine to system interface. Upon completion of this program, students will:

- *Read and describe the characteristics of basic circuitry and compute circuit capacity*
- *Demonstrate wiring design and identify basic electrical components*
- *Troubleshoot analog and digital circuits using standard and specialized test equipment*
- *Program and troubleshoot PLC systems for basic system control*
- *Describe how various industrial processes are coalesced using advanced PLC techniques*
- *Demonstrate the use of electrical, electronic solid state, digital, and pneumatic transmitters in practical process control instrumentation*
- *Effectively communicate during problem solving and troubleshooting*

Fall Semester

__	Course No.	Title	Credits
EELE	101*	Intro. to Electrical Fund's	2
ELCT	110	Basic Electricity I	5
ELCT	103*	Elec. Code Study/Codeology	3
PHSX	110*	Applied Physics	4
M	121M*	College Algebra 3	
or			
M	152m*	Precalculus Algebra	4
	Semester Total		**17/18**

Spring Semester

Course	No.	Title	Credits
MCH	101	Intro. to Manufacturing Processes	1
ELCT	137	Electrical Drafting	2
CAPP	106*	Short Courses: Computer App's	1
COMX	115C	Intro. to Interpersonal Comm.	3
or			
IDS	135C	Think'g: How to Problem Solve	3
ECP	104	Workplace Safety	1
M	095*	Intermediate Algebra	4
ELCT	100	Intro. to Electricity	3
ELCT	111	Electric Meters and Motors	3
	Semester Total		**18**

Montana Board of Regents
CURRICULUM PROPOSALS

Fall Semester

__	Course	No.	Title	Credits
ETEC	285		Adv. Program'ble Controllers	3
ETEC			Advanced Electronics	4
ELCT	210*		Advanced Current Theory	5
WRIT	122C*		Intro. to Business Writing	3
ETEC	299		Capstone: Electronics	3
	Semester Total			**18**

Spring Semester

__	Course	No.	Title	Credits
ELCT	102*		Electrical Fundamentals II	4
ETEC	250*		Solid State Electronics I	4
ETEC	245*		Digital Electronics	4
ELCT	250		Programmable Logic Control's	4
	Semester Total			**16**

Advisor(s): Pete Wade
Building/Room #: OT 108
Phone #: (406) 756-3968
Email address: pwade@fvcc.edu

Program Information

- A student may apply for graduation upon completion of Certificate Levels I, II, III, or IV. Alternatively, a student may apply for graduation with an AAS degree upon completion of all four levels.
- Good mathematical skills are imperative. Precalculus algebra (M 152) is recommended.

Additional Costs

- There are lab fees associated with some of the classes in this program. They are listed in the semester course schedule.

Opportunities after graduation

- In Flathead County, employment opportunities in electronics manufacturing have grown over 70% since 2006.
- Typical wages for electronics technicians are above average both state and nationally

B. Describe the planned implementation of the proposed program, including estimates of numbers of students at each stage.

We are already offering the machinist version of Level I, titled Technician Track Level I, for our present one year program in Industrial Machine Technology. We plan to offer Level II of the Electronics Technician program in FA/14 and Level III in SP/15. Initially, we expect approximately half a dozen students in the

program. In Flathead County, employment opportunities in electronics manufacturing have increased more than 70% since 2006. Typical wages for electronics technicians are above average both state and nationally. Very recently, the lead electronics employee for a large local employer reported that individuals with electrical, but not electronics, training have left for better paying jobs elsewhere. Persons with electrical training are this company's only source for someone who can be trained for electronics work. This employer is paying this employee to assist us in developing, and assisting with this program.

6. Resources

A. Will additional faculty resources be required to implement this program? If yes, please describe the need and indicate the plan for meeting this need.

Yes. There are 6 new electronics courses in this program. We have identified three qualified instructors for these courses, equal to one course per instructor per semester.

B. Are other, additional resources required to ensure the success of the proposed program? If yes, please describe the need and indicate the plan for meeting this need.

Yes. We have identified the necessary equipment and there are grant funds available to purchase this equipment. In addition, we recently completed a remodel of an area in the Occupational Trades Building which added two classrooms and five offices.

7. Assessment

How will the success of the program be measured?

Number of enrolled students, as well as completion rates, are available through our Director of Institutional Research. We are also able to assess employment, albeit on a voluntary basis, and feedback from employers who are members of the advisory committee. The latter feedback would relate to the level of preparedness for employment.

8. Process Leading to Submission

Describe the process of developing and approving the proposed program. Indicate, where appropriate, involvement by faculty, students, community members, potential employers, accrediting agencies, etc.

Our process included the development of an industry advisory committee that included representatives from 20 different businesses. This committee met several times with a goal of identifying gaps or voids in the local workforce. Specifically, we heard many times the typical shortcomings of prospective entry level employees. With guidance from these representatives, we developed programs and curricula designed to address these deficiencies

January 8-9, 2014

ITEM 162-305-R0114

Request for authorization to implement an Industrial Machine Technology AAS Degree

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THAT

The Board of Regents authorizes Flathead Valley Community College to implement an AAS Degree in Industrial Machine Technology.

EXPLANATION

FVCC requests to implement a 72-credit AAS program in Industrial Machine Technology. The program will consist of four stackable certificates designed to provide instruction in the theory and operation of mills and lathes, both manual and CNC, and other tools associated with the machinist trade.

ATTACHMENTS

Level II Request Form
Curriculum Proposal Form

Montana Board of Regents

LEVEL II REQUEST FORM

Item Number: **162-305-R0114** Meeting Date: **January 8 – 9, 2013**

Institution: **Flathead Valley Community College** CIP Code: **48.051**

Program Title: **Industrial Machine Technology AAS**

Level II proposals require approval by the Board of Regents.

Level II action requested ***(place an X for all that apply and submit with completed Curriculum Proposals Form):***

Level II proposals entail substantive additions to, alterations in, or termination of programs, structures, or administrative or academic entities typically characterized by the (a) addition, reassignment, or elimination of personnel, facilities, or courses of instruction; (b) rearrangement of budgets, cost centers, funding sources; and (c) changes which by implication could impact other campuses within the Montana University System and community colleges. Board policy 303.1 indicates the curricular proposals in this category:

___ **1. Change names of degrees (e.g. from B.A. to B.F.A.)**

___ **2. Implement a new minor or certificate where there is no major or no option in a major;**

X **3. Establish new degrees and add majors to existing degrees; and**

___ **4. Any other changes in governance and organization as described in Board of Regents' Policy 218, such as formation, elimination or consolidation of a college, division, school, department, institute, bureau, center, station, laboratory, or similar unit.**

Specify Request:

FVCC requests to implement a 72-credit AAS program in Industrial Machine Technology. The program will consist of four stackable certificates designed to provide instruction in the theory and operation of mills and lathes, both manual and CNC, and other tools associated with the machinist trade.

Montana Board of Regents

CURRICULUM PROPOSALS

1. Overview

This is an addition of two semesters to the present two semester program. Completion of all four semesters (levels) leads to the proposed AAS degree in Industrial Machine Technology, while completion of only the first two semesters (levels) leads to the current CAS degree.

2. Provide a one paragraph description of the proposed program. Be specific about what degree, major, minor or option is sought.

The Industrial Machine Technology program, which leads to the proposed AAS degree, provides instruction in the theory and operation of mills and lathes, both manual and CNC, other tools related to the machinist trade, and associated programming.

3. Need

A. To what specific need is the institution responding in developing the proposed program?

FVCC applied for, and was awarded, a second round TAACCCT grant with a focus on a set of interconnected, stackable credential training programs directed toward developing workers for northwest Montana's advanced manufacturing industry. Our process included the development of an industry advisory committee to provide insight into educational needs within the manufacturing industry. This advisory committee included representatives from 20 different businesses. At the several meetings, there were robust discussions aimed at identifying competency voids in the local workforce, and then how to design training programs and curriculum tracks that would effectively address those voids. We repeatedly heard about the same voids. Although worker training is not typically addressed by these businesses, we certainly received input regarding needed training. And of course, an awareness of what is missing points toward solutions.

B. How will students and any other affected constituencies be served by the proposed program?

The stackable credentials allow participants (students) multiple points of entry and exit, depending on their individual career needs, and the recommendations of their employer, to reach higher wages. A person may graduate with a certificate upon completion of any of levels I, II, III, and IV. Alternatively, a person may graduate with the proposed AAS degree upon completion of all four levels.

Montana Board of Regents
CURRICULUM PROPOSALS

C. What is the anticipated demand for the program? How was this determined?

Data in the following table came from research FVCC conducted as part of our due diligence for the proposal we submitted for a round II TAACCCT grant. Source is EMSI.

Factor (Advanced Manufacturing): **Evidence of Employer Demand in Flathead and Lincoln County, MT**			
Current Employment Opportunities (Sources: Economic Modeling Systems, Inc. data for Lincoln and Flathead Counties)			
Targeted Occupations (for SOC codes listed above):	**Projected New Job Openings**		**Local Employer Demand** (Industry representatives helped FVCC identify workforce demand in these occupations during a series of conversations addressing where voids existed in the local training system)
	2012-2015	**2012-2020**	
Machinist	143	379	All employers engaged in outreach indicated a growing need for dependable workers with technical skills in this range. Plum Creek, for instance indicated a need for 50-100 workers in this range of competencies.
Manufacturing Technician	34	88	
Industrial Machinery Mechanic	95	241	At least three large employers (Defiance, Applied Materials and Plum Creek) indicated a growing need for mechanics/millwrights.
Industrial Electronics Technician	19	46	Our two largest employers in manufacturing, Plum Creek and Applied Materials each indicated a need for 10-20 electronics specialist in the next few years.
First Line Supervisors – Manufacturing	26	65	Applied Materials and Neptune Aviation have continued to highlight the need for general leadership skills amongst their supervisors, putting demand for training at 5-10 worker per year.

Total Projected New Jobs (Industry)	Total Overall Industry Annual Openings	Total Projected New Jobs (Industry)	Total Overall Industry Annual Openings
Present – 7/1/2015 (short-term window)		**Present – 7/1/2020 (10 year window)**	
EMSI Labor Statistics projections			
317	106	819	102
Local Employer Projections (*for next "4" and "10" years*)			
339	85	985	99

4. Institutional and System Fit

A. What is the connection between the proposed program and existing programs at the institution?

Level I, titled Technician Track Level I, is nearly the same for the proposed AAS degree in Industrial Machine Technology and also Electronics Technician. There is a difference in the math requirement and also two of the technical skills courses.

B. Will approval of the proposed program require changes to any existing programs at the institution? If so, please describe.

No.

C. Describe what differentiates this program from other, closely related programs at the institution (if appropriate).

NA.

D. How does the proposed program serve to advance the strategic goals of the institution?

FVCC has four core themes; these are transfer preparation, workforce preparation, developmental education, and community education. The proposed program directly addresses workforce preparation, and it is a component of community education.

E. Describe the relationship between the proposed program and any similar programs within the Montana University System. In cases of substantial duplication, explain the need for the proposed program at an additional institution. Describe any efforts that were made to collaborate with these similar programs; and if no efforts were made, explain why. If articulation or transfer agreements have been developed for the substantially duplicated programs, please include the agreement(s) as part of the documentation.

Helena College has a machining program. The MUS website for course equivalency shows only one course common to the first year offered by Helena College and FVCC; that course is MCH 120. At this time, it appears that the 9 new courses for the two additional semesters of our proposed program will be unique to us. Although we were aware of Helena College's program, ours was developed collaboratively with the industrial members of our advisory committee. Our program will primarily serve place-bound students; we don't anticipate that it would directly compete with Helena's program.

5. Program Details

A. Provide a detailed description of the proposed curriculum. Where possible, present the information in the form intended to appear in the catalog or other publications. NOTE: In the case of two-year degree programs and certificates of applied science, the curriculum should include enough detail to determine if the characteristics set out in Regents' Policy 301.12 have been met.

Industrial Machine Technology

Associate of Applied Science Degree

The Industrial Machine Technology program provides instruction in the theory and operation of mills and lathes, both manual and CNC, other tools related to the machinist trade, and associated programming.

Montana Board of Regents
CURRICULUM PROPOSALS

Upon completion of this program, students will:

- Apply quantitative skills in conjunction with trade handbook information to solve problems
- Effectively communicate during the problem solving process
- Use tools and equipment to form and machine various materials in a manufacturing laboratory environment
- Describe precision measurement and quality control procedures
- Use various precision measuring tools including a coordinate measuring machine
- Demonstrate advanced machining operations that are performed on CNC machines, and also Swiss CNC machines
- Produce advanced programs using G code
- Demonstrate advanced techniques that are used on manual mills and lathes

Fall Semester

Course	No.	Title	Credits
MCH	101	Intro. to Manufacturing Processes	1
MFGT	115	Machine Shop Fundamentals	2
CAPP	106*	Short Courses: Computer Applications	1
COMX	115C	Intro. to Interpersonal Comm.	3
or			
IDS	135C	Thinkering: How to Problem Solve	3
ECP	104	Workplace Safety	1
M	111*	Technical Mathematics	3
MCH	120	Blueprint Reading & Int. Mach.	3
MCH	129*	Machine Quality Control and Precision Measurements	3
	Semester Total		**17**

January Interim Session

MCH	121	Mill and Lathe Systems	4
	Interim Total		**4**

Montana Board of Regents
CURRICULUM PROPOSALS

Spring Semester

__	Course	No.	Title	Credits
MCH		102	Intro. to Manufacturing Materials	2
DDSN		135	Solidworks	2
MCH		122	Introduction to MASTERCAM	3
MCH		125*	HAAS CNC Lathe Operations	3
MCH		126*	Adv. Mill and Lathe Systems	3
MCH		127*	HAAS CNC Mill Operations	3
	Semester Total			**16**

Fall Semester

__	Course	No.	Title	Credits
MCH			Geometric Dim. & Tol.	3
MCH			Advanced Manual Mill	3
MCH			Advanced CNC Mill Operations	3
MCH			Machinery's Handbook	3
MCH			Advanced CAD/CAM	4
	Semester Total			**16**

Spring Semester

__	Course	No.	Title	Credits
MCH			Swiss CNC and Mill-Turn Sys.	4
MCH			Advanced Manual Lathe	3
MCH			Advanced CNC Lathe Op's	3
MCH		299	Capstone: Machinist	3
WRIT		122C*	Intro. to Business Writing	3
	Semester Total			**16**

Montana Board of Regents
CURRICULUM PROPOSALS

Optional Course Offering:

MCH 298* Internship: Adv. Manufacturing 1

Advisor(s): Lloyd Haugen, Dan Leatzow

Building/Room #: OT 109, OT 202

Phone #: (406) 756-3938, (406) 756-4187

Email address: lhaugen@fvcc.edu, dleatzow@fvcc.edu

Program Information

- Each completed semester's courses constitute a certificate in that level. A student may apply for graduation in Level I, II, III, or IV. Or, a student may apply for graduation with a Certificate of Applied Science upon completion of Levels I and II. Alternatively, a student may apply for graduation with the AAS degree upon completion of all four levels.
- An internship is optional for this program. Students must apply for internship placements for this program the prior semester. There is a selection process for applicants. See page xx for more information and application deadlines.

Additional Costs

- There are lab fees associated with some of the classes in this program. They are listed in the semester schedule.

Opportunities after graduation

- CNC machinists work in machinery and machine tool manufacturing, small arms manufacturing, and machine shops. Growth in the manufacturing industry and the need to replace an aging workforce is expected to provide opportunities for graduates.
- In Montana, employment of CNC machinists is projected to increase by 44% between 2010 and 2020. Both state and national projected employment growth exceeds the rate of overall projected employment growth.

B. Describe the planned implementation of the proposed program, including estimates of numbers of students at each stage.

If approved, the third semester courses will be offered FA/14, and the fourth semester courses will be offered SP/15. Based on student numbers in level I in FA/13 and student statements of interest, we anticipate 12 or more students in the third and fourth semesters for the first time that these will be offered.

