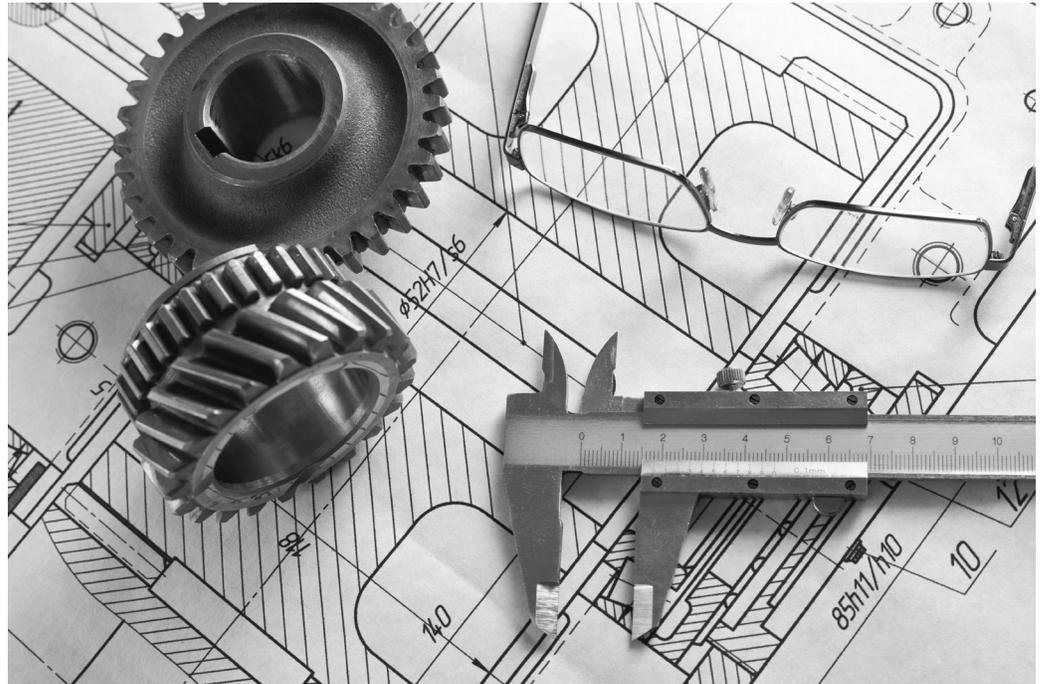


Education & Training Opportunities for Advanced Manufacturing at Higher Education and Vocational Schools in SE Massachusetts



A project of the
Institute for Policy and Regional Engagement
Bridgewater State University

In collaboration with
Brockton Area Workforce Investment Board

Brockton Area Workforce
BAWIB
Investment Board



Southeastern Massachusetts is rich in the breadth of occupations and opportunities available in advanced manufacturing that provides residents with a career pathway and a sustainable living. The Brockton Area Workforce Investment Board (BAWIB), in collaboration with our industry and educational partners, is preparing for both pipeline and incumbent workers by responding to demands in the workforce through occupational education and training opportunities. This report will give stakeholders an overview of the education and training offerings in southeastern MA relevant to advanced manufacturing, providing them with additional tools for the retention and growth of their employees and their business. With the diverse occupations that compose manufacturing, this industry can experience growth by advancing the skills of the workforce and implementing current technology and strategies. Developed in partnership with Bridgewater State University, this report will provide the data necessary to deliver training programs in high demand occupations that can produce positive economic benefits for our region.

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For many years, Advanced Manufacturing has been at the forefront of creating jobs in Southeastern Massachusetts and played a vital role in stimulating the economy. Business owners in the region have voiced their concerns and difficulties in finding qualified, skilled workers who have been trained to manufacture goods and services. We hear those concerns and are excited to collaborate with Bridgewater State University's Management Department and the Brockton Area Workforce Investment Board to identify the gap between employer needs and training programs currently offered.

