

**BOARD OF HIGHER EDUCATION
REQUEST FOR COMMITTEE AND BOARD ACTION**

COMMITTEE: Academic Affairs

NO: AAC 19-24

COMMITTEE DATE: June 11, 2019

BOARD DATE: June 18, 2019

**APPLICATION OF MOUNT WACHUSETT COMMUNITY COLLEGE TO AWARD THE
ASSOCIATE IN SCIENCE IN MATHEMATICS**

MOVED: The Board of Higher Education hereby approves the application of **Mount Wachusett Community College** to award the **Associate in Science in Mathematics**.

Upon graduating the first class for this program, the College shall submit to the Board a status report addressing its success in reaching program goals as stated in the application and in the areas of enrollment, curriculum, faculty resources, and program effectiveness.

VOTED: Motion approved by AAC 06/11/2019; Motion adopted by the BHE 06/18/2019

Authority: Massachusetts General Laws Chapter 15A, Section 9(b)

Contact: Winifred M. Hagan, Ed.D., Associate Commissioner for Academic Affairs and Student Success

BOARD OF HIGHER EDUCATION
June 2019
Mount Wachusett Community College

INTENT AND MISSION

The Mount Wachusett Community College (MWCC) mission statement includes a commitment to being responsive to the changing needs of communities served, with a focus on preparing and engaging students in challenging learning opportunities.

In the fall of 2016, MWCC's Science, Technology, Engineering and Math (STEM) facilities opened on the Gardner campus. MWCC reports that this has influenced an increase in the number and capabilities of STEM students. The intent of the proposed program is to respond to the many students who have asked for an Associate in Science in Mathematics (AS/Math) program. It is planned that graduates will meet workforce needs in careers areas such as mathematics education, actuarial science, statistics, and operational research analysis. In addition, MWCC intends that the proposed program will address the growth in STEM fields in Massachusetts, including the shortage of secondary-level math teachers for the immediate region. It is further intended that the proposed AS/Math will become a part of the A2B Commonwealth Commitment and ensuring transfer for students to complete a bachelor's degree at a public 4-year college. The proposed AS/Math was also designed to align with MA goals to increase the number of STEM graduates entering the workforce upon completion of their baccalaureate degree.

The proposed program has obtained all necessary governance approvals on campus and was unanimously approved by the Mount Wachusett Community College Board of Trustees on April 12, 2018. The required letter of intent was circulated on March 15, 2018.

NEED AND DEMAND

National and State Labor Market Outlook

MWCC reported that recent labor market projections from Career Coach, O NET, Indeed, and the Bureau of Labor Statistics specifically referenced careers as actuaries, statisticians, operations research analysts, and secondary math teachers as areas of employment with jobs within 50 miles of the Gardner campus. MWCC noted that jobs for statisticians are expected to grow 34 percent from 2016 to 2026, with a Career Coach projection of 148 positions within the 50-mile radius. Jobs for operations research analysts are reportedly projected to grow 27 percent from 2016 to 2026 with 490 jobs predicted in the region. MWCC reports that actuarial jobs are expected to grow 22 percent during the same period with 88 jobs predicted; and secondary school math teaching jobs are expected to grow 8 percent, mostly to replace many retiring teachers. While this degree will not directly address a workforce shortage, it is designed to be a transfer program to four-year institutions and will enable MWCC students to transfer and become members of the workforce with a bachelor's degree.

Student Demand

The AS in Mathematics program started as a concept in tandem with the expansion of upper level engineering options. Many of the same students who were taking Calculus III and

Calculus-Based Physics broached the idea of a mathematics degree for transfer purposes. MWCC found that there are a limited number of A2B transfer opportunities in mathematics and this opportunity would be significant for students planning to transfer. Some of the students making the inquiry were interested in teaching mathematics as a career. As a direct result of student inquiry, MWCC determined that by providing two additional courses in mathematics the program and students would be eligible for participation in MassTransfer. It was also determined that existing faculty have the knowledge and skills required to provide instruction in the 2 new courses.