6. Resources

A. Will additional faculty resources be required to implement this program? If yes, please describe the need and indicate the plan for meeting this need.

Yes. The additional two semesters equates to 9 new courses. We have had a full time instructor in this program for some time. There is a current adjunct instructor who is able and very interested in teaching

additional courses. In addition, we hired a manufacturing specialist whose duties include considerable teaching responsibilities

B. Are other, additional resources required to ensure the success of the proposed program? If yes, please describe the need and indicate the plan for meeting this need.

The necessary additional machining equipment has already been purchased with grant funds.

7. Assessment

How will the success of the program be measured?

Number of enrolled students, as well as completion rates, are available through our Director of Institutional Research. We are also able to assess employment, albeit on a voluntary basis, and feedback from employers who are members of the advisory committee. The latter feedback would relate to the level of preparedness for employment.

8. Process Leading to Submission

Describe the process of developing and approving the proposed program. Indicate, where appropriate, involvement by faculty, students, community members, potential employers, accrediting agencies, etc.

Our process included the development of an industry advisory committee that included representatives from 20 different businesses. This committee met several times with a goal of identifying gaps or voids in the local workforce. Specifically, we heard many times the typical shortcomings of prospective entry level employees. With guidance from these representatives, we developed programs and curricula designed to address these deficiencies.

January 8-9, 2014

ITEM 162-306-R0114
Request to implement a Nondestructive Testing Certificate of Applied Science

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THAT

The Board of Regents authorizes Flathead Valley Community College to implement a Certificate of Applied Science in Nondestructive Testing.

EXPLANATION

FVCC requests to implement a 33-credit CAS program in Nondestructive Testing. The program is designed to provide students experience in nondestructive test methods, visual inspection, liquid penetrant, magnetic particle, eddy current, ultrasonic and radiographic testing.

ATTACHMENTS

Level II Request Form
Curriculum Proposal Form

Montana Board of Regents

LEVEL II REQUEST FORM

Item Number: **162-306-R0114** Meeting Date: **January 8 – 9, 2014**

Institution: **Flathead Valley Community College** CIP Code: 15.0799

Program Title: **Nondestructive Testing Certificate of Applied Science**

Level II proposals require approval by the Board of Regents.

Level II action requested ***(place an X for all that apply and submit with completed Curriculum Proposals Form):***

Level II proposals entail substantive additions to, alterations in, or termination of programs, structures, or administrative or academic entities typically characterized by the (a) addition, reassignment, or elimination of personnel, facilities, or courses of instruction; (b) rearrangement of budgets, cost centers, funding sources; and (c) changes which by implication could impact other campuses within the Montana University System and community colleges. Board policy 303.1 indicates the curricular proposals in this category:

___ **1. Change names of degrees (e.g. from B.A. to B.F.A.)**

___ **2. Implement a new minor or certificate where there is no major or no option in a major;**

X **3. Establish new degrees and add majors to existing degrees; and**

___ **4. Any other changes in governance and organization as described in Board of Regents' Policy 218, such as formation, elimination or consolidation of a college, division, school, department, institute, bureau, center, station, laboratory, or similar unit.**

Specify Request:

FVCC requests to implement a Certificate of Applied Science program in Nondestructive Testing.

Montana Board of Regents

CURRICULUM PROPOSALS

1. Overview

FVCC currently has a 28 credit certificate program in Nondestructive Testing. The admission guidelines for Nondestructive Testing state that a year of welding experience or satisfactory completion of WLDG 111 (Welding Theory I Practical, 4 credits) is necessary to enroll in one of the second semester courses. We propose explicitly including WLDG 111 (and ECP 104) as part of the program. The proposal results in a credit total of 33, thereby making it a Certificate of Applied Science.

2. Provide a one paragraph description of the proposed program. Be specific about what degree, major, minor or option is sought.

The Nondestructive Testing program is designed to provide students experience in nondestructive test methods, visual inspection, liquid penetrant, magnetic particle, eddy current, ultrasonic and radiographic testing.

3. Need

A. To what specific need is the institution responding in developing the proposed program?

The proposed CAS in Nondestructive Testing (NDT) was created in response to feedback from employers that graduates of the current NDT Certificate program were lacking in welding skills, as many NDT technicians are obliged to test welds. Having a basic knowledge of welding is not only helpful with such a task, but it also enhances employability. The proposed CAS includes a welding course in addition to the NDT courses. The addition of WLDG 111, which includes a variety of welding terms, concepts, and procedures, satisfies a prerequisite for a welding codebook course in the second semester. Although FVCC currently offers an AAS program in Welding and Inspection Technology, which includes courses in nondestructive testing, there are persons who are interested in the field of nondestructive testing, but not interested in welding as a career field, thus necessitating both programs.

B. How will students and any other affected constituencies be served by the proposed program?

Please see response to 3A.

C. What is the anticipated demand for the program? How was this determined?

FVCC has offered this program for the past year. There are several students enrolled. We anticipate that enrollment will increase to 8-10 students next year.

4. Institutional and System Fit

A. What is the connection between the proposed program and existing programs at the institution?

The courses in the 2 semester Nondestructive Testing program are included in the 4 semester program in Welding and Inspection Technology.

Montana Board of Regents
CURRICULUM PROPOSALS

B. Will approval of the proposed program require changes to any existing programs at the institution? If so, please describe.

No.

C. Describe what differentiates this program from other, closely related programs at the institution (if appropriate).

The proposed program is a 2 semester program in contrast to the 4 semester Welding and Inspection Technology program.

D. How does the proposed program serve to advance the strategic goals of the institution?

FVCC has four core themes; these are transfer preparation, workforce preparation, developmental education, and community education. The proposed program directly addresses workforce preparation, and it is a component of community education.

E. Describe the relationship between the proposed program and any similar programs within the Montana University System. In cases of substantial duplication, explain the need for the proposed program at an additional institution. Describe any efforts that were made to collaborate with these similar programs; and if no efforts were made, explain why. If articulation or transfer agreements have been developed for the substantially duplicated programs, please include the agreement(s) as part of the documentation.

FVCC has the only program in Nondestructive Testing in Montana. At Montana Tech, students in their general engineering program with welding option take a course in nondestructive testing. The American Society for Nondestructive Testing (ASNT) has rigid hourly requirements for education in order to take the ASNT Level II exam. These total 216 hours; our program meets these hourly requirements. ASNT also has rigid hourly requirements for work experience in order to take the Level II exam. For example, 840 hours of work experience in radiographic testing are needed in order to take the exam in this method.

5. Program Details

A. Provide a detailed description of the proposed curriculum. Where possible, present the information in the form intended to appear in the catalog or other publications. NOTE: In the case of two-year degree programs and certificates of applied science, the curriculum should include enough detail to determine if the characteristics set out in Regents' Policy 301.12 have been met.

Montana Board of Regents
CURRICULUM PROPOSALS

Nondestructive Testing

Certificate of Applied Science Degree

Fall Semester

__	Course	No.	Title	Credits
M	111*		Technical Mathematics	3
NDTE	110*		Intro. to Nondestructive Test'g	3
NDTE	111*		Liquid Penetrant and Magnetic Particle Testing	3
NDTE	115*		Eddy Current Testing	3
WLDG	111*		Welding Theory I Practical	4
			Semester Total	**16**

Spring Semester

__	Course	No.	Title	Credits
CAPP	106*		Short Courses: Computer App's	1
NDTE	112*		Ultrasonic Testing	5
NDTE	120		Radiographic Testing/Film Interpretation	5
NDTE	125*		AWS D1.1 Code Book	2
WRIT	122C*		Intro. to Business Writing	3
ECP	104		Workplace Safety	1
			Semester Total	**17**
			Total Credits	**33**

Admission Guidelines

- Visual acuity should be correctable to 20-20 with capability of differentiating contrast among colors and shades.
- WLDG 185, which is a welding certification course, is recommended.

Montana Board of Regents
CURRICULUM PROPOSALS

Certifications

- Students who successfully complete the Certificate of Applied Science program will have achieved the educational requirements necessary to take the ASNT Level II National Certification exam. ASNT also requires documented work experience as part of the application for the Level II exam.

B. Describe the planned implementation of the proposed program, including estimates of numbers of students at each stage.

As noted in the overview and the response to 3A, FVCC currently offers this program as a 28 credit certificate program.

6. Resources

A. Will additional faculty resources be required to implement this program? If yes, please describe the need and indicate the plan for meeting this need.

Not at this time. If student enrollment increases substantially, additional faculty will be needed.

B. Are other, additional resources required to ensure the success of the proposed program? If yes, please describe the need and indicate the plan for meeting this need.

FVCC already has the necessary equipment to operate the program. If additional student testing kits become necessary, we have an internal equipment fund to which requests may be addressed.

7. Assessment

How will the success of the program be measured?

Number of enrolled students, as well as completion rates, are available through our Director of Institutional Research. We are also able to assess employment, albeit on a voluntary basis, and feedback from employers who visit FVCC every spring to talk with students about possible employment. The latter feedback would relate to the level of preparedness for employment.

8. Process Leading to Submission

Describe the process of developing and approving the proposed program. Indicate, where appropriate, involvement by faculty, students, community members, potential employers, accrediting agencies, etc.

FVCC has had a successful AAS program in Welding and Inspection Technology for several years. This program includes all of our courses in nondestructive testing. About three years ago, faculty discussions began around the idea of having a separate 2 semester program in nondestructive testing. There were two primary reasons for advancing this idea. First, a 2 semester program compared to one of 4 semesters allows a person to enter the workforce a year sooner. Second, there are persons who are interested in a career in nondestructive testing, but who are not interested in welding per se.

January 8-9, 2014

ITEM 162-2007-R0114
Request for authorization to offer a Minor in Optics and Photonics

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THAT

The Board of Regents authorizes Montana State University to offer a minor in Optics and Photonics

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EXPLANATION

We propose a new Minor in Optics for undergraduate students majoring in Electrical Engineering, Computer Engineering, Physics, and Chemistry and Biochemistry at Montana State University. The Minor will complement and encourage cross-disciplinary activities among three departments (Electrical & Computer Engineering, Physics, Chemistry & Biochemistry) and two colleges (Engineering and Letters & Sciences).

ATTACHMENTS

Level II Request Form
Curriculum Proposal Form

Montana Board of Regents

LEVEL II REQUEST FORM

Item Number: **162-2007-R0114** Meeting Date: **January 8-9, 2014**

Institution: **Montana State University** CIP Code: **15.0304**

Program Title: **Minor in Optics and Photonics**

Level II proposals require approval by the Board of Regents.

Level II action requested ***(place an X for all that apply and submit with completed Curriculum Proposals Form):***

Level II proposals entail substantive additions to, alterations in, or termination of programs, structures, or administrative or academic entities typically characterized by the (a) addition, reassignment, or elimination of personnel, facilities, or courses of instruction; (b) rearrangement of budgets, cost centers, funding sources; and (c) changes which by implication could impact other campuses within the Montana University System and community colleges. Board policy 303.1 indicates the curricular proposals in this category:

___ **1. Change names of degrees (e.g. from B.A. to B.F.A.)**

___ **2. Implement a new minor or certificate where there is no major or no option in a major;**

X **3. Establish new degrees and add majors to existing degrees; and**

___ **4. Any other changes in governance and organization as described in Board of Regents' Policy 218, such as formation, elimination or consolidation of a college, division, school, department, institute, bureau, center, station, laboratory, or similar unit.**

Specify Request:

Montana State University requests authorization to offer a minor in Optics and Photonics for undergraduate students majoring in Electrical Engineering, Computer Engineering, Physics, and Chemistry and Biochemistry at Montana State University. The Minor will complement and encourage cross-disciplinary activities among three departments (Electrical & Computer Engineering, Physics, Chemistry & Biochemistry) and two colleges (Engineering and Letters & Sciences).

Montana Board of Regents

CURRICULUM PROPOSALS

1. Overview

We propose a new Minor in Optics for undergraduate students most likely majoring in Electrical Engineering, Computer Engineering, Physics, and Chemistry and Biochemistry at Montana State University. The Minor will complement and encourage cross-disciplinary activities among three departments (Electrical & Computer Engineering, Physics, Chemistry & Biochemistry) and two colleges (Engineering and Letters & Sciences).

2. Provide a one paragraph description of the proposed program. Be specific about what degree, major, minor or option is sought.

The undergraduate non-teaching minor in optics is designed to provide undergraduate students a core set of knowledge and skills to prepare them for rapidly growing opportunities in optical science and engineering. Requirements include courses in optics, electrical engineering and physics, as well as electives chosen to match the interests and needs of each student.

3. Need

A. To what specific need is the institution responding in developing the proposed program?

Since 1980, the Gallatin Valley has become home to an impressive and growing number of companies in technologies involving optics and lasers. Figure 1 is a timeline illustrating this exponential growth. Many of these companies were formed by MSU graduates or faculty, and others moved here for the quality of life or to become part of the growing Montana optics community. During this same time period, MSU transitioned from employing two faculty members who worked in optics in 1980 to more than two dozen in 2012. As part of the synergistic growth of the Montana optics community, MSU established the Regents-approved *Optical Technology Center* (OpTeC) in 1995. The activities undertaken through this center have strengthened public-private collaboration and increased the transfer of optical technology from the university to the private sector. The Bozeman area is increasingly recognized as an area of activity with international significance in the broad field of optics. Because of this growth, the local optics industry is now reaching the state of maturity where it needs an increased number of employees with highly technical training in optics. The proposed optics degree is an overdue step that will significantly improve the ability of MSU to train top talent for the growing Montana optics industry.

Montana Board of Regents
CURRICULUM PROPOSALS

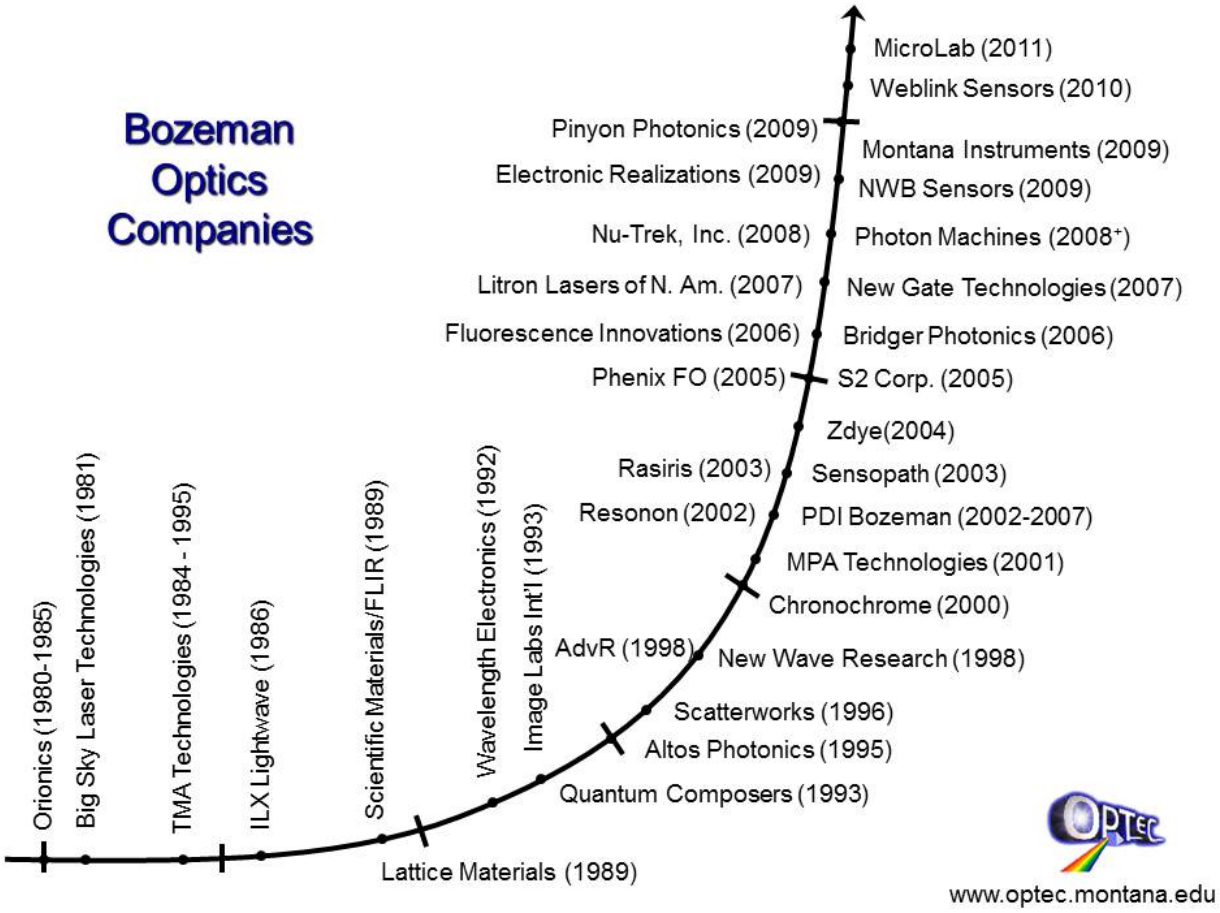

Figure 1. Exponential growth of Montana optics companies in the Gallatin Valley.