It has always been our goal at Bridgewater State University to educate and prepare our students so that they will be ready to enter the workforce immediately upon graduation. Bridgewater State University is willing and able to work with our partners; local businesses, regional planning agencies, chambers of commerce and regional workforce development boards. In collaboration with our partners, we have been able to research, develop and lead the implementation of a strategy to enhance the workforce, in the case of this report on advanced manufacturing, in order to revitalize the cities and towns in Southeastern Massachusetts.



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Bridgewater State University Acknowledgements

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This report has been supported by the Sector Partnership National Emergency Grants, Administered by the Commonwealth Corporation.



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Executive Summary

In a collaborative effort, Bridgewater State University's Institute for Policy Analysis and Regional Engagement (IPARE); Ricciardi's College of Business' Management Department; and the Brockton Area Workforce Investment Board united to identify the gap between employer needs for Advanced Manufacturing hiring, and the training available for developing the regional workforce in this specific area. This included an examination of the programs, curriculum, and certificates that are being offered at colleges, universities and vocational technical schools that relate to Advanced Manufacturing.

The information provided in this report focuses on the current programs and certificates that are relevant to Advanced Manufacturing within the Higher Education and vocational technical schools in the Southeast region of Massachusetts.

Advanced Manufacturing plays a significant role in the Southeast regional economy of Massachusetts. With nearly 30,000 employees and over 1,000 businesses in 2012, the Southeast region's Advanced Manufacturing sector is the third largest in the Commonwealth. Dr. Henry Renski and Ryan Wallace, researchers from the University of Massachusetts Amherst, undertook an investigation producing a series of detailed examinations of Advanced Manufacturing, each focusing on different areas of the Commonwealth. In their report, they divided the Advanced Manufacturing field in the Southeast region into six subsectors defined as Chemical and Plastics, Computers and Electronic Products, Fabricated Metal & Machinery, Food Processing and Production, Medical Equipment and Supplies, and Paper and Printing.

This report provides tables and charts incorporating the programs and certificates that were identified in the colleges, universities, and vocational schools with the six subsectors to identify the capacity of offered programs and certificates relevant to each defined Advanced Manufacturing subsector. The programs and certificates highlighted in the tables were collected through secondary data online. We found an extensive number of programs and certificates within the Higher Education institutions identifying with the Computers and Electronics products subsector; with the least in the Food Processing and Production subsector. We also found predominant programs in the vocational technical schools tailoring to more of the occupations found in the Fabricated Metal and Machinery, and Medical Equipment and Supplies subsector.

How to Use the Report:

Readers may utilize the data provided in this report to facilitate or guide their own decision-making, collaboration, and dialogue. Designed for multiple stakeholders; Employers, Jobseekers and Educators, that data contained within will provide information on the types of education and training that is available in our region and how to access it. We request that you simply reference the source of the data, including the specific sources of data listed with individual tables and charts. Completed in December 2016, please contact the individual institutions for details on the current schedules.

Current Curriculum Settings Relevant to Advanced Manufacturing in Community Colleges & Universities in the Southeast Region

Table 1-a & 1-b report the curriculum settings relevant to the Advanced Manufacturing sub-sectors that were identified in the community colleges, and state universities located within Southeastern Massachusetts. Programs and certificates that are in a particular subsector have a level of association with the occupations found in that subsector.

Table 1-a
The Curriculum Settings Relevant to Advanced Manufacturing

Advanced Manufacturing Subsector Definitions	Massasoit Community College	Higher Education Institutions		
		Bristol Community College	Cape Cod Community College	Massachusetts Maritime Academy
Chemicals & Plastics (Including Pharmaceuticals)	-Architectural Technology -Biotechnology Certificate -Engineering Transfer Program	-Architectural and Structural Technology -Biotechnology/Biomedical -Biomanufacturing Technology Transfer -Biomanufacturing Technology -Biotechnology Certificate -CNC Machining and Programming Certificate	-Engineering Technology	
Computers & Electronic	-Architectural Technology -Computer Technology: Programming Option -Computer Repair & Maintenance Cert. -Engineering Transfer Program -Electronic Circuit Technology	-Architectural and Structural Technology -Automation Technology Concentration -Computer Programming Concentration/Certificate -Computer-Aided Design and Drafting Certificate -Computer-Aided Design and Mfg. (CAD/CAM) -CNC Machining and Programming Certificate -Electrical Technology with Solar Energy -Electro-Mechanical with Green Energy Technology -Solar Energy Certificate	-Computer Science: Programming Concentration -Engineering Technology -Information Technology -Green Design & Engineering	