OVERVIEW OF PROPOSED PROGRAM

MWCC plans that the proposed AS/Math program will leverage the numbers of degree seeking students entering the engineering sciences. Administration and oversight of the proposed AS/Math will be by the School of Business, Science, Technology and Mathematics where all science and mathematics courses are delivered. The Department Chair and Mathematics faculty report to the Division Dean. Existing courses include Introduction to Functions and Modeling, Pre-Calculus, Calculus I through III, Ordinary Differential Equations, and Linear Algebra.

Duplication

Middlesex Community College offers an AA in Mathematics and Greenfield Community College offers a combined degree in Science-Math Education that is part of A2B. The proposed AS/Math program will be unique within a 40-mile radius of the Gardner campus in offering students an opportunity to focus on upper level advanced mathematics courses in preparation for the rigor of a baccalaureate program.

ACADEMIC AND RELATED MATTERS

Admission

MWCC's partnerships with area PK-12 schools are expected to serve as a feeder to the proposed program through the Math Modeling project. Established in AY14, the Math Modeling Program provides high school math educators with the curriculum used by MWCC's Mathematics Department. This classroom-based approach has resulted in the alignment of curriculum between high school and college educators to better address readiness issues of the pedagogy and content of mathematics instruction, and of student learning and knowledge of mathematics in preparing for a math major. The program serves approximately 365 students in eight area high schools annually and is expected to prepare students for the proposed program. Data on the Math Modeling cohorts is tracked annually by MWCC. In addition, the Gateway to College initiative and Pathways Program, specific dual enrollment programs, are planned as feeders to the proposed AS in Mathematics.

It is planned that the new AS/Math will require students to enter the program at the level of Calculus I. MWCC plans that any student who is eligible to take Calculus I, regardless of age, will be eligible to enter the program. MWCC also plans to offer summer classes to assist students who are not yet eligible for calculus 1 but want to obtain an AS in math. They will be supported with tutoring as well as a co-requisite strategy included within the Statistics and

Introduction to Functions and Modeling courses. It is also expected that the TRiO Visions program will assist any students in all disciplines, including Mathematics.

Program Enrollment

	Year 1	Year 2	Year 3	Year 4
New Full Time	5	5	5	5
Continuing Full Time	0	5	5	5
New Part Time	3	3	3	3
Continuing Part Time	0	3	3	3
Totals	8	16	16	16

Curriculum (Attachment A)

MWCC plans that the curriculum will prepare students beyond the MA 28 credit STEM-Transfer Core, by enabling students to develop mathematical critical thinking skills that promote mastery of complex formulations and the ability to propose alternative pathways to solve specific problems.

Internships and Field Studies

MWCC 's Brewer Center for Civic Learning and Community Engagement offers service learning and internships in all disciplines and it is expected that the proposed math program will be integrated with it. It is also planned that the new STEM Starter Academy Summer Bridges partnership with Fitchburg State University will offer research opportunities for students.

RESOURCES AND BUDGET

Budget (Attachment B)

Faculty and Administration (Attachment C)

No additional faculty or changes to facilities are anticipated for the proposed program as MWCC expects to utilize existing faculty and teaching space. The courses required for this degree have been developed and approved through internal governance and no additional courses,

resources, or teaching staff are planned. The program will reside within the School of Business, Science, Technology and Mathematics under the supervision of the Dean and Assistant Dean of Business, Science, Technology and Mathematics, who report directly to MWCC's Vice President of Academic and Student Affairs.

Facilities, Library and Information Technologies

The LaChance library at MWCC is fully staffed and supported by a head librarian, two reference librarians and administrative support. Faculty and students will have full access to databases including EBSCO, CINAHL, Health Reference Center and other reference materials online or at the Gardner Campus. The software license for Mathematica was purchased for engineering majors and will need to be renewed each year for \$5300.00 plus \$1558.82 to cover the cost of additional math students in the proposed program.

Affiliations and Partnerships

MWCC reports that it has robust partnerships with area PK-12 schools, including the Math Modeling project, Gateway to College initiative and Pathways programs mentioned above in the Admissions section of this motion.