B. How will students and any other affected constituencies be served by the proposed program?
Optics has been called an "enabling technology" by the National Academy of Science (*Harnessing Light: Optical Science and Engineering for the 21st Century,* 1998; *Optics and Photonics: Essential Technologies for Our Nation*, 2012). These reports identified numerous ways that optical technologies benefit our nation and the world, including optical fiber communication networks that enable the Internet, tiny laser diodes that enable CD and DVD players and recorders, compact imaging modules that enable the world's tiniest cell phones to the world's largest telescopes, and infrared imagers that enable night-vision superiority for our military. This rapidly growing range of optical applications corresponds to a rapidly growing need for engineers and scientists who are ready to create tomorrow's optical technologies. The proposed *optics* minor is an important step that MSU can take now to address this national and regional need, which will lead to growth in the number of graduates qualified to get and create new optics jobs in Montana.

C. What is the anticipated demand for the program? How was this determined?

We estimate that one-to-two dozen students will graduate each year from a fully implemented *optics* minor. Many of these will become employees of local companies. The ongoing and growing demand for students trained in optics from the undergraduate and graduate graduates was identified in discussions

with the leaders of more than one dozen local optics companies, such as Bridger Photonics, Resonon, Quantel USA, ILX Lightwave, S2 Corporation, Altos Photonics, and others. Many of these discussions have taken place over multiple years during our annual OpTeC meeting held at MSU each summer (attended by MSU faculty, students, and local optics company leaders and employees). A more recent discussion occurred in fall 2012 at a Bozeman meeting to discuss economic development opportunities in optics. Similar discussions have occurred in phone conversations between the OpTeC Director and leaders of local optics companies, and during our weekly OpTeC colloquia, which are attended regularly by company members in addition to the academic audience.

Beyond Montana, there also is strong demand throughout the western U.S. (and beyond) for students with formal training in optics, especially ones trained in the process of designing and building optical systems. This practical focus is, in fact, a feature of our program that will greatly increase demand for our graduates over those from schools that focus only on a few academic sub-areas of optics. For example, recent discussions have identified strong interest from large companies in Colorado (Ball Aerospace and Lockheed-Martin Coherent Technologies) for graduates trained in optical design, especially in one of our strongest specialty areas, optical sensor systems. Similar interest has been found in discussions with companies from Quebec to San Diego.

Rapidly growing demand for optics professionals with cross-disciplinary training also motivates this new program at MSU. For example, MSU currently has faculty members who design state-of-the-art optical sensor systems, and others who use such systems for research in fields including agriculture, ecology, biochemistry, space sciences, and other diverse applications. The new optics minor will provide enhanced opportunities for these faculty members to work together with undergraduate students who are trained to work and communicate across these disciplines.

4. Institutional and System Fit

A. What is the connection between the proposed program and existing programs at the institution?
The proposed minor is a combination of electrical and computer engineering, physics, and chemistry. Current students often take a few optics electives during their undergraduate program, but the minor will help us offer and help the students identify the best selection of classes to prepare for either advanced studies in graduate school or immediate employment in the field. There is no similar program at MSU or at any university in Montana or surrounding states.

B. Will approval of the proposed program require changes to any existing programs at the institution? If so, please describe.

No changes are required to begin the optics minor, which is designed to use existing courses, instructors, and lab facilities as a cross-departmental option. However, we have identified two classes that would greatly benefit students, especially in meeting the needs that have been expressed to us by local employers. These are undergraduate courses in 1) Nonlinear optics, and 2) Optical design. The first has been taught recently as a special topics course and will be phased more permanently into the curriculum as demand and opportunity allows. The second will be provided by creating a co-convened undergraduate version of an existing graduate class (EELE 582).

C. Describe what differentiates this program from other, closely related programs at the institution (if appropriate).
There is no counterpart of this minor at MSU or within Montana and the surrounding states.

Montana Board of Regents
CURRICULUM PROPOSALS

D. How does the proposed program serve to advance the strategic goals of the institution?
The optics minor directly addresses the following goals within the Montana University System (MUS) 2012 Strategic Plan:

Goal 2.1 Increase responsiveness to workforce development needs by expanding and developing programs in high-demand fields in the state.

Goal 2.2 Establish collaborative programs among institutions, the private sector, and the state to expand research, technology transfer, the commercialization of new technologies, and the development of our entrepreneurs.

The proposed optics minor also directly addresses the following goals, objectives, and metrics in the Montana State University (MSU) 2012 Strategic Plan:

Goal (Learning): MSU prepares students to graduate equipped for careers and further education.

Objective L.2: Increase graduation rates at MSU

Objective L.3 Increase job placement and further education rates

Goal (Integration): By integrating learning, discovery and engagement, and by working across disciplines, the MSU community will improve the world.

Objective I.1: Increase the integration of learning, discovery and engagement.

Metric I.1.4: By 2019, faculty scholarly products with undergraduate and graduate students will increase 50%.

Objective I.2: Increase work across disciplines.

Metric I.2.1: By 2019, the number of students completing interdisciplinary programs will increase 30%.

Metric I.2.2: BY 2019, MSU will increase interdisciplinary research and creative projects on campus.

Furthermore, MSU's College of Engineering has three strategic areas in the 2009 five-year plan: 1) global connections, 2) cross-disciplinary collaboration, and 3) technological leadership. The proposed optics minor addresses all these areas.

Based on the cooperative design of the optics degree program, and the enabling nature of optical technology, the proposed optics degree is in direct alignment with the cross-disciplinary goals at the College, University, and System level.

E. Describe the relationship between the proposed program and any similar programs within the Montana University System. In cases of substantial duplication, explain the need for the proposed

program at an additional institution. Describe any efforts that were made to collaborate with these similar programs; and if no efforts were made, explain why. If articulation or transfer agreements have been developed for the substantially duplicated programs, please include the agreement(s) as part of the documentation.

There is no similar program in the Montana University System or in surrounding states.

5. Program Details

A. Provide a detailed description of the proposed curriculum. Where possible, present the information in the form intended to appear in the catalog or other publications. NOTE: In the case of two-year degree programs and certificates of applied science, the curriculum should include enough detail to determine if the characteristics set out in Regents' Policy 301.12 have been met.

The undergraduate non-teaching minor in optics is designed to provide undergraduate students a core set of knowledge and skills to prepare them for rapidly growing opportunities in optical science and engineering. Requirements include courses in optics, electrical engineering and physics, as well as electives chosen to match the interests and needs of each student. To earn this minor a student must complete the following:

12 core credits		
EELE 334	Electromagnetic Theory I	3
or PHSX 423	Electricity and Magnetism I	(3)
EELE 432	Applied Electromagnetics	3
or PHSX 425	Electromagnetic Theory II	(3)
EELE 482	Electro-Optical Systems	3
PHSX 427	Advanced Optics	3
or PHSX 437	Laser Applications	(3)
9 credits optics electives:		9
PHSX 427	Advanced Optics	3
PHSX 437	Laser Applications	3
PHSX 444	Advanced Physics Lab (optics offering)	4
EELE 408	Photovoltaic Systems	3
EELE 484	Laser Engineering	3
CHMY 371	Physical Chemistry	3

Montana Board of Regents
CURRICULUM PROPOSALS

EELE 488	EE Capstone Design I[1]	2
EELE 489	EE Capstone Design II[1]	2
PHSX 499	Senior Capstone Seminar[1]	1
XXXX 490	Undergraduate Research[1]	≤ 3
XXXX 491	Special Topics[2]	≤ 3
XXXX 492	Independent Study[2]	≤ 3
XXXX 494	Seminar/Workshop[1]	≤ 2
	TOTAL	**21**

[1] A maximum of four (4) credits of these classes may be used if the topic is directly related to optics, on approval by academic advisor and research advisor/instructor.

[2] Maximum of three (3) credits of these classes may be used if the topic is directly related to optics, on approval by academic advisor and research advisor/instructor.

Note: The following 500-level classes can be taken as electives in the Optics minor by seniors with a cumulative grade-point average ≥ 3.25 (by petition to the Registrar) and provided all prerequisites are met.

EELE 538	Advanced Topics in Electromagnetics & Optics
EELE 581	Fourier Optics & Imaging
EELE 582	Optical Design
EELE 583	Remote Sensing Systems
PHSX 515	Advanced Topics in Physics (if topic is directly optics related)
CHMY 527	Optical Spectroscopy
CHMY 557	Quantum Mechanics
CHMY 560	Symmetry, Orbitals, and Spectroscopy

Students pursuing the BS in Electrical Engineering at MSU-Bozeman can earn the optics minor with no extra credits with careful selection of electives and by completing an optics-related capstone design project.

Students pursuing the BS in Physics Professional Option at MSU-Bozeman or the BS in Physics Interdisciplinary Option at MSU-Bozeman can earn the optics minor with no extra credits with careful

selection of physics electives, by taking EELE 482 as one of their university or declared area electives, and by completing optics-related research (490R and 499R) as their required senior project.

B. Describe the planned implementation of the proposed program, including estimates of numbers of students at each stage.

Immediately upon approval of the degree program, advertisements will be distributed throughout MSU and the local and regional optics companies. A new OPTI rubric will be established and existing courses that will become a core part of the optics curriculum will be cross-listed with the OPTI rubric, while maintaining their original home department (e.g., EELE, PHSX, CHMY). One faculty member from each of the three participating departments will be identified to serve on the Optics Program Committee that oversees the optics minor and overall optics program.

While filing the *Application for Baccalaureate Degree* for the major, students pursuing the optics minor also will submit the *Application for a Non-teaching Minor* by the deadlines set forth in the University Catalog. Department heads will serve as the minor certifying officers, but the optics program committee will advise them as needed. They will certify that students have completed the required course credits for the optics minor.

6. Resources

A. Will additional faculty resources be required to implement this program? If yes, please describe the need and indicate the plan for meeting this need.

No new faculty members are required for implementing the optics minor.

B. Are other, additional resources required to ensure the success of the proposed program? If yes, please describe the need and indicate the plan for meeting this need.

The proposed optics minor requires limited additional resources, principally to accommodate the inevitable increase in administrative overhead necessary to publicize the program, advise students, and process the *Application for a Non-teaching Minor* paperwork when a student is ready to graduate. These efforts will be handled in the three participating departments with cooperation from the interdisciplinary Optical Technology Center (OpTeC).

7. Assessment

How will the success of the program be measured?

All departments in the MSU College of Engineering use a systematic assessment plan (http://www.montana.edu/wwwprov/assessment/assessmentplans.htm) for all academic programs and courses. We continually assess objectives and outcomes at the program and course levels. This same assessment plan will be used for the optics minor.

In addition, we will provide annual assessment based on student, employer, and alumni satisfaction, and input provided by Montana optics industry leaders, including feedback provided during the annual OpTeC meeting. Student enrollment, graduation rates, and employment trends will be recorded and reviewed annually at an annual meeting of the OpTeC. Appropriate revisions will be determined from all these sources.

Montana Board of Regents
CURRICULUM PROPOSALS

8. Process Leading to Submission

Describe the process of developing and approving the proposed program. Indicate, where appropriate, involvement by faculty, students, community members, potential employers, accrediting agencies, etc.

OpTeC faculty members (from ECE, Physics, and Chemistry & Biochemistry) have gathered several times in recent years to discuss national trends in undergraduate and graduate optics education, existing MSU optics course offerings, and needed courses. A working group, comprising one faculty member from each of the three participating departments, designed this optics minor proposal. Input was gathered from leaders of many of the local optics companies at a fall 2012 meeting, and a public meeting was held in January 2013 during the weekly OpTeC Colloquium time for faculty and students to hear about and comment on the proposal. Finally, input has been solicited from the faculty of the participating departments and the proposal is presently making its way through the relevant MSU committees.

January 8-9, 2014

ITEM 162-2008-R0114
Request for authorization to offer a Master's of Science in Optics and Photonics

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THAT

The Board of Regents authorizes Montana State University to offer a Master's of Science in Optics and Photonics.

EXPLANATION

Request authorization to offer a Master's of Science degree in Optics and Photonics at Montana State University. This is a cooperative, multi-department, cross-college degree that complements, integrates, and leverages ongoing graduate education and research activities in the departments of Electrical & Computer Engineering, Physics, and Chemistry & Biochemistry.

ATTACHMENTS

Level II Request Form
Curriculum Proposal Form

Montana Board of Regents

LEVEL II REQUEST FORM

Item Number: **162-2008-R0114** Meeting Date: **January 8-9, 2014**

Institution: **Montana State University** CIP Code: **40.0807**

Program Title: **Master's in Optics and Photonics**

Level II proposals require approval by the Board of Regents.

Level II action requested ***(place an X for all that apply and submit with completed Curriculum Proposals Form):***

Level II proposals entail substantive additions to, alterations in, or termination of programs, structures, or administrative or academic entities typically characterized by the (a) addition, reassignment, or elimination of personnel, facilities, or courses of instruction; (b) rearrangement of budgets, cost centers, funding sources; and (c) changes which by implication could impact other campuses within the Montana University System and community colleges. Board policy 303.1 indicates the curricular proposals in this category:

___ **1. Change names of degrees (e.g. from B.A. to B.F.A.)**

___ **2. Implement a new minor or certificate where there is no major or no option in a major;**

X **3. Establish new degrees and add majors to existing degrees; and**

___ **4. Any other changes in governance and organization as described in Board of Regents' Policy 218, such as formation, elimination or consolidation of a college, division, school, department, institute, bureau, center, station, laboratory, or similar unit.**

Specify Request:

Request authorization to offer a Master's of Science degree in Optics and Photonics at Montana State University. This is a cooperative, multi-department, cross-college degree that complements, integrates, and leverages ongoing graduate education and research activities in the departments of Electrical & Computer Engineering, Physics, and Chemistry & Biochemistry.

Montana Board of Regents

CURRICULUM PROPOSALS

1. Overview

We propose a Master of Science degree in Optics and Photonics at Montana State University – Bozeman. This is a cooperative, multi-department, cross-college degree that complements, integrates, and leverages ongoing graduate education and research activities in the departments of Electrical & Computer Engineering, Physics, and Chemistry & Biochemistry.

2. Provide a one paragraph description of the proposed program. Be specific about what degree, major, minor or option is sought.

The Master's of Science in Optics and Photonics degree is an interdisciplinary, cooperative program managed by the Optics Program Committee on behalf of the three participating departments: Physics, Electrical and Computer Engineering, and Chemistry and Biochemistry. Students apply directly to the Optics Program and are admitted through one of the participating departments, selected based on advisor affiliation and student interest.