Advanced Manufacturing Subsector Definitions	Massasoit Community College	Higher Education Institutions		
		Bristol Community College	Cape Cod Community College	Massachusetts Maritime Academy
Fabricated Metal Products & Machinery	-Architectural Technology -Engineering Transfer Program -HVAC Technology	-Architectural and Structural Technology -Automation Technology Concentration -Mechanical Technology with Wind Power -CNC Machining and Programming Certificate	-Engineering Technology Certificate -Robotics & Manufacturing -Automation Certificate	
Food Processing & Production	-Culinary Arts -Food Production -Pastry	-Automation Technology Concentration -Culinary Arts	-Culinary Arts	
Medical Equipment & Supplies	-Architectural Technology -Biotechnology Cert.	-Architectural and Structural Technology -Automation Technology Concentration -Computer-Aided Design and Mfg. (CAD/CAM) Certificate -CNC Machining and Programming Certificate	-Engineering Technology -Automation Certificate	
Paper & Printing	-Engineering Transfer Program	-Fine Arts -Graphic Design	-Graphic Design	
Other			-Hazardous Materials Mgmt. & Waste Tech.	-Facilities Engineering

Source: Found on the online platforms of the institutions listed in the table, author's summarization

Table1-b

Advanced Manufacturing Subsector Definitions	Higher Education Institutions				
	Bridgewater State University	UMass Dartmouth	Quincy College	Stonehill College	Wheaton College
Chemicals & Plastics (Including Pharmaceuticals)	-Biochemistry -Chemistry	-Biochemistry Bioengineering -Biotechnology -Chemistry	Biotechnology and Compliance Certificate -Engineering Technician	-Biochemistry -Chemistry -Chemistry & Chemical Engineering	-Biochemistry -Chemistry
Computers & Electronics Products	-Computer Science	-Electrical and Computer Engineering -Computer and Information Science -Industrial & Systems Engineering -Software Engineering	-Computer Science: Programming -Engineering Technician	-Computer Science -Computer Science & Computer Engineering -Physics & Electrical Engineering -Physics & Mechanical Engineering	-Computer Science -Mathematics & Computer Science
Fabricated Metal Products & Machinery		-Electrical and Computer Engineering -Mechanical Engineering: Manufacturing Concentration -Industrial & Systems Engineering	-Engineering Technician	-Physics & Electrical Engineering -Physics & Mechanical Engineering	
Food Processing & Production		-Mechanical Engineering: Manufacturing Concentration		-Physics & Mechanical Engineering	