PROGRAM EFFECTIVENESS

Goal	Measurable Objective	Strategy for Achievement	Timetable
Students who successfully complete AS in Mathematics degree will transfer to baccalaureate institutions to complete their studies in mathematics	75% of the students successfully transfer post AS degree to complete their studies	Academic support/professional tutoring Intrusive advising Weekly communication with Mathematics Department Chair	incoming Sept. 2019 incoming Sept 2020 incoming Sept 2021
MWCC AS in Mathematics will be recognized and accepted for transfer by 4-year baccalaureate institutions	MWCC AS in Mathematics degree is accepted by 4 or more baccalaureate institutions for the purposes of transfer/articulation	Strict adherence to the A2B pathways for Mass Transfer in mathematics Establish articulation agreements with private and out-of-state institutions	Annual program reports required institutionally 5-year review of all programs required institutionally
Students in the AS in Mathematics degree are retained and gain the knowledge to continue in the program	75% of students in the AS in Mathematics program are retained	Program learning outcomes evaluated at the end of year 1 and year 2 Advisory board formed consisting of 1 high school math educator, 1 baccalaureate math educator, and 1 MWCC math/engineering alumnus	Monitored annually
Students who complete the AS in Mathematics degree will demonstrate proficiency in mathematical reasoning	75% of the students will be eligible to undertake the capstone presentation in mathematics using discussion, seminars, research papers, assessments, projects	Students will recognize math applications in real world problems Students will illustrate the process of making real world problems precise Students will show synthesis of ideas across the math curriculum	May 2020 May 2021 May 2022

EXTERNAL REVIEW AND INSTITUTIONAL RESPONSE

The proposed program was reviewed by Dr. Michael Cullinane, Ph.D., Professor and Chair of the Mathematics department, Keene State College in NH and Dr. Michael Winders, Ph.D., Professor and Chair of the Mathematics department, Worcester State University in Massachusetts.

The review team noted that students who graduate from MWCC with an AS in Mathematics and transfer to a four-year institution in order to complete a bachelor's degree will experience significant cost savings. The reviewers indicated that this is a critical factor for many underserved students as it provides access to a four-year mathematics degree. The review team also noted that the course requirements of an undergraduate mathematics major are remarkably similar across four-year colleges and universities in the United States and that the proposed program includes all these requirements. The team emphasized that the Mathematical Association of America has general agreement on content that should be part of the first two years of study in an undergraduate mathematics major and that the proposed program aligns well with this content. They found each of the required courses to have clearly articulated student learning outcomes, consistent with what students are expected to achieve. These learning outcomes address knowledge, methods, theory, and application. Dr. Winders noted that graduates of the proposed program transferring into Worcester State's mathematics major would be ready and able to choose from four concentrations: Statistics and Modeling, Secondary Education, Actuarial Studies, and Traditional. The reviewers further underscored the expectation that students will be using the software Mathematica to develop skill at learning and doing mathematics using technology, as an important capability for careers in mathematics, statistics and data analytics, actuarial science, and operations research. The reviewers suggested that in addition to course outcomes, faculty consider developing four to six overall program learning outcomes for which students would demonstrate proficiency.

MWCC responded in agreement with the external review report and is considering adjustments to the capstone content to include high-level program learning proficiencies.

STAFF ANALYSIS AND RECOMMENDATION

Staff thoroughly reviewed all documentation submitted by **Mount Wachusett Community College** and the external reviewers. Staff recommendation is for approval of the proposed **Associate in Science in Mathematics** program.

ATTACHMENT A: CURRICULUM

Required (Core) Courses in the Major (Total # courses required = 7)		
<i>Course Number</i>	<i>Course Title</i>	<i>Credit Hours</i>
MAT 211	Calculus I	4
MAT 212	Calculus II	4
MAT 213	Calculus III	4
MAT 220	Linear Algebra	4
MAT 230	Ordinary Differential Equations	4
PHY 120	Calculus-Based Physics I	4
PHY 121	Calculus-Based Physics II	4
	<i>Sub Total Required Credits</i>	28
Elective Courses (Total # courses required =4)		
ENG 101	College Writing, I	3
ENG 102	College Writing II	3
CIS 109	Introduction to Programming	3
CIS 290	Java I	3
	<i>Sub Total Elective Credits</i>	12
<i>Distribution of General Education Requirements</i>		<i># of Gen Ed Credits</i>
Attach List of General Education Offerings (Course Numbers, Titles, and Credits)		
Arts and Humanities, including Literature and Foreign Languages		9
Mathematics and the Natural and Physical Sciences		8
Social Sciences		6
<i>Sub Total General Education Credits</i>		23
<i>Curriculum Summary</i>		
Total number of courses required for the degree		17
Total credit hours required for degree		63

ATTACHMENT B: BUDGET

MWCC expects that no new faculty nor start-up costs will be required for the proposed program. Rather, it is intended that the proposed program will leverage existing resources within the institution. Annual full-time salaries calculated based on 2% annual increase. MWCC plans the math faculty full-time teaching will be for 8 courses per year. The cost of the Mathematica License at \$5300 for 34 users is planned as well.