The proposed Optics degree will allow students to focus on the discipline of optics while also exploring cross-disciplinary applications spanning traditional academic fields. The Optics degree will attract students who want an optics degree and would otherwise not come to MSU. Therefore, launching this degree program will diversify and expand the number of students we currently train through existing degree programs in Electrical Engineering, Physics, and Chemistry and Biochemistry. The program also will increase the number of students working on optics-related projects, and therefore increase the number of graduates qualified to secure and create new optics jobs in Montana.

3. Need

A. To what specific need is the institution responding in developing the proposed program?

Since 1980, the Gallatin Valley has become home to an impressive and growing number of companies in technologies involving optics and lasers. Figure 1 is a timeline illustrating this exponential growth. Many of these companies were formed by MSU graduates or faculty, and others moved here for the quality of life or to become part of the growing Montana optics community. During this same time period, MSU-Bozeman transitioned from employing two faculty members who worked in optics in 1980 to more than two dozen in 2012. As part of the synergistic growth of the Montana optics community, MSU established the Regents-approved *Optical Technology Center* (OpTeC) in 1995. The activities undertaken through this center have strengthened public-private collaboration and increased the transfer of optical technology from the university to the private sector. The Bozeman area is increasingly recognized as an area of activity with international significance in the broad field of optics. Because of this growth, the local optics industry is now reaching the state of maturity where it needs an increased number of employees with highly technical training in optics. The proposed optics degree is an overdue step that will significantly improve the ability of MSU to train top talent for the growing Montana optics industry.

Montana Board of Regents
CURRICULUM PROPOSALS

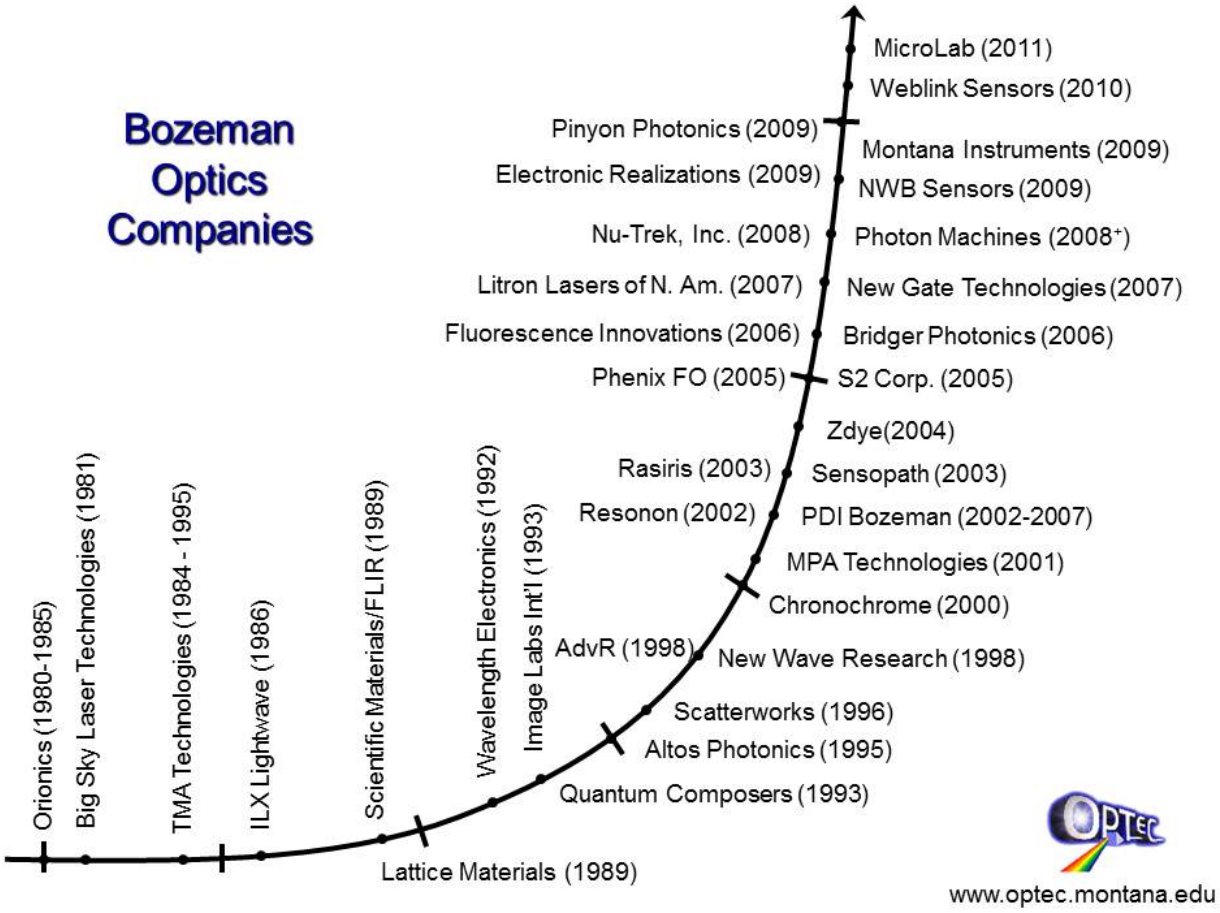

Figure 1. Exponential growth of Montana optics companies in the Gallatin Valley

B. How will students and any other affected constituencies be served by the proposed program?
Optics has been called an "enabling technology" by the National Academy of Science (*Harnessing Light: Optical Science and Engineering for the 21st Century,* 1998; *Optics and Photonics: Essential Technologies for Our Nation*, 2012). These reports identified numerous ways that optical technologies benefit our nation and the world, including optical fiber communication networks that enable the Internet, tiny laser diodes that enable CD and DVD players and recorders, compact imaging modules that enable the world's tiniest cell phones to the world's largest telescopes, and infrared imagers that enable night-vision superiority for our military. This rapidly growing range of optical applications corresponds to a rapidly growing need for engineers and scientists who are ready to create tomorrow's optical technologies. However, currently there are only a small number of universities that grant degrees tailored specifically to optics. Most employees of optics companies instead gather their training in related disciplines. The previously cited National Academy reports cite a critical national need for more cross-disciplinary training in optics.

The proposed Optics degree will allow students to focus on the discipline of optics while also exploring cross-disciplinary applications spanning traditional academic fields. The Optics degree will attract students who want an optics degree and would otherwise not come to MSU. Therefore, launching this

degree program will diversify and expand the number of students we currently train through existing degree programs in Electrical Engineering, Physics, and Chemistry and Biochemistry. The program also will increase the number of students working on optics-related projects, and therefore increase the number of graduates qualified to secure and create new optics jobs in Montana.

C. What is the anticipated demand for the program? How was this determined?

We estimate that a fully operational optics program will enroll approximately 20 graduate students continually. At least 20% are likely to be employees of local optics companies, and many others will become employees of those companies upon graduation. The growing demand for graduates having an advanced degree in optics was identified in discussions with the leaders of more than one dozen local optics companies, such as Bridger Photonics, Resonon, Quantel USA, ILX Lightwave, S2 Corporation, and others. Many of these discussions have taken place over multiple years during our annual OpTeC meeting held at MSU each summer (attended by MSU faculty, students, and local optics company leaders and employees). A more recent discussion occurred in fall 2012 at a Bozeman meeting to discuss economic development opportunities in optics. Similar discussions have occurred in phone conversations between the OpTeC Director and leaders of local optics companies, and during our weekly OpTeC colloquia, attended regularly by company members as well as an academic audience.

Beyond Montana, strong demand for optics graduates exists throughout the western U.S. (and beyond), especially ones trained in the process of designing and building optical systems. This practical focus is, in fact, a feature of our program that will greatly increase demand for our graduates over those from schools that focus only on a few academic sub-areas of optics. For example, recent discussions have identified strong interest from large companies in Colorado (Ball Aerospace and Lockheed-Martin Coherent Technologies) for graduates trained in optical design, especially in one of our strongest specialty areas, optical sensor systems. Similar interest has been found in discussions with companies from Quebec to San Diego.

Rapidly growing demand for optics professionals with cross-disciplinary training also motivates establishing this new program at MSU. For example, MSU currently has faculty members who design state-of-the-art optical sensor systems and others who use such systems for research in fields including agriculture, ecology, biochemistry, space sciences, and other diverse applications. The new optics degree program will provide enhanced opportunities for these faculty members to work together with graduate students who are trained to work and communicate across these disciplines.

4. Institutional and System Fit

A. What is the connection between the proposed program and existing programs at the institution?
Current students work on optics-related research projects as they earn graduate degrees in Electrical Engineering, Physics, or Chemistry and Biochemistry. With the establishment of this new degree, we anticipate growth in the number of students pursuing optics-related topics because experience at the few universities who offer formal optics degrees (e.g., University of Arizona, University of Rochester, University of Central Florida) shows that many students prefer to pursue a degree in optics over one of the traditional disciplines such as physics or electrical engineering. This growth is expected to increase and diversify the number of cross-department projects at MSU. For example, in some cases, the Optics M.S. will provide a valuable technological base from which students will move into a Ph.D. program involving heavy use of optical methods in a conventional discipline such as chemistry and biochemistry, physics, or electrical engineering.

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B. Will approval of the proposed program require changes to any existing programs at the institution? If so, please describe.

No changes are required for existing programs. The optics degree is designed to use existing courses, instructors, and lab facilities, as a cross-departmental degree option.

C. Describe what differentiates this program from other, closely related programs at the institution (if appropriate).

The Optics degree will draw on existing faculty and facilities within the departments of Physics, Electrical and Computer Engineering (ECE), and Chemistry and Biochemistry. The degree will be distinct from the other graduate degrees offered by these departments because it will require students to take courses from at least two of these departments, and it will allow students to emphasize their study of optics over other topics that are required by degrees in the traditional disciplines. Each optics student will be advised by a graduate advisor from the faculty of one of the three existing departments and a graduate supervisory committee made up of faculty from at least two of the three departments that participate in this cooperative program.

D. How does the proposed program serve to advance the strategic goals of the institution?

The previous discussion of this proposed optics degree directly addresses the following goals within the Montana University System (MUS) 2012 Strategic Plan:

Goal 2.1 Increase responsiveness to workforce development needs by expanding and developing programs in high-demand fields in the state.

Goal 2.2 Establish collaborative programs among institutions, the private sector, and the state to expand research, technology transfer, the commercialization of new technologies, and the development of our entrepreneurs.

Goal 2.3 Expand graduate education capacity and opportunities in order to increase educational attainment of Montanans, fuel economic development, grow the research and development enterprise, and contribute to the cultural and social fabric of Montana and the region.

The proposed Optics degree also directly addresses the following goals, objectives, and metrics in the Montana State University (MSU) 2012 Strategic Plan:

Goal (*Learning*): MSU prepares students to graduate equipped for careers and further education.

Objective L.2: Increase graduation rates at MSU

Metric L.2.2: By 2019, the number of graduate degrees awarded will increase from 548 to 625 per year. The number of doctoral degrees awarded will increase from 56 to 80 per year.

Objective L.3 Increase job placement and further education rates

Metric L.3.2: By 2019, the percent of graduates pursuing an advanced degree

will increase from an average of 21% to 25%.

Goal (Discovery): MSU will raise its national and international prominence in research, creativity, innovation and scholarly achievement, and thereby fortify the university's standing as one of the nation's leading public research universities.

Objective D.3: Expand the scale, breadth, and quality of doctoral education.

Metric D.3.2: The graduate student population will increase 20% to approximately 2,350 by 2019, with an emphasis on increasing doctoral student enrollment.

Metric D.3.3: By 2019, the number of graduate degrees awarded will increase from 548 to 625 per year. Science, technology, engineering, and mathematics (STEM) master's and doctoral degrees will increase to 325. All doctoral degrees awarded will increase from 56 to 80 per year.

Goal (Integration): By integrating learning, discovery and engagement, and by working across disciplines, the MSU community will improve the world.

Objective I.1: Increase the integration of learning, discovery and engagement.

Metric I.1.4: By 2019, faculty scholarly products with undergraduate and graduate students will increase 50%.

Objective I.2: Increase work across disciplines.

Metric I.2.1: By 2019, the number of students completing interdisciplinary programs will increase 30%.

Metric I.2.2: BY 2019, MSU will increase interdisciplinary research and creative projects on campus.

Furthermore, MSU's College of Engineering has three strategic areas in the 2009 five-year plan: 1) global connections, 2) cross-disciplinary collaboration, and 3) technological leadership. The proposed optics degree program addresses all these areas.

Based on the cooperative design of the optics degree program, and the enabling nature of optical technology, the proposed optics degree is in direct alignment with the cross-disciplinary goals at the College, University, and System level.

E. Describe the relationship between the proposed program and any similar programs within the Montana University System. In cases of substantial duplication, explain the need for the proposed program at an additional institution. Describe any efforts that were made to collaborate with these similar programs; and if no efforts were made, explain why. If articulation or transfer agreements have been developed for the substantially duplicated programs, please include the agreement(s) as part of the documentation.

There is no similar program in the Montana University System.

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5. Program Details

A. Provide a detailed description of the proposed curriculum. Where possible, present the information in the form intended to appear in the catalog or other publications. NOTE: In the case of two-year degree programs and certificates of applied science, the curriculum should include enough detail to determine if the characteristics set out in Regents' Policy 301.12 have been met.

The Optics degree is an interdisciplinary, cooperative program managed by the Optics Program Committee on behalf of the three participating departments: Physics, Electrical and Computer Engineering, and Chemistry and Biochemistry. Students apply directly to the Optics Program and are admitted through one of the participating departments, selected based on advisor affiliation and student interest.

The Master of Science degree in Optics is earned by satisfying these requirements.

Take two fundamentals courses (one PHSX and one EELE):		6
PHSX 427	Advanced Optics	3
PHSX 437	Laser Applications	3
EELE 482	Electro-Optical Systems	3
EELE 484	Laser Engineering	3
Take one specialty course:		3
EELE 581	Fourier Optics & Imaging	3
EELE 582	Optical Design	3
PHSX 531	Nonlinear Optics & Spectroscopy	3
CHMY 527	Optical Spectroscopy	3
CHMY 560	Symmetry, Orbitals, & Spectroscopy	3

Take 6 credits of optics electives chosen from the following:		6
EELE 432	Applied Electromagnetics	3
EELE 482	Electro-Optical Systems	3
EELE 484	Laser engineering	3
EELE 538	Advanced Topics in EM & Optics	3
EELE 581	Fourier Optics & Imaging	3

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EELE 582	Optical Design	3
EELE 583	Remote Sensing Systems	3
PHSX 427	Advanced Optics	3
PHSX 437	Laser Applications	3
PHSX 507	Quantum Mechanics II	3
PHSX 515	Advanced Topics in Physics[1]	3
PHSX 520	Electromagnetic Theory II	3
PHSX 531	Nonlinear Optics & Spectroscopy	3
CHMY 421	Advanced Instrument Analysis	3
CHMY 527	Optical Spectroscopy	3
CHMY 557	Quantum Chemistry	3
CHMY 560	Symmetry, Orbitals, & Spectroscopy	3
CHMY 564	Advanced Quantum Chemistry	3
EELE, PHSX, CHMY 591 Special Topics[1]		1-3
EELE, PHSX, CHMY 592 Independent Study[1]		1-3
OPTI 594	Optics Seminar[2]	

[1] Maximum of 3 credits total of these courses allowed if subject is directly optics related.

[2] Maximum of 2 credits total of optics seminar allowed.

Take at least 5 credits of technical electives at 400 level and above:

ECE, Physics, Math, Chemistry and Biochemistry, Biology, or Business, etc.	5
Take at least 10 credits under Plan A or Plan B:	10
Plan-A: 10 credits Master's Thesis (EELE, PHSX, CHMY 590)	10
Plan-B: 3 credits Professional Paper (OPTI 575)	3
7 additional technical elective credits	7
	TOTAL 30

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Note: At least 20 credits must be at the 500 level

Optics graduate students are required to pass the optics qualifying examination at the end of their first year of enrollment. Students who fail the qualifying examination may have a second chance to pass the exam the second year, but in that case financial assistance may not be available the second year. Optics graduate students will defend their thesis or professional paper in an oral examination.