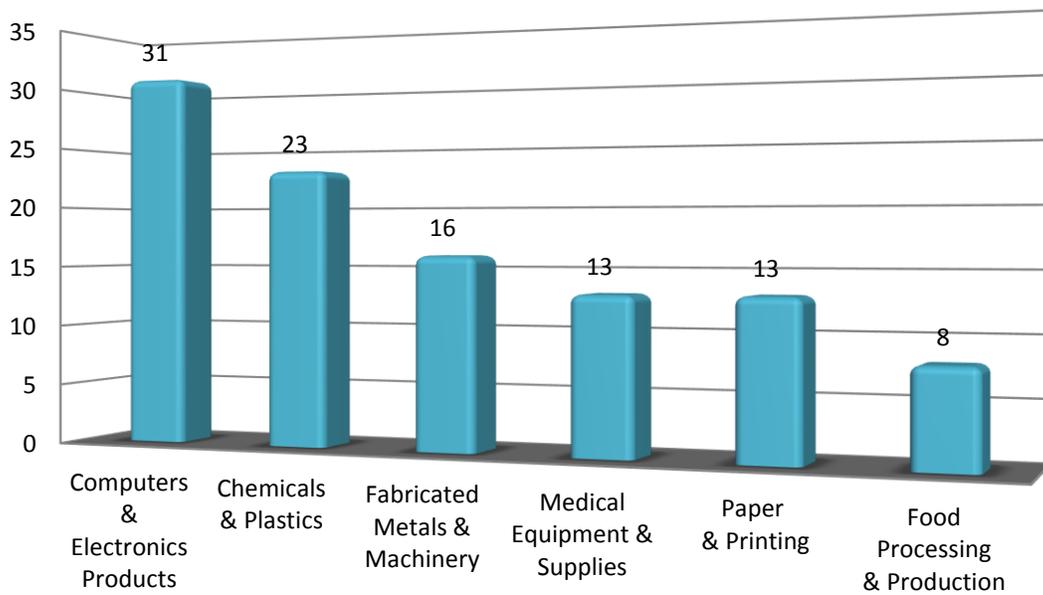
Advanced Manufacturing Subsector Definitions	Higher Education Institutions				
	Bridgewater State University	UMass Dartmouth	Quincy College	Stonehill College	Wheaton College
Medical Equipment & Supplies		-Electrical and Computer Engineering -Mechanical Engineering: Manufacturing Concentration -Industrial & Systems Engineering		-Physics & Electrical Engineering -Physics & Mechanical Engineering	
Paper & Printing	-Fine Arts -Graphic Design	-Industrial & Systems Engineering -Fine Arts -Graphic Design -Printing/2D Studies	-Engineering Technician -Fine Arts	-Graphic Design	
Other	-Operations Mgmt.	-Operations Mgmt: Supply Chain Mgmt. Concentration			

Source: Found on the online platforms of the institutions listed in the table, author's summarization

The term advanced manufacturing is used to broadly describe a major segment of Massachusetts' economy that encompasses an array of industry specific sub-sectors. These include Chemicals and Plastics (Including Pharmaceuticals), Computer and Electronic Products, Fabricated Metal Products and Machinery, Food Processing and Production, Medical Equipment and Supplies, and Paper and Printing. Referencing the academic catalogs of the higher education institutions within the borders of Southeastern Massachusetts, programs and certificates relevant to the key occupations found in these subsectors of advanced manufacturing were highlighted. The results of our findings are depicted in chart-1.

Chart 1

Summary of Higher Ed Curriculum Settings Related to Advanced Manufacturing Careers



Source: author's summarization

Computers and Electronics Products

The program concentrations and certificates listed under the Computers and the Electronics Products subsector have the highest number of programs relative to all the subsectors identified to have relevance to Advanced Manufacturing in the Southeast region (Chart 1). We comprised about thirty-one (31) program concentrations and certificates relative to the occupations found in this subsector from the colleges and universities in the Southeast area. The skill requirements in this subsector are the highest and most diverse of the six sub-sectors. A much higher percentage of the jobs are in computer & mathematical and architectural & engineering occupations (Renski and Wallace, 2014).

Table 2

Summary of Key Occupations in Computers and Electronics Products, 2012

SOC	Occupational Title
51-2092	Team Assemblers
51-1011	First-Line Supervisors of Production and Operating Workers
51-4041	Machinists
51-9061	Inspectors, Testers, Sorters, Samplers, and Weighers
17-2141	Mechanical Engineers
51-2022	Electrical and Electronic Equipment Assemblers
15-1132	Software Developers, Applications
11-9041	Architectural and Engineering Managers
11-3051	Industrial Production Managers
17-2112	Industrial Engineers
17-3023	Electrical and Electronics Engineering Technicians
15-1133	Software Developers, Systems Software
51-4011	Computer-Controlled Machine Tool Operators, Metal and Plastic
17-2071	Electrical Engineers
17-3026	Industrial Engineering Technicians

Source: Renski and Wallace 2014. Abridged by author.

Table 2 reports the key occupations in the Computers and Electronics Products sector reported by Renski and Wallace: *A Profile of Advanced Manufacturing in the Commonwealth: Key Industry and Occupational Trends (July 2014)* that we used in analyzing the relevance of the programs listed under this subsector.