<i>One Time / Start-Up Costs</i>	<i>Annual Expenses</i>				
<i>Cost Categories</i>		Year 1 AY20	Year 2 AY21	Year 3 AY22	Year 4 AY23
PERSONNEL / STAFF					
MAT211 and MAT212 2/8 full-time workload or 25%. 30% of the students are math majors.		\$4,662.06			
MAT211, 212, 220, 213 and 230: 5/8 full time workload or 63%. 30% of the students are math majors.			\$11,983.37	\$12,223.03	\$12,467.49
SUB TOTAL		\$4,662.06	\$11,983.37	\$12,223.03	\$12,467.49
Instructional Materials, Library Acquisitions					
Additional Mathematica Licenses		\$779.41	\$1,558.82	\$1,558.82	\$1,558.82
Facilities, clinical sites, marketing, other					
Marketing / Printing		0	0	0	0
	TOTAL	\$5,441.47	\$13,542.19	\$13,781.86	\$14,026.32

One Time / Start-Up Support	<i>Revenues</i>	<i>Annual Income</i>			
	<i>Revenue Sources</i>	Year 1/AY20 5 Full Time 3 Part Time	Year 2/AY21 10 Full Time 6 Part Time	Year 3/AY22 10 Full Time 6 Part Time	Year 4/AY23 10 Full Time 6 Part Time
	Tuition: \$25.00 per credit hour	\$1,600.00	\$4,000.00	\$4,000.00	\$4,000.00
	Fees: \$192 PER CREDIT	\$12,288.00	\$30,720.00	\$30,720.00	\$30,720.00
	TOTALS	\$13,888.00	\$34,720.00	\$34,720.00	\$34,720.00

ATTACHMENT C: FACULTY

Summary of Faculty Who Will Teach in Proposed Program							
Name of faculty member (Name, Degree and Field, Title)	Check if Tenured	(C) to indicate core course (OL) course currently taught online.	Number of sections	Division of College of Employment	Full- or Part- time in Program	Full- or part-time in other department or program	Sites where individual will teach program courses
Case, Shawn M.S. in Mathematics, Associate Professor	<input type="checkbox"/>	<ul style="list-style-type: none"> • Ordinary Differential Equations (C) • Calculus 1 (C, OL) • Calculus 2 (C) 	(1) (5) (3)	Day	Full-Time	No	• Main Campus
Thomas Valletta, M.S. in Mathematics Assistant Professor	<input type="checkbox"/>	<ul style="list-style-type: none"> • Calculus 1(C, OL) • Linear Algebra 	(1) (1)	Day	Full-Time	No	<ul style="list-style-type: none"> • Main Campus • Web
Kiprono, Festus, M.S. in Associate Professor	<input checked="" type="checkbox"/>	<ul style="list-style-type: none"> • Calculus 2 (C) • Calculus 3 (C) 	(3) (1)	Day	Full-Time	No	• Main Campus
Ramakanth Ananthoji, PhD in Polymer Chemistry, M.S. in Mathematics,Assistant Professor		<ul style="list-style-type: none"> • Linear Algebra (C) • Calculus 1 (C) 	(1) (1)	Day	Full-Time	Yes, Chemistry	<ul style="list-style-type: none"> • Main Campus • Web
Olszak, Peter, Ph.D in Optical Physics,Associate Professor	<input type="checkbox"/>	<ul style="list-style-type: none"> • Calculus 2 (C) • Calculus 3 (C) • Calc.Physics 1 • Calc Physics 2 	(1) (2) (5) (5)	Day	Full-Time	Yes, Pre-Engineering and Physics	• Main Campus