B. Describe the planned implementation of the proposed program, including estimates of numbers of students at each stage.

On approval of the degree program, advertisements will be placed in the leading magazines of the optical science and engineering communities. A new OPTI rubric will be established, along with the new support courses, OPTI 575 (Professional Paper), OPTI 590 (Master's Thesis), and OPTI 594 (Seminar). Existing courses that will become a core part of the optics curriculum will be cross-listed with the OPTI rubric, while maintaining their original home department (e.g., EELE, PHSX, CHMY). One faculty member from each of the three participating departments will be identified to serve on the Optics Program Committee that oversees curriculum design and student admissions.

The Optics MS program will be introduced with very low costs. During the first year of operation, it is expected that approximately six graduate students will be enrolled. This number is expected to grow to a dozen by the third year and to approximately twenty by the fifth year. If recent trends in the local optics industry continue, this enrollment could double within 5-10 years. These numbers are in addition to students who will continue to pursue optics-related degrees in Electrical Engineering, Physics, and Chemistry. This growth will require the establishment of dedicated Teaching Assistantship (TA) positions for the Optics program, dedicated administrative support, and financial support for program advertisement and recruiting. Financial support will be pursued both internally and externally. After the MS program is successfully established, we will determine if and how to establish an Optics Ph.D. program.

6. Resources

A. Will additional faculty resources be required to implement this program? If yes, please describe the need and indicate the plan for meeting this need.

No new faculty members are required for the initial implementation of the Optics M.S. degree program. Current tenure-track faculty who are anticipated to become part of the Optics program include five in Electrical and Computer Engineering, six in Physics, and three in Chemistry and Biochemistry (total = fourteen). An additional five existing research faculty members are expected to participate in the program.

Faculty members affiliated with the Optics program will have a modest amount of additional expectations to implement the program. For example, each year three Optics faculty members will be asked to serve on the Optics Program Committee, chaired initially by the OpTeC Director. All Optics faculty members will be asked to submit and grade questions for the Optics Qualifying Exam, to be offered at the end of each academic year.

No new courses are required to implement the Optics M.S. degree. However, as the field and demand progress, courses will be added, dropped, or modified to maintain the highest level of relevance. These decisions will be made at the department level with input from the Optics program committee.

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B. Are other, additional resources required to ensure the success of the proposed program? If yes, please describe the need and indicate the plan for meeting this need.

The program will require a half-time Administrative Assistant to manage graduate student recruitment, applications, and admissions, along with a modest sum for recruitment and operations. These funds will be pursued through internal and external proposals.

7. Assessment

How will the success of the program be measured?

All departments in the MSU College of Engineering use a systematic assessment plan (http://www.montana.edu/wwwprov/assessment/assessmentplans.htm) for all academic programs and courses. We continually assess objectives and outcomes at the program and course levels. This same assessment plan will be used for the Optics program.

In addition, we will provide annual assessment based on student, employer, and alumni satisfaction, and input provided by Montana optics industry leaders, including feedback provided during the annual OpTeC meeting. Student enrollment, graduation rates, and employment trends will be recorded by the Optics Program Administrative Assistant, and reviewed annually by the Optics Program Committee. The Optics Program initially will be directed by the OpTeC Director, who reports to the Vice-President for Research. An annual meeting of the OpTeC faculty will be held to discuss and review the annual assessment. Appropriate revisions will be determined from all these sources.

8. Process Leading to Submission

Describe the process of developing and approving the proposed program. Indicate, where appropriate, involvement by faculty, students, community members, potential employers, accrediting agencies, etc.

OpTeC faculty members (from ECE, Physics, and Chemistry & Biochemistry) have gathered several times in recent years to discuss national optics degree trends, existing MSU optics course offerings, and needed courses. A working group, comprising one faculty member from each of the three participating departments designed the optics program. Input from local optics companies, including ILX Lightwave, Quantel Lasers, Bridger Photonics, S2 Corp., NWB Sensors, FLIR/Scientific Materials, AdvR, and Altos Photonics, was gathered during a fall 2012 economic development meeting. A public meeting was held in January 2013 during the weekly OpTeC Colloquium time for faculty and students to hear about and comment on the proposal. Finally, the program was reviewed and approved by the graduate curriculum committees and the department heads of the participating departments, the deans of the two colleges, and the university graduate committee.

January 8-9, 2014

ITEM 162-1019-R0114
Request for authorization to establish a Neural Injury Center

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THAT

The Board of Regents of Higher Education authorizes the University of Montana-Missoula to create the Neural Injury Center.

EXPLANATION

The University of Montana proposes a new Neural Injury Center, with the purpose of integrating existing scientific, educational, and clinical expertise within different UM academic units to provide resources dedicated to serving military veterans with neural injuries (e.g. traumatic brain injury [TBI], post-traumatic stress disorder [PTSD], stroke, spinal cord injury) as they progress from medical rehabilitation to the college campus, vocational training, employment, and community living. The Center will offer support and education for family members through on-campus opportunities and follow-up support. The Center will provide veterans, both on-and-off-campus, with information regarding PTSD and TBI and provide anonymous screening, consultation, ongoing treatment (if needed), and networking with existing community resources. In addition, the Center will support basic and clinical research to translate laboratory discoveries into improved care for patients with TBI.

ATTACHMENTS

Level II Request Form
Curriculum Proposal Form

Montana Board of Regents

LEVEL II REQUEST FORM

Item Number: **162-1019-R0114** Meeting Date: **January 8-9, 2014**

Institution: **University of Montana-Missoula** CIP Code: **13.106**

Program Title: **Neural Injury Center**

Level II proposals require approval by the Board of Regents.

Level II action requested ***(place an X for all that apply and submit with completed Curriculum Proposals Form):***

Level II proposals entail substantive additions to, alterations in, or termination of programs, structures, or administrative or academic entities typically characterized by the (a) addition, reassignment, or elimination of personnel, facilities, or courses of instruction; (b) rearrangement of budgets, cost centers, funding sources; and (c) changes which by implication could impact other campuses within the Montana University System and community colleges. Board policy 303.1 indicates the curricular proposals in this category:

___ **1. Change names of degrees (e.g. from B.A. to B.F.A.)**

___ **2. Implement a new minor or certificate where there is no major or no option in a major;**

___ **3. Establish new degrees and add majors to existing degrees; and**

X **4. Any other changes in governance and organization as described in Board of Regents' Policy 218, such as formation, elimination or consolidation of a college, division, school, department, institute, bureau, center, station, laboratory, or similar unit.**

Specify Request:

The University of Montana proposes a new Neural Injury Center, with the purpose of integrating existing scientific, educational, and clinical expertise within different UM academic units to provide resources dedicated to serving military veterans with neural injuries (e.g. traumatic brain injury [TBI], post-traumatic stress disorder [PTSD], stroke, spinal cord injury) as they progress from medical rehabilitation to the college campus, vocational training, employment, and community living. The Center will offer support and education for family members through on-campus opportunities and follow-up support. The Center will provide veterans, both on-and-off-campus, with information regarding PTSD and TBI and provide anonymous screening, consultation, ongoing treatment (if needed), and networking with existing community resources. In addition, the Center will support basic and clinical research to translate laboratory discoveries into improved care for patients with TBI.

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CURRICULUM PROPOSALS

1. Overview

The proposed Neural Injury Center (NIC) will be a collaborative of faculty and facilities located on the campus of the University of Montana – Missoula (UM). The focus of the Center is to integrate existing scientific, educational and clinical expertise within different UM academic units to provide a centralized and unique combination of personnel and resources dedicated to serving military veterans with neurological injury (e.g. traumatic brain injury [TBI], stroke, spinal cord injury etc.) as they progress from in-patient rehabilitation to the college campus, vocational training, employment and community living. The NIC will also offer support and education for family members and caregivers through on-campus opportunities and follow-up support. The NIC will provide veterans, on- and off-campus, with information regarding post traumatic stress disorder (PTSD) and TBI and provide an opportunity for anonymous screening, consultation, ongoing treatment if needed, and networking with existing community resources. In addition, the NIC will support basic and clinical research to translate laboratory discoveries into improved care for patients with TBI. The NIC will not duplicate existing services, but rather provide new opportunities and support for veterans, particularly those wishing to engage in the pursuit of educational goals. Currently no Center or facility provides a singular location for supporting the needs of the veteran and caregivers during their educational and vocational pursuits. The integration of these activities in an environment that also encompasses clinical trials and translational research among the Center's collaborating scientists also sets the NIC apart from other programs.

The Center will be housed and administered within the College of Health Professions and Biomedical Sciences. Academic programs centrally involved will include the School of Physical Therapy and Rehabilitation Science, Department of Biomedical and Pharmaceutical Sciences, Department of Pharmacy Practice, Center for Structural and Functional Neuroscience, Department of Communicative Sciences and Disorders, Department of Health and Human Performance, School of Social Work and the Department of Psychology. The Center will be closely affiliated with the Nora Staael Evert Physical Therapy Clinic, which includes three integrated programs, UMPT Sports & Orthopedics, UMPT Neurological and Mobility Impairments, and the UMPT New Directions Wellness Center. The latter is a facility dedicated to providing fitness programs and education for the disabled.

Collaborating programs will likely include, but are not limited to, UM's Veterans Office, UM's Department of Health and Human Performance, UM's Rural Institutes on Disabilities, UM's Western Montana Health Education Center, the Community Medical Center Bridges Program, the Montana Neuroscience Institute Foundation, and the Montana Brain Injury Center. It is also anticipated that Center staff will form a close relationship with healthcare professionals at the Veteran's Hospital in Fort Harrison, Providence St. Patrick Hospital and Community Medical Center in Missoula, and provide unique opportunities for the State's newly accredited Family Medicine Residency of Western Montana.

2. Provide a one paragraph description of the proposed program. Be specific about what degree, major, minor or option is sought.

As described above, the Center will integrate existing scientific, educational and clinical expertise within different UM academic units to provide a centralized resource dedicated to serving military veterans with brain injury (e.g. traumatic brain injury [TBI], post-traumatic stress disorder [PTSD], stroke, spinal cord injury) as they progress from in-patient rehabilitation to the college campus, vocational training, employment and community living. The NIC will also offer support and education for family members through on-campus opportunities and follow-up support. The Center will provide veterans, on- and off-

campus, with information regarding PTSD and TBI and provide an opportunity for anonymous screening, consultation, ongoing treatment if needed, and networking with existing community resources. In addition, the NIC will support basic and clinical research to translate laboratory discoveries into improved care for patients with TBI.

3. Need

A. To what specific need is the institution responding in developing the proposed program?

There are over 600 veterans receiving educational benefits at the University of Montana. In discussions with the University's Veteran's Education and Transition Services Office (VETS Office), it has been brought to our attention that many veterans struggle with brain-related injuries that compromise their educational experience. Veterans who served prior to 2010 might never have received screening for TBI or PTSD and are not receiving any services. Moreover, Montana is second in the United states in both the percentage of veterans per capita, and TBI-related deaths. The University of Montana-Missoula already has a nucleus of scientists working in TBI and related areas. The NIC seeks to strengthen this nucleus to enhance interdisciplinary interaction, extramural funding success, and advancement of laboratory studies to translational and clinical trial work.

B. How will students and any other affected constituencies be served by the proposed program?

Student veterans will be the primary beneficiaries of the proposed Center. In addition, it is anticipated that students enrolled in the physical therapy, psychology, pharmacy, neuroscience and speech pathology programs will benefit through exposure to a veteran client base receiving treatment, screening or consultations within the center. As research teams grow, it is also anticipated that there will be benefits to graduate students.

C. What is the anticipated demand for the program? How was this determined?

There are at least 600 veterans receiving educational benefits at the University of Montana. It is thought that the number of students who are veterans is higher than this figure because currently there is no way of knowing if a student is a veteran unless they are receiving financial assistance and prior to 2010 combatants were not screened for TBI upon exiting the service. This information was provided by the University's Veteran's Education and Transition Services Office.

4. Institutional and System Fit

A. What is the connection between the proposed program and existing programs at the institution?
Collaborating programs will include, but are not limited to, the University's Veterans Office, the Montana Neuroscience Institute Foundation, Western Montana Area Health Education Center, Department of Pharmacy Practice, School of Social Work, School of Public and Community Health Sciences, Department of Communicative Sciences and Disorders, Clinical Psychology program, and Department of Health and Human Performance. It is also anticipated that center staff will form close relationships with healthcare professionals at Providence St. Patrick Hospital and the aforementioned newly accredited residency program in family medicine. The overriding connection among the programs is advancement of knowledge and services to the veteran.

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B. Will approval of the proposed program require changes to any existing programs at the institution? If so, please describe.

No

C. Describe what differentiates this program from other, closely related programs at the institution (if appropriate).

The University's Veteran's Education and Transition Services Office provides services to veterans. These services focus on obtaining financial benefits, networking with other national veteran organizations and local health-care providers and providing a supportive environment and meeting place for veterans. The proposed Center will be focused on research and rehabilitation services. There will be a strong collaboration between the Center and the VETS office, but there will not be any duplication of services.

D. How does the proposed program serve to advance the strategic goals of the institution?

The Center's focus on research and community service fit extremely well with the University's mission. The NIC will contribute to teaching, research and service in numerous ways. Teaching will be enhanced, especially in clinically-related areas. One of the challenges for non-medical school based physical therapy, pharmacy and communication science curricula is the lack of daily contact with patient populations. As students rotate through our on-campus clinics it is anticipated that they will have the opportunity for observation and hands-on treatment of our wounded veterans. This experience will be invaluable.

Research will be a primary focus of the Center and it will facilitate increased interactions among scientists engaged in various aspects of brain injury. To our knowledge, there is no similar facility in the Northwest region that houses scientists engaged in such a wide range of research interests (from molecular to translational) within a single center devoted to TBI. It is anticipated that collaborations will result in increased funding opportunities and entrepreneurial activity. The Center will establish a new research emphasis on TBI and related brain injury.

Service to the community, the state of Montana and military veterans is another major focus and strength of the proposed Center. While there are many disparate services available to veterans within the state, there is no single location or service that provides the veteran with guidance for both their medical and educational needs. Importantly, our public outreach and educational efforts will seek to reach those veterans who may not know that they are experiencing a treatable problem. It is well-reported that many veterans believe cognitive and coordination problems are normal impairments post-combat. Others fear the stigma of asking for help. We hope to reach these individuals by providing public outreach and a facility where anonymous screening can take place. And, if needed, provide ongoing treatment without compromising their educational and vocational efforts. The Center's location on the University of Montana campus and near to Missoula College creates a perfect opportunity of convenience for the veteran and ease of collaborative efforts on the veteran's behalf of medical and educational personnel.

The NIC is consistent with and will remain committed to the University's strategic plan and aspirations through 2020. Through its programs, it will help students with disabilities, specifically veterans, succeed academically and personally (Partnering for Student Success); facilitate recruitment of non-

resident veteran students and building stronger governmental relationships (Education for the Global Century); facilitate and conduct critical basic and applied research (Discovery and Creativity); attract national experts through unique service, and research opportunities, increase professional development opportunities, and improve facilities (Dynamic Learning Environment); and be engaged in the elements associated with the Planning-Assessment Continuum, to ensure long-term Center viability.

E. Describe the relationship between the proposed program and any similar programs within the Montana University System. In cases of substantial duplication, explain the need for the proposed program at an additional institution. Describe any efforts that were made to collaborate with these similar programs; and if no efforts were made, explain why. If articulation or transfer agreements have been developed for the substantially duplicated programs, please include the agreement(s) as part of the documentation.