Chemicals and Plastics

Our study showed that the educational programs in the community colleges and universities in Southeastern Massachusetts area have a relatively large number of programs and certifications relative to the occupations found in the Chemical and Plastics sub-sector. We found twenty-three (23) courses and certification programs relevant to this subsector (Chart 1). Many of the programs and certifications listed under this subsector were highly specialized to this subsector, including programs such as biochemistry, bioengineering, biotechnology, and chemical engineering. According to Renski and Wallace (2014), this subsector is dominated by science and engineering related occupations.

With that, there were also programs we found that shared core crossover knowledge based requirements relative to this subsector, namely operations management and engineering technology programs and certifications. **Appendix A** provides information concentrating on the program concentrations and certifications that were identified in the community colleges and universities.

Table 3

Summary of Key Occupations in Chemical and Plastics, 2012

SOC	Occupational Title
51-1011	First-Line Supervisors of Production and Operating Workers
51-9111	Packaging and Filling Machine Operators and Tenders
51-9061	Inspectors, Testers, Sorters, Samplers, and Weighers
51-9198	Helpers--Production Workers
11-3051	Industrial Production Managers
49-9041	Industrial Machinery Mechanics
17-2112	Industrial Engineers
51-4021	Extruding and Drawing Machine Setters, Operators, and Tenders, Metal and Plastic
17-3026	Industrial Engineering Technicians
51-4072	Molding, Coremaking, and Casting Machine Setters, Operators, and Tenders, Metal and Plastic
51-4111	Tool and Die Makers
51-9023	Mixing and Blending Machine Setters, Operators, and Tenders
17-2031	Biomedical Engineers
19-4031	Chemical Technicians
51-9041	Extruding, Forming, Pressing, and Compacting Machine Setters, Operators, and Tenders

Source: Renski and Wallace 2014. Abridged by author.

Table 3 shows the key occupations in the Chemicals and Plastics sector reported by Renski and Wallace: *A Profile of Advanced Manufacturing in the Commonwealth: Key Industry and Occupational Trends (July 2014)* that we used in analyzing the relevance of the programs listed under this subsector.

Fabricated Metal Products & Machinery

Our analysis showed that this subsector has the third highest number of program concentrations and certifications relative to all the subsectors at about sixteen (16) identified in the colleges and universities in the Southeast region (Chart 1). According to Renski and Wallace (2014), jobs in this sector are heavily oriented to machining and tool operator occupations, therefore the programs we listed under this subsector are relative to occupations in the machining and tool operator occupations.

Table 4

Summary of Key Occupations in the Fabricated Metal Products & Machinery, 2012

<u>SOC</u>	<u>Occupational Title</u>
51-2092	Team Assemblers
51-1011	First-Line Supervisors of Production and Operating Workers
51-4041	Machinists
51-9061	Inspectors, Testers, Sorters, Samplers, and Weighers
51-9198	Helpers--Production Workers
17-2141	Mechanical Engineers
11-9041	Architectural and Engineering Managers
51-4121	Welders, Cutters, Solderers, and Brazers
11-3051	Industrial Production Managers
49-9041	Industrial Machinery Mechanics
17-2112	Industrial Engineers
51-2041	Structural Metal Fabricators and Fitters
51-4011	Computer-Controlled Machine Tool Operators, Metal and Plastic
51-4031	Cutting, Punching, and Press Machine Setters, Operators, and Tenders, Metal and Plastic
51-4081	Multiple Machine Tool Setters, Operators, and Tenders, Metal and Plastic

Source: Renski and Wallace 2014. Abridged by author.

Table 4 shows the key occupations in the Fabricated Metals and Machinery sector reported by Renski and Wallace: *A Profile of Advanced Manufacturing in the Commonwealth: Key Industry and Occupational Trends (July 2014)* that we used in analyzing the relevance of the programs listed under this subsector.



Medical Equipment and Supplies

We identified about thirteen (13) programs and certifications that were relative to this subsector in our analysis. This sub-sector shares some core occupations with the fabricated metals and machinery sub-sector such as engineers, machinists, and other types of machine operators (Renski and Wallace, 2014), and as such, we analyzed the relevance of the programs identified in the higher education institutions based on their relativity to the key occupations found under this subsector.