Existing programs at the University (as well as at the local, and state level) provide for a wealth of possible collaborations but no known program duplications. University programs and services include the following:

- University of Montana Veterans' Office (umt.edu/veterans): Provides campus lounge for veterans and advice on GI bill.
- Montana Neuroscience Institute Foundation
- OCHE Veterans Success Initiative

Members of the steering committee have met with representatives from the University's VETs office, and the Montana Neuroscience Institute Foundation. There was much useful dialogue during these meetings with many recommendations being incorporated into this proposal. The meetings established a collaborative atmosphere and established that there were no duplication of services.

5. Program Details

A. Provide a detailed description of the proposed curriculum. Where possible, present the information in the form intended to appear in the catalog or other publications. NOTE: In the case of two-year degree programs and certificates of applied science, the curriculum should include enough detail to determine if the characteristics set out in Regents' Policy 301.12 have been met.

Not applicable

B. Describe the planned implementation of the proposed program, including estimates of numbers of students at each stage.

It is expected that the program will be phased in beginning with an interactive veterans' web resource, available in the Soring of 2014. In the interim, campus services relevant to veteran services will be organized by focus groups, to create innovative communication strategies for veterans to engage in learning about and accessing services designed to reduce barriers to higher education. By the fall of 2014, the Neural Injury Center will begin to offer screening, evaluative and as appropriate, therapeutic services for clients with neural injury, particularly traumatic brain injury and spinal cord injury.

It is not anticipated that students will become directly involved until the 2014-2015 academic year, principally interacting with clients as they currently do in the Nora Staael Evert Physical Therapy Clinic. With increased clientele, it is expected that the opportunities for student engagement will both

increase in number but also broaden by diagnoses.

Associated research projects will begin in earnest during the 2014-2015AY and these projects would be expected to increase the number of graduate students in a variety of disciplines.

6. Resources

A. Will additional faculty resources be required to implement this program? If yes, please describe the need and indicate the plan for meeting this need.

No additional faculty resources are required at this time.

B. Are other, additional resources required to ensure the success of the proposed program? If yes, please describe the need and indicate the plan for meeting this need.

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It is anticipated the Center will benefit from a variety of both publicly and privately funded agencies. The budget as proposed is a conservative estimate of direct revenues to sustain the Center budget over five years.

	Year 1	Year 2	Year 3	Year 4	Year 5
Revenue					
Program Fees – Net revenues from client care (physical therapy, speech, psychology)	n/a	3000	4000	5000	6000
Other Funds – from OCHE/MUS (Veteran's Success Initiative)	50000	25000	0	0	0
Other Funds – private donation	50000	TBD	TBD	TBD	TBD
State Funds (UM General Fund)	0	0	0	0	0
State Funds – Physical Therapy Designated Account	20000	20000	20000	20000	20000
Total Revenue	**120000**	**128000**	**124000**	**175000**	**226000**
Costs					
Personnel (Faculty, professionals, staff)	75406	90317	93026	95817	98691
Equipment	2000	5000	5000	5000	5000
Supplies	500	750	1000	1250	1500
Travel	2000	4000	4000	4000	4000
Other Expenses (Year 1, a funded project (OCHE) is budgeted to enhance web communication with clients. Years 1-5 include expenses for work-study student assistance and a $10,000 fee waiver for a PhD student.	34000	16000	16000	16000	16000
Total Costs	**113906**	**16067**	**119026**	**122067**	**125191**

7. Assessment - How will the success of the program be measured?

Specific outcome measures will include the number of clients accessing the center, feedback from the University's VET center, the number of referrals made by the Center to other veteran-related services, new research projects initiated, research publications and amount of extramural funding sought and obtained. The following policies are in place; 1) the Director will report to the Dean of the College of Health Professions or his/her designate, which may initially be the Chair of the School of Physical Therapy and Rehabilitation Science; 2) the Research Director will prepare periodic reports on the research efforts of the Center to be submitted to the Center Director; 3) the Scientific Advisory Board will meet semi-annually and provide a written report to the Center Director.

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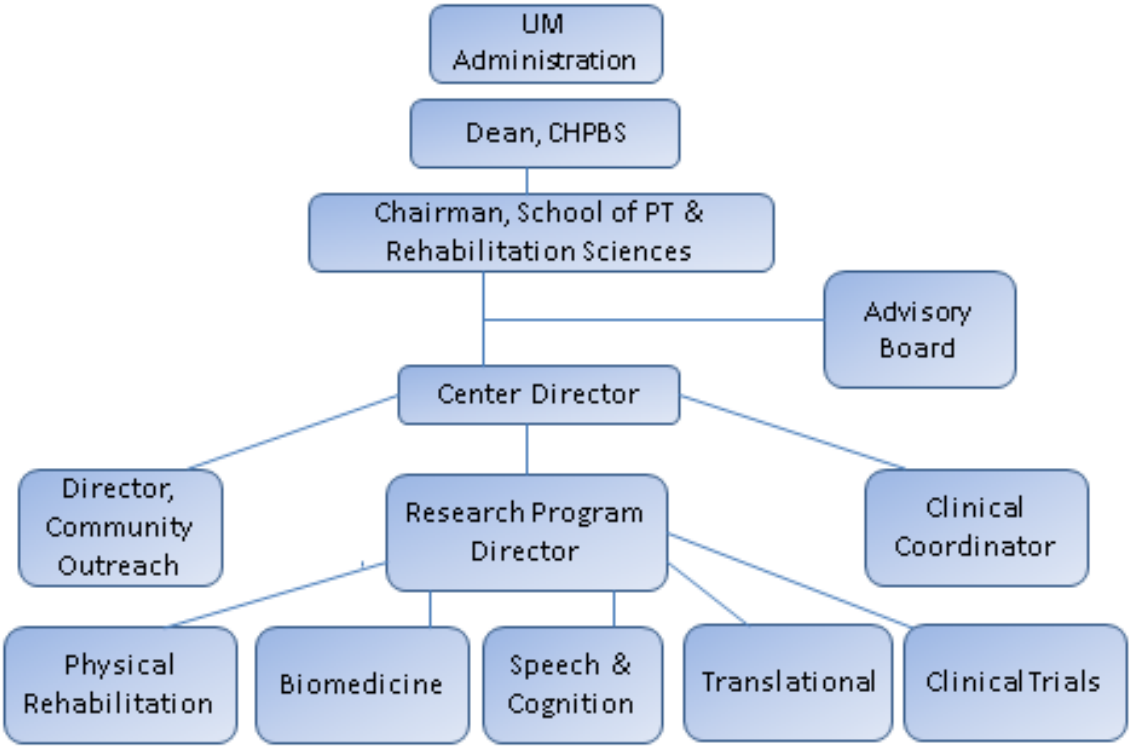

8. Process Leading to Submission

The concept of a Neural Injury Center originated in the fall of 2011 as a proposal to the Campus Development Committee and a subsequent concept paper developed by Reed Humphrey, Ph.D., Chair of the School of Physical Therapy and Rehabilitation Science, to create an educational and medical intervention and research program for- but not limited to – veterans and their families. The proposal called for the establishment of an integrated neuroscience community within The University focusing on neural injury and rehabilitation. Out of this effort came the concept of a program for veterans and their families entitled "Project Flourish." This effort would be unique in that it would combine research, rehabilitation, and education. This project, physically housed and administered in the College of Health Professions and Biomedical Sciences School of Physical and Rehabilitation Science, would partner with existing programs in the state such as the Wounded Warriors Project, the Station Foundation, and Team Red, White and Blue to offer comprehensive services to veterans and their families, as well as all victims of traumatic brain injury, stroke and spinal cord injury.

The original planning group included Reed Humphrey, Chair of the School of Physical Therapy and Rehabilitation Science, Professor Charles Leonard (Physical Therapy), Associate Dean Vernon Grund, Michael Kavanaugh, Director of the Center for Structural and Functional Neuroscience, and Richard Bridges, Chair of Biomedical and Pharmaceutical Sciences. A larger steering committee will add community members and a veteran, the Director of UM's Veterans Center, and representatives from Pharmacy Practice, Social Work, Public and Community Health Sciences, Family Practice Medical Residency, Communicative Sciences and Disorders, and Clinical Psychology.

Montana Board of Regents

CURRICULUM PROPOSALS

Professor Charles Leonard has been in charge of drafting the Neural Injury Center proposal. He and/or Chair Reed Humphrey has met with and discussed the concept of the proposal with various groups in the community and on campus for constructive feedback. This includes representatives from the Wounded Warriors Project, Community Hospital Bridges Program, the Montana Neuroscience Institute, the Montana Brain Injury Center, the UM Veterans Center, and representatives from the Board of Regents.

The project has received some preliminary financial support via the OCHE Veterans Success Initiative and the School of Physical Therapy and Rehabilitation Science. It is consistent with efforts at the University to improve services for veterans on campus and enhance veteran enrollments and retention. It has been reviewed by faculty in the School of Physical Therapy and Rehabilitation Science, by the Associate Dean for Planning and Development, and by the Dean of the College of Health Professions and Biomedical Sciences. It has been approved by the Faculty Senate.

January 8-9, 2014

ITEM 162-1503-R0114
Request to establish a Certificate of Applied Science in Welding Technology

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THAT

In accordance with Montana University System Policy, the Board of Regents of Higher Education authorizes Highlands College of Montana Tech to establish a Certificate of Applied Science in Welding Technology.

EXPLANATION

This program was proposed by Highlands College of Montana Tech as part of its implementation of Montana's recently awarded Strengthening Workforce Alignment in Montana's Manufacturing and Energy Industries (SWAMMEI) Grant. The SWAMMEI Grant provides an opportunity for two-year colleges to develop industry-driven curricula that could result in, among other things, stackable credentials. The goal of this proposal is to revise current curricula of Highlands College so as to develop new stackable offerings and thereby potentially increase student progression and completion rates.

ATTACHMENTS

Level II Request Form
Curriculum Proposal Form

Montana Board of Regents

LEVEL II REQUEST FORM

Item Number: **162-1503-R0114** Meeting Date: **January 8-9, 2014**

Institution: **Highlands College of Montana Tech** CIP Code: **48.0508**

Program Title: **Certificate of Applied Science in Welding Technology**

Level II proposals require approval by the Board of Regents.

Level II action requested ***(place an X for all that apply and submit with completed Curriculum Proposals Form):***

Level II proposals entail substantive additions to, alterations in, or termination of programs, structures, or administrative or academic entities typically characterized by the (a) addition, reassignment, or elimination of personnel, facilities, or courses of instruction; (b) rearrangement of budgets, cost centers, funding sources; and (c) changes which by implication could impact other campuses within the Montana University System and community colleges. Board policy 303.1 indicates the curricular proposals in this category:

___ **1. Change names of degrees (e.g. from B.A. to B.F.A.)**

X **2. Implement a new minor or certificate where there is no major or no option in a major;**

___ **3. Establish new degrees and add majors to existing degrees; and**

___ **4. Any other changes in governance and organization as described in Board of Regents' Policy 218, such as formation, elimination or consolidation of a college, division, school, department, institute, bureau, center, station, laboratory, or similar unit.**

Specify Request:

Highlands College of Montana Tech requests Level II approval for a new Certificate of Applied Science in Welding Technology. This program will be operated by Highlands College.

Montana Board of Regents
Curriculum Proposals

1. Overview

This program is proposed by Highlands College of Montana Tech as part of its implementation of Montana's recently awarded Strengthening Workforce Alignment in Montana's Manufacturing and Energy Industries (SWAMMEI) Grant. The SWAMMEI Grant provides an opportunity for two-year colleges to develop industry-driven curricula that could result in, among other things, stackable credentials. The goal of this proposal is to revise current curricula of Highlands College so as to develop new stackable offerings and thereby potentially increase student progression and completion rates.

Currently, Highlands College has an Associate of Applied Science in Metals Fabrication. The concept behind this degree program was to have the students complete a combination of welding and machining courses in order to earn their AAS in Metals Fabrication. The intent of the subject proposals is to create a Certificate of Applied Science in Welding Technology and a Certificate of Applied Science in Machining Technology as stackable credentials leading to an AAS, once it is completely revised. Subsequent to these developments, the AAS in Metals Fabrication will be put in moratorium in order to revise the AAS in Metals Fabrication in order to be in alignment with the two new CAS programs.

The two new CAS programs will allow students the choice of joining the workforce sooner with a credential after only two semesters rather than four. Additionally, those students who wish to earn the AAS in Metals Fabrication may still have the option to potentially leave school with both the stacked CAS and the AAS.

Students of the CAS in Welding Technology will learn the skills needed to pass the AWS Level I SENSE Certification. This industry specific certification demonstrates to employers that students have a particular aptitude and breadth of knowledge in welding.

This CAS is a 41 credit hour certificate. The structure of the program allows students to complete the required 41 credits by attending a Fall and Spring semesters, making this a program that students can expeditiously complete and enter the workforce with a valuable and legitimate college credential in the quickest time possible.

2. Provide a one paragraph description of the proposed program. Be specific about what degree, major, minor or option is sought.

The CAS in Welding Technology is the credential being sought herein. It will provide students the opportunity to learn the important aspects of the science and art of welding. Students will start their curriculum with shop safety and Interpersonal Communications, designed specifically for workplace needs. Students will then move into Blueprint Reading and Welding Symbols, Shielded Metal Arc Welding, Gas Metal Arc Welding and Flux Core Arc Welding. In the second semester they will cover Applied Metallurgy, Gas Tungsten Arc Welding, Design and Fabrication and complete their related instruction in math and writing.

Montana Board of Regents
Curriculum Proposals

3. Need

A. To what specific need is the institution responding in developing the proposed program?

Highlands College conducts an evaluation of all its new programs, especially in the areas of industry demand. The Montana Department of Labor reports that one of the greatest areas of need in Montana is the major industry sector of Manufacturing which includes both Welding and Machining. Highlands College is participating in the SWAMMEI Grant and, as such, has the obligation to prepare more students, in quicker ways, for the high wage jobs in both welding and manufacturing.

Additionally, it should be noted that welding and machining at Highlands College are not new. This proposal is intended as an improvement to help students earn credentials and enter the workforce more quickly and in greater numbers. Our current program has grown to a point of becoming unmanageable for one instructor without some major changes. In the past ten years we have increased enrollment, going from 6 students to 50 without any increase in faculty. This many students spread into two lab areas (welding & machining) is problematic as well as unsafe. We need to have a faculty member with the students in each training area to better serve the student and to maintain safe and effective learning objectives.

B. How will students and any other affected constituencies be served by the proposed program?

Offering this CAS program at Highlands College is a win both for the students, as well as the local welding employers and the more distant welding employers in Montana. Students of the CAS in Welding Technology will learn the skills needed to pass the AWS Level I SENSE Certification. Employees who enter the workforce with prior education and specialized training would be able to advance to higher-paying, more permanent positions at a faster rate.

C. What is the anticipated demand for the program? How was this determined?

According to the Montana Department of Labor, currently, welders earn $16.66 per hour (which is 94% of the regional median wage) and machinists earn $18.56 per hour (which is 105% of the regional median wage). Current data from the awarded SWAMMEI Grant is that there are 271 current openings for welders with an increase to 318 over the next 4 years and a further increase to 598 openings over the next 8 years. In machining there are 212 current openings for machinists with an increase to 145 over the next 4 years and a further increase to 277 openings over the next 8 years.

4. Institutional and System Fit

A. What is the connection between the proposed program and existing programs at the institution?

Currently, Highlands College has an Associate of Applied Science in Metals Fabrication. The concept behind this degree program was to have the students complete a combination of welding and machining courses in order to earn their AAS in Metals Fabrication. The intent of the subject proposals is to create a Certificate of Applied Science in Welding Technology and a Certificate of Applied Science in Machining Technology as stackable credentials leading to an AAS. Subsequent to these developments, the AAS in Metals Fabrication will be put in moratorium in order to revise the AAS in Metals Fabrication in order to be in alignment with the two new CAS programs.

Montana Board of Regents
Curriculum Proposals

The new CAS program will allow students the choice of joining the workforce sooner with a credential after only two semesters rather than four. Additionally, those students who wish to earn the AAS in Metals Fabrication may still have the option to potentially leave school with both the stacked CAS and the AAS.

B. Will approval of the proposed program require changes to any existing programs at the institution? If so, please describe.

Yes. The approval of the proposed CAS program will require changes to existing programs at Highlands College. The AAS in Metals Fabrication will be put in moratorium in order to revise the AAS in Metals Fabrication in order to be in alignment with the two new CAS programs.

C. Describe what differentiates this program from other, closely related programs at the institution (if appropriate).

Highlands College currently has an AAS in Metals Fabrication. Other than that, there are no other Metals Fabrication/Welding/Machining programs at Highlands College.

D. How does the proposed program serve to advance the strategic goals of the institution?

Highlands College falls under several institutional strategic goals and work plans. First Montana Tech's strategic plan states under the Theme of "Be a National Leader in Educating Undergraduate and Graduate Students" and subtheme "Be Excellent in Instruction and Student Learning," "Use best practices to improve retention and learning." These new CAS programs will increase the number of workforce certificates and it will increase the number of graduates employed full-time in their field.

Additionally, Montana Tech's strategic plan states in the subtheme "Use Assessment Proactively to Improve Teaching and Learning," that measure student achievement against national benchmarks. This new CAS program in welding will do just that with the students having the potential of earning their AWS Level I SENSE Certification. One of the three strategic areas the Montana Board of Regents is focusing on, for two year institutions, is workforce development. Targets in the area of workforce development are to offer accessible, responsive, student centered learning that facilitates and supports degree completion and decreases time to employment. In addition, programs offered will prepare students for high demand living wage employment. This program hits all those targets and contributes the workforce development goals in the soon to be released Montana Tech comprehensive mission and strategic plan.

E. Describe the relationship between the proposed program and any similar programs within the Montana University System. In cases of substantial duplication, explain the need for the proposed program at an additional institution. Describe any efforts that were made to collaborate with these similar programs; and if no efforts were made, explain why. If articulation or transfer agreements have been developed for the substantially duplicated programs, please include the agreement(s) as part of the documentation.

The establishment of Welding and Machining programs at the majority of the two-year colleges in the state is a testament for the need for these workers at cities throughout the state. Additionally, with the SWAMMEI Grant, the full intent is to have programs around the state which are available to increase the number of students and degree completions.

Montana Board of Regents
Curriculum Proposals

This proposal does not radically change what already exists at Highlands College. Instead, it enhances the program by making the credentials stackable from the CAS to the AAS. However, programs around the state include: City College in Billings, Great Falls College, Flathead Valley Community College, Missoula College, Helena College, Dawson Community College and MSU Northern. The proposed program will follow the MUS initiative for common course numbering and inter-campus transferability.

As noted in the previously cited Department of Labor report, which states that both current and future demand for job growth in the welding industries is predicted to increase, this increased demand in all areas of the state and the geographic separation between the campuses, make additional welding programs necessary to fill regional needs.

5. Program Details

A. Provide a detailed description of the proposed curriculum. Where possible, present the information in the form intended to appear in the catalog or other publications. NOTE: In the case of two-year degree programs and certificates of applied science, the curriculum should include enough detail to determine if the characteristics set out in Regents' Policy 301.12 have been met.

The program's curriculum and course descriptions are included in Appendix A.

B. Describe the planned implementation of the proposed program, including estimates of numbers of students at each stage.

New incoming students will have a choice of entering either the Welding Program or the Machining program. Our current program does not allow this. At the completion of either program the student can either enter the workforce immediately. or re-enroll in the other program. The implementation plan calls for a program start of the CAS in Welding program in Fall, 2014. The number of students admitted to the program the first year is estimated at 15-30. A new, revised version of the AAS in Metals Fabrication will be worked on for a possible rollout in the Fall, 2016 or 2017.

6. Resources

A. Will additional faculty resources be required to implement this program? If yes, please describe the need and indicate the plan for meeting this need.

Yes. Highlands College will hire a full-time Faculty to teach the classes in the Machining Program. The current single faculty member will teach the classes in Welding.

Fortunately, the SWAMMEI Grant will fund the additional faculty member for four years. After that time, Montana Tech/Highlands College will decide whether to institutionalize the position.

B. Are other, additional resources required ensuring the success of the proposed program? If yes, please describe the need and indicate the plan for meeting this need.

Due to the expected increase in expenses for supplies, nominal additional costs are anticipated. The anticipated additional costs will be covered by the fees associated with the program which will be paid by the additional students.

Montana Board of Regents
Curriculum Proposals

7. Assessment
How will the success of the program be measured?

The proposed program will be assessed using the following metrics:

1. Graduation/completion rates
2. Student retention
3. Enrollments
4. Certification pass rate
4. Placement in the field
5. Employer satisfaction with graduates

The program's Industrial Advisory Board will review the assessment measures on an annual basis. Student evaluations are another important assessment tool for faculty and administration. Finally, the programs will be assessed by the Montana Tech Assessment Committee.

8. Process Leading to Submission
Describe the process of developing and approving the proposed program. Indicate, where appropriate, involvement by faculty, students, community members, potential employers, accrediting agencies, etc.

The proposed CAS in Welding Technology program was initiated due to student, community and industry demand; however, one of the primary driving factors was the awarding of the SWAMMEI Grant to Montana. The SWAMMEI Grant is providing an opportunity for Highlands College to develop industry driven curricula that will result in, among other things, stackable credentials (CAS to AAS).

The CAS program proposal was first vetted and approved by the Highlands College Trades & Technical Department. Subsequently, the programs were vetted and approved by the Dean of Highlands College and the Montana Tech's Curriculum Review Committee. The Montana Tech Faculty Senate approved the proposal in November. The Provost Office reviewed the program and submitted it to the Board of Regents. Upon approval from the Board of Regents, the program proposal will be submitted to the Northwest Commission on Colleges and Universities for review.

Montana Board of Regents
Curriculum Proposals

APPENDIX A

CAS in Welding Technology Program

Course Descriptions

WLDG155 Design and Fabrication
Credits: 4 Prerequisites: Completion of all first semester Credits.
This course incorporates all skills learned during the fall semester courses. Students will learn proper identification, care, and use of hand tools used in metal fabrication. Students will be assigned in-shop and live work projects to refine their fabrication and welding skills.

WLDG140 Intro GAS Tungsten Arc Welding (GTAW)- Integrated Lab
Credits: 3 Prerequisites: Completion of all First Semester Credits.
In this course, students will be given instruction on using the Gas Tungsten ARC welding (GTAW) process. This course will cover instruction on safety, setup, and proper techniques in welding aluminum, mild steel, and stainless steel. Instruction will also be given on proper setup and uses of spool guns used in industry.

WLDG117 Blueprint Reading and Weld Symbols
Credits: 3 Prerequisites: Enrolled in Highlands College Welding Program
This course covers the basics for understanding the reading of blueprints and shop drawings. The use of AWS welding symbols for blueprint reading is also covered.

WLDG112 Cutting Processes
Credits: 1 Prerequisites: Enrolled in Highlands College Welding Program
This course will examine the different cutting processes used in today's welding industry. The cutting processes examined in this course are Oxy Fuel, Plasma Arc, and Carbon Arc cutting. Hands on training will be administered throughout this course to ensure that proper technique and safety measures are met with all above mentioned cutting processes.

WLDG105 Shop Safety
Credits: 1 Prerequisites: Enrolled in Highlands College Welding Program
Safe work practices are paramount in all aspects of industrial work. Students will receive training in each piece of equipment using manufacturers' safety recommendations. Students will learn to identify and follow safe work practices as well as inspections of power equipment (portable and stationary), hand tools, and also demonstrate the safe and proper use of each tool.

WLDG155 Design and Fabrication
Credits: 4 Prerequisites: Completion of all First semester Credits.
This course incorporates all skills learned during the fall semester courses. Students will learn proper identification, care, and use of hand tools used in metal fabrication. Students will be assigned in-shop and live work projects to refine their fabrication and welding skills.

WLDG180 Shielded Metal Arc Welding
Credits: 4 Prerequisites: Enrolled in Highlands College Welding Program

Montana Board of Regents
Curriculum Proposals

This course starts with a basic understanding of the stick welding process, including the concepts of basic electricity, filler metals, and applications. A hands-on welding experience is gained through multiple steps and exercises, using multiple welding filler metals and welding positions. An American Welding Society certification can be obtained at the end of the course.

WLDG 275 Gas Metal Arc Welding
4 cr. Offered spring. Prereq., Enrolled in Highlands College Welding Program .
Theory and safe operation of Gas Metal Arc Welding (GMAW). Theory of flux core arc welding applied to GMAW. Primary focus on application, practical skill development, and producing welds that meet industry standards. Metals welded are low carbon steel, stainless steel, and aluminum. Short circuit arc and spray arc transfer used. Examination of gas and electrode selection.

WLDG 187 Flux Core Arc Welding
4 cr. Offered spring. Prereq. Enrolled in Highlands College Welding Program.
Theory, practice, and safe operation of flux core arc welding equipment. Coupons are welded in the flat, horizontal, and vertical positions to industry standards using a variety of welding electrodes, diameters, and power sources, which prepare students for welding qualification to the American Welding Society Structural Welding Code specifications.

WLDG 215 Gas Tungsten Arc Welding (Integrated Lab)
4 cr. Offered autumn.
The theory and safe operation of Gas Tungsten Arc Welding (GTAW). Examination of power source controls and operation along with associated consumables such as gasses, electrode filler materials for carbon steel, stainless steel, and aluminum. Welding skill development according to industry standards using these materials in the flat, horizontal, and vertical positions

WLDG 282 - AWS Level 1 CENSE Cert
4 Cr. (Hrs: 1 Lec, 6 Lab)
Course covers GMAW (Gas Metal Arc Welding), GTAW (Gas Tungsten Arc Welding) FCAW (Flux Core Arc Welding), Plasma cutting and Air arc gouging. Students will learn and practice welding techniques used to pass the AWS entry-level welder examination. Prerequisite: Completion of all first semester credits. 0.000 OR 4.000 Credit hours

WLDG 205 - Applied Metallurgy
3 Crs (Hrs: 3 Lec)
Study of metal classifications, heat treatment processes. Properties of metals, hardness, strength, ductility, etc. and the effects of welding processes on them. Prerequisite: Completion of all 1 st semester credits. 3.000 Credit hours.

M 111 Technical Mathematics
3 credits (Hrs: 3 Lec.)
This course presents basic mathematical topics as they are applied in a technical program. Topics covered include percent, ratio proportion, formula evaluation, basic algebra and geometry concepts, trigonometry and measurement are developed and integrated in a technical.

OR

Montana Board of Regents
Curriculum Proposals

M 090 Introductory Algebra
4 credits (Hrs: 4 Lec.)
Brief review of fractions and decimals. Beginning algebra concepts including the real number system, algebraic expressions, linear equations, exponents and polynomials, the rectangular coordinate system, and simple factoring. Also, basic geometry, measurement, and problem solving with applications for technical and business fields.
Prerequisite(s): M 061 or Compass score of 45-54. Course generally offered year round.

WRIT 095 Developmental Writing
3 credits (Hrs: 3 Lec.)
Course provides instruction and practice in basic writing skills, emphasizes paragraph development and organization, and reviews sentence structure, word choice, and spelling. Assignments include short pieces, journals, and essays. Mastery of the basics of grammar and mechanics is assumed. Prepares students for College Writing I (WRIT 101). Incoming students not meeting the minimum passing score on placement test are required to enroll in and successfully complete WRIT 095 prior to enrolling in WRIT 101.

OR

WRIT 104 Workplace Communications
3 credits (3 lec/wk)
Designed to teach students the fundamentals of the English language, including grammar, spelling, punctuation, and word usage, with emphasis on applying these skills in written communication for the work world.

Montana Board of Regents
Curriculum Proposals

Welding Technology Program
Certificate of Applied Science Degree

Fall Entry Only

Student Name _____ **Catalog**_____

Student ID _____ **PIN** _____

Course Number	Course Title	Credits	Semester Completed	Transfer or Waive	Grade
First Semester					
WLDG 105	Shop Safety	1			
WLDG 112	Cutting Processes	1			
WLDG 180	Shielded Metal Arc Welding (SMAW)	4			
WLDG 117	Blueprint Read & Welding Symbols	3			
WLDG 275	Gas Metal Arc Welding (GMAW)	4			
WLDG 187	Flux Core Arc Welding (FCAW)	4			
PSYX 100 COMM 110	Introduction to Psychology or Interpersonal Communications	3			
	Credits (Fall)	20			
Second Semester					
WLDG 205	Applied Metallurgy	3			
WLDG 282	AWS Level I SENSE Certification	4			
WLDG 155	Design & Fabrication	4			
WLDG 140	Gas Tungsten Arc Welding (GTAW)	3			
WLDG 291	Special Topics	1			
WRIT 104 or WRIT 095	Workplace Communications or Developmental Writing	3 3			
M 111 or M 90	Technical Math or Intro to Algebra	3 3			
	Credits (Spring)	21			
	Total Program Credits	41			

January 8-9, 2014

ITEM 162-1504-R0114
Request to establish a Certificate of Applied Science in Machining Technology

---

THAT

In accordance with Montana University System Policy, the Board of Regents of Higher Education authorizes Highlands College of Montana Tech to establish a Certificate of Applied Science in Machining Technology.

EXPLANATION

The CAS in Machining Technology program was proposed by Highlands College of Montana Tech as part of its implementation of Montana's recently awarded Strengthening Workforce Alignment in Montana's Manufacturing and Energy Industries (SWAMMEI) Grant. The SWAMMEI Grant provides an opportunity for two-year colleges to develop industry driven curricula that could result in, among other things, stackable credentials. The goal of this proposal is to revise current curricula of Highlands College so as to develop new stackable offerings and thereby potentially increase student progression and completion rates.

ATTACHMENTS

Level II Request Form
Curriculum Proposal Form

Montana Board of Regents

LEVEL II REQUEST FORM

Item Number: **162-1504-R0114** Meeting Date: **January 8-9, 2014**

Institution: **Highlands College of Montana Tech** CIP Code: **48.0501**

Program Title: **Certificate of Applied Science in Machining Technology**

Level II proposals require approval by the Board of Regents.

Level II action requested ***(place an X for all that apply and submit with completed Curriculum Proposals Form):***

Level II proposals entail substantive additions to, alterations in, or termination of programs, structures, or administrative or academic entities typically characterized by the (a) addition, reassignment, or elimination of personnel, facilities, or courses of instruction; (b) rearrangement of budgets, cost centers, funding sources; and (c) changes which by implication could impact other campuses within the Montana University System and community colleges. Board policy 303.1 indicates the curricular proposals in this category:

___ **1. Change names of degrees (e.g. from B.A. to B.F.A.)**

X **2. Implement a new minor or certificate where there is no major or no option in a major;**

___ **3. Establish new degrees and add majors to existing degrees; and**

___ **4. Any other changes in governance and organization as described in Board of Regents' Policy 218, such as formation, elimination or consolidation of a college, division, school, department, institute, bureau, center, station, laboratory, or similar unit.**

Specify Request:

Highlands College of Montana Tech requests Level II approval for a new Certificate of Applied Science in Machining Technology. This program will be operated by Highlands College.

Montana Board of Regents

CURRICULUM PROPOSALS

1. Overview

The CAS in Machining Technology program was proposed by Highlands College of Montana Tech as part of its implementation of Montana's recently awarded Strengthening Workforce Alignment in Montana's Manufacturing and Energy Industries (SWAMMEI) Grant. The SWAMMEI Grant provides an opportunity for two-year colleges to develop industry driven curricula that could result in, among other things, stackable credentials. The goal of this proposal is to revise current curricula of Highlands College so as to develop new stackable offerings and thereby potentially increase student progression and completion rates.

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The two new CAS programs will allow students the choice of joining the workforce sooner with a credential after only two semesters rather than four. Additionally, those students who wish to earn the AAS in Metals Fabrication may still have the option to potentially leave school with both the stacked CAS and the AAS.

Students of the CAS in Machining Technology will learn the skills needed to earn the Mastercam Certification and the National Institute for Metalworking Skills (NIMS) Certificate. These industry specific certifications demonstrate to employers that students have a particular aptitude and breadth of knowledge in machining.

This CAS is a 41 credit hour certificate. The structure of the program allows students to complete the required 41 credits by attending a Fall and Spring semesters, making this a program that students can expeditiously complete and enter the workforce with a valuable and legitimate college credential in the quickest time possible.

2. Provide a one paragraph description of the proposed program. Be specific about what degree, major, minor or option is sought.

The CAS in Machining Technology is the credential being sought herein. It will provide students the opportunity to learn the important aspects of the science and art of machining. Students will start their curriculum with Interpersonal Communications, designed specifically for workplace needs. Students will then move into Blueprint Reading and Interpretation for Machining, CNC I and II, Machine Quality and Controls and Precision Measurement, Metallurgy, Advanced Machining and Manufacturing and complete their related instruction in math and writing.

Montana Board of Regents
CURRICULUM PROPOSALS

3. Need

A. To what specific need is the institution responding in developing the proposed program?

Highlands College conducts an evaluation of all its new programs, especially in the areas of industry demand. The Montana Department of Labor reports that one of the greatest areas of need in Montana is the major industry sector of Manufacturing which includes both Welding and Machining. Highlands College is participating in the SWAMMEI Grant and, as such, has the obligation to prepare more students, in quicker ways, for the high wage jobs in both welding and manufacturing.

Additionally, it should be noted that welding and machining at Highlands College are not new. This proposal is intended as an improvement to help students earn credentials and enter the workforce more quickly and in greater numbers. Our current program has grown to a point of becoming unmanageable for one instructor without some major changes. In the past ten years we have increased enrollment, going from 6 students to 50 without any increase in faculty. This many students spread into two lab areas (welding & machining) is problematic as well as unsafe. We need to have a faculty member with the students in each training area to better serve the student and to maintain safe and effective learning objectives.

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Offering this CAS program at Highlands College is a win both for the students, as well as the local machining employers and the more distant machining employers in Montana. Students of the CAS in Machining will learn the skills needed to pass the Mastercam Certification and the NIMS Certification. Employees who enter the workforce with prior education and specialized training would be able to advance to higher-paying, more permanent positions at a faster rate.

C. What is the anticipated demand for the program? How was this determined?

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Montana Board of Regents
CURRICULUM PROPOSALS

The two new CAS programs will allow students the choice of joining the workforce sooner with a credential after only two semesters rather than four. Additionally, those students who wish to earn the AAS in Metals Fabrication may still have the option to potentially leave school with both the stacked CAS and the AAS.

B. Will approval of the proposed program require changes to any existing programs at the institution? If so, please describe.

Yes. The approval of the proposed CAS program will require changes to existing programs at Highlands College. The AAS in Metals Fabrication will be put in moratorium in order to revise the AAS in Metals Fabrication in order to be in alignment with the two new CAS programs.

C. Describe what differentiates this program from other, closely related programs at the institution (if appropriate).

Highlands College currently has an AAS in Metals Fabrication. Other than that, there are no other Metals Fabrication/Welding/Machining programs at Highlands College.

D. How does the proposed program serve to advance the strategic goals of the institution?

Highlands College falls under several institutional strategic goals and work plans. First Montana Tech's strategic plan states under the Theme of "Be a National Leader in Educating Undergraduate and Graduate Students" and subtheme "Be Excellent in Instruction and Student Learning," "Use best practices to improve retention and learning." These new CAS programs will increase the number of workforce certificates and it will increase the number of graduates employed full-time in their field.

Additionally, Montana Tech's strategic plan states in the subtheme "Use Assessment Proactively to Improve Teaching and Learning," that measure student achievement against national benchmarks. This new CAS program in welding will do just that with the students having the potential of earning the Mastercam Certification and the NIMS Certification. One of the three strategic areas the Montana Board of Regents is focusing on, for two year institutions, is workforce development. Targets in the area of workforce development are to offer accessible, responsive, student centered learning that facilitates and supports degree completion and decreases time to employment. In addition, programs offered will prepare students for high demand living wage employment. This program hits all those targets and contributes the workforce development goals in the soon to be released Montana Tech comprehensive mission and strategic plan.

E. Describe the relationship between the proposed program and any similar programs within the Montana University System. In cases of substantial duplication, explain the need for the proposed program at an additional institution. Describe any efforts that were made to collaborate with these similar programs; and if no efforts were made, explain why. If articulation or transfer agreements have been developed for the substantially duplicated programs, please include the agreement(s) as part of the documentation.

The establishment of Welding and Machining programs at the majority of the two-year colleges in the state is a testament for the need for these workers at cities throughout the state. Additionally, with the SWAMMEI Grant, the full intent is to have programs around the state which are available to increase the number of students and degree completions.

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This proposal does not radically change what already exists at Highlands College. Instead, it enhances the program by making the credentials stackable from the CAS to the AAS. However, programs around the state include: City College in Billings, Great Falls College, Flathead Valley Community College, Missoula College, Helena College, Dawson Community College and MSU Northern. The proposed program will follow the MUS initiative for common course numbering and inter-campus transferability.

As noted in the previously cited Department of Labor report, which states that both current and future demand for job growth in the machining industries is predicted to increase, this increased demand in all areas of the state and the geographic separation between the campuses, make additional machining programs necessary to fill regional needs.

5. Program Details

A. Provide a detailed description of the proposed curriculum. Where possible, present the information in the form intended to appear in the catalog or other publications. NOTE: In the case of two-year degree programs and certificates of applied science, the curriculum should include enough detail to determine if the characteristics set out in Regents' Policy 301.12 have been met.

The program's curriculum and course descriptions are included in Appendix A.

B. Describe the planned implementation of the proposed program, including estimates of numbers of students at each stage.

New incoming students will have a choice of entering either the Welding Program or the Machining program. Our current program does not allow this. At the completion of either program the student can either enter the workforce immediately or re-enroll in the other program. The implementation plan calls for a program start of the CAS in Machining program in Fall 2015. The number of students admitted to the program the first year is estimated at 15-30. A new, revised version of the AAS in Metals Fabrication will be worked on for a possible rollout in the Fall, 2016 or 2017.

6. Resources
A. Will additional faculty resources be required to implement this program? If yes, please describe the need and indicate the plan for meeting this need.

Yes. Highlands College will hire a full-time Faculty to teach the classes in the Machining Program. The current single faculty member will teach the classes in Welding.

Fortunately, the SWAMMEI Grant will fund the additional faculty member for four years. After that time, Montana Tech/Highlands College will decide whether to institutionalize the position.

B. Are other, additional resources required ensuring the success of the proposed program? If yes, please describe the need and indicate the plan for meeting this need.

Due to the expected increase in expenses for supplies, nominal additional costs are anticipated. The anticipated additional costs will be covered by the fees associated with the program which will be paid by the additional students.

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7. Assessment
How will the success of the program be measured?

The proposed program will be assessed using the following metrics:

1. Graduation/completion rates
2. Student retention
3. Enrollments
4. Certification pass rate
4. Placement in the field
5. Employer satisfaction with graduates

The program's Industrial Advisory Board will review the assessment measures on an annual basis. Student evaluations are another important assessment tool for faculty and administration. Finally, the programs will be assessed by the Montana Tech Assessment Committee.

8. Process Leading to Submission
Describe the process of developing and approving the proposed program. Indicate, where appropriate, involvement by faculty, students, community members, potential employers, accrediting agencies, etc.

The proposed CAS in Machining Technology program was initiated due to student, community and industry demand; however, one of the primary driving factors was the awarding of the SWAMMEI Grant to Montana. The SWAMMEI Grant is providing an opportunity for Highlands College to develop industry driven curricula that will result in, among other things, stackable credentials (CAS to AAS).

The CAS program proposals were first vetted and approved by the Highlands College Trades & Technical Department. Subsequently, the programs were vetted and approved by the Dean of Highlands College and the Montana Tech's Curriculum Review Committee. The Montana Tech Faculty Senate approved this proposal in November. The Provost Office reviewed the program and submitted it to the Board of Regents. Upon approval from the Board of Regents the program proposal will be submitted to the Northwest Commission on Colleges and Universities for review.

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APPENDIX A

CAS in Machining Technology Program

Course Descriptions

First Semester

MCH 268 CNC Machining I
3 credits (Hrs: 3 Lec.)

This course is designed to expose the students to the basics of Computer Numerically Controlled (CNC) programming. Programming will begin at entry level using G-Codes and M-Codes. MDI (Manual Data Input) will be used to generate programs. Fixtures, jigs, and proper tool selection will be covered. Programs will be written and used on a Haas Mini Mill.

MCH 120 Blueprint Reading and Interpretation for Machining
3 credits (Hrs: 3 Lec.)

Blueprint reading covers orthographic projection, line identification, auxiliary and sectional views, dimensioning of drawings, common abbreviations, tolerance, and sketching techniques.

MCH 160 Machine Shop I
3 credits (Hrs: 1 Lec., 4 Lab)

Introduction to machine shop practices. Course covers hand tools, precision measuring tools, taps & dies, layout. Beginning use of drilling machines, lathes, pedestal grinders, drill bit and lathe tool sharpening. Speeds and feed rates. Shop safety and PPE .

MCH 245 Shop Practices
2 credits (Hrs: ongoing)

This is an ongoing semester course during normally scheduled shop hours. It is intended to match students with live, practical shop experiences involving subject matter previously covered in other courses. Emphasis will be on safety and productivity.

MCH 129 Machine Quality Control and Precision Measurements
3 credits(Hrs: 1Lec., 2Lab)

Students will develop the knowledge and skills to prepare them to analyze and evaluate the processes and methodology required in an industrial production environment to determine if quality control standards are being met.
Topics include: use of non-precision measuring tools, use of precision measuring tools, use of comparison gauges, and analysis of measurements

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MCH 230 Tooling and Fixtures Used in CNC
2 credits(Hrs: 2Lec)

Tooling and fixtures used in CNC are discussed in a classroom environment. These topics, for both mill and lathe, will be discussed in order to facilitate the students' ability to select proper work holding devices and cutting tools for various types of machining operations that may be performed. Cutting tool information is one of the most multifaceted areas of study for developing machinists and programmers. Both must be able to discern proper set-ups based on part and tool geometry while providing proper speed and feed data. The use of formulas and reference materials will be studied as a necessary facet of the manufacturing process.

PSYX 100 Introduction to Psychology
3 credits (Hrs: 3 Lec.)

An introductory survey of the scientific study of behavior. This course presents the theory, applications and research findings of modern academic psychology. Both human and non-human species are covered.
Satisfies Social Science core. Course generally offered both semesters.

Or

COMX 115 Interpersonal Communication
3 credits (Hrs: 3 Lec.)

Considers the nature and role of person-to-person communication and influence transactions. Emphasizes the development of knowledge and skills applicable to face-to-face interactions between individuals.

CAS in Machining Technology Program

Course Descriptions

Second Semester

MCH 260 Machine Shop II
3 credits (Hrs: 1 Lec., 4 Lab)

Advanced lathe operations, cutting threads, tapers, and parting tools. Use of milling machines and grinding machines, cutting keyways, precision movements using X,Y,Z, coordinate system, and indexing. **Prerequisite(s):** MCH 160. Course generally offered 1st semester.

MCH 269 CNC Machining II
3 credits (Hrs: 3 Lec.)

This Class is a continuation of MCH 268 CNC Machining I. Master CAM software will be used to generate programs and parts. Fixtures, jigs, and proper tool selection will be covered. Programs will be written,

and then communicated to the Haas Mini Mill. Four axis milling and contouring will be used.
Prerequisite(s): MCH 268 .

MCH 240 Metallurgy
2 credits(Hrs: 2 Lec.)

The student will learn about types of ferrous and nonferrous metals and their applications. Metal numbering systems and the types of heat-treating will also be covered.

MCH 265 Advanced Machining and Manufacturing
4 credits (Hrs: 2 Lec., 4 Lab)

Students will learn advanced lathe and millwork and track costs associated with the manufacturing of the part. Each part will be manufactured to specified tolerances. Quality Assurance records developed by each student will be used to ensure quality control. A team project will be to develop a manufacturing plan for the production of fabricated parts. This will include employee management, time management, cost management, part development, and quality assurance records. The plan will be implemented using local are high school students as employees and a short run production part will be manufactured.

MCH 231 CNC Turning Operations Level 1
3 credits(Hrs: 1 Lec., 2Lab)

This course is an introduction to CNC Turning Centers and the safe operation of common operating procedures, set-up and maintenance of the machine and control panel, which will be discussed and implemented. The student will become acquainted with the ways in which various companies utilize CNC machine tools and personnel while learning methods for the installation of tools, establishing machine, fixture and part zero reference offsets. The students will also be introduced to the methods and reasons behind the modification of these reference offsets and other geometry offsets used to machine parts to demanding geometric tolerances.
Prerequisites: Completion of 1st Semester

MCH 291 Special Topic
1 credits(Hrs: 1Lec.)

This course combines the skills acquired in their program to research and develop a project from its beginning through its completion. Students will use their writing, math and fabrication skills to complete the project.
Prerequisites: Completion of 1st Semester

M 111 Technical Mathematics
3 credits (Hrs: 3 Lec.)

This course presents basic mathematical topics as they are applied in a technical program. Topics covered include percent, ratio proportion, formula evaluation, basic algebra and geometry concepts, trigonometry and measurement are developed and integrated in a technical.

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OR

M 090 Introductory Algebra
4 credits (Hrs: 4 Lec.)

Brief review of fractions and decimals. Beginning algebra concepts including the real number system, algebraic expressions, linear equations, exponents and polynomials, the rectangular coordinate system, and simple factoring. Also, basic geometry, measurement, and problem solving with applications for technical and business fields.

Prerequisite(s): M 061 or Compass score of 45-54. Course generally offered year round.

WRIT 095 Developmental Writing
3 credits (Hrs: 3 Lec.)

Course provides instruction and practice in basic writing skills, emphasizes paragraph development and organization, and reviews sentence structure, word choice, and spelling. Assignments include short pieces, journals, and essays. Mastery of the basics of grammar and mechanics is assumed. Prepares students for College Writing I (WRIT 101). Incoming students not meeting the minimum passing score on placement test are required to enroll in and successfully complete WRIT 095 prior to enrolling in WRIT 101.

OR

WRIT 104 Workplace Communications
3 credits (3 lec/wk)
Designed to teach students the fundamentals of the English language, including grammar, spelling, punctuation, and word usage, with emphasis on applying these skills in written communication for the work world.

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Machining Technology Program
Certificate of Applied Science Degree

Fall Entry Only

Student Name _____ Catalog_____

Student ID _____ PIN _____

Course Number	Course Title	Credits	Semester Completed	Transfer or Waive	Grade
First Semester					
MCH 268	CNC I	3			
MCH 120	Blue print Reading & Interpretation for Machining	3			
MCH 160	Machine Shop I	3			
MCH 245	Shop Practices	2			
MCH 129	Machine Quality Control & Precision Measurement	3			
MCH 230	Tooling & Fixtures Used in CNC	2			
PSYX 100 or COMM 110	Introduction to Psychology or Interpersonal Communications	3 3			
	Credits (Fall)	19			
Second Semester					
MCH 260	Machine Shop II	3			
MCH 269	CNC II	3			
MCH 240	Metallurgy	2			
MCH 265	Advanced Machining & Manufacturing	4			
MCH 231	CNC Turning Operations Level 1	3			
MCH 291	Special Topic	1			
M 111 or M 90	Technical Math or Intro to Algebra	3 3			
WRIT 104 or WRIT 095	Workplace Communications or Developmental Writing	3 3			
	Credits (Spring)	22			
	Total Program Credits	41			