Table 5

Summary of Key Occupations in Medical Equipment and Supplies, 2012

<u>SOC</u>	<u>Occupational Title</u>
51-2092	Team Assemblers
51-4041	Machinists
51-6031	Sewing Machine Operators
17-2141	Mechanical Engineers
11-9041	Architectural and Engineering Managers
11-3051	Industrial Production Managers
17-2112	Industrial Engineers
51-9199	Production Workers, All Other
51-4011	Computer-Controlled Machine Tool Operators, Metal and Plastic
51-4081	Multiple Machine Tool Setters, Operators, and Tenders, Metal and Plastic
51-4033	Grinding, Lapping, Polishing, and Buffing Machine Tool Setters, Operators, and Tenders, Metal and Plastic
51-4111	Tool and Die Makers
51-2023	Electromechanical Equipment Assemblers
51-9032	Cutting and Slicing Machine Setters, Operators, and Tenders
17-2031	Biomedical Engineers
51-4122	Welding, Soldering, and Brazing Machine Setters, Operators, and Tenders

Source: Renski and Wallace 2014. Abridged by author.

Table 5 shows the key occupations in Medical Equipment and Supplies sector reported by Renski and Wallace: *A Profile of Advanced Manufacturing in the Commonwealth: Key Industry and Occupational Trends July (2014)* that we used in analyzing the relevance of the programs listed under this subsector.

Paper and Printing

On average, the skill levels required for employment in this sector are relatively low with a few exceptions (Renski and Wallace, 2014). Thirteen (13) programs and certifications were identified after our examination. Table 6 shows the key occupations in the Paper and Printing sector reported by Renski and Wallace: *A Profile of Advanced Manufacturing in the Commonwealth: Key Industry and Occupational Trends July (2014)* that we used in analyzing the relevance of the programs listed under this subsector.

Table 6

Summary of Key Occupations in Paper and Printing, 2012

SOC	Occupational Title
51-1011	First-Line Supervisors of Production and Operating Workers
51-9198	Helpers--Production Workers
51-5112	Printing Press Operators
11-3051	Industrial Production Managers
51-9199	Production Workers, All Other
51-5113	Print Binding and Finishing Workers
51-4031	Cutting, Punching, and Press Machine Setters, Operators, and Tenders, Metal and Plastic
51-9121	Coating, Painting, and Spraying Machine Setters, Operators, and Tenders
51-4111	Tool and Die Makers
51-9032	Cutting and Slicing Machine Setters, Operators, and Tenders
53-7063	Machine Feeders and Offbearers
51-5111	Prepress Technicians and Workers
51-9196	Paper Goods Machine Setters, Operators, and Tenders
51-9031	Cutters and Trimmers, Hand

Source: Renski and Wallace 2014. Abridged by author



Food Processing and Production

This subsector has the least identified programs relative to all the other subsectors in our analysis. Many of the core occupations involve industrial food preparing and processing. The Food Processing and Production has few high-level skill requirements and is more characteristic of more traditional forms of low-skilled, routine forms of production (Renski and Wallace, 2014). We were able to identify about eight (8) programs and certifications from our analysis.

Table 7

Summary of Key Occupations in the Food Processing and Production, 2012

SOC	Occupational Title
51-2092	Team Assemblers
51-1011	First-Line Supervisors of Production and Operating Workers
51-9111	Packaging and Filling Machine Operators and Tenders
53-7064	Packers and Packagers, Hand
53-3031	Driver/Sales Workers
51-9198	Helpers--Production Workers
51-3011	Bakers
49-9041	Industrial Machinery Mechanics
51-3092	Food Batchmakers
51-3022	Meat, Poultry, and Fish Cutters and Trimmers
51-3099	Food Processing Workers, All Other
51-9192	Cleaning, Washing, and Metal Pickling Equipment Operators and Tenders
51-3093	Food Cooking Machine Operators and Tenders

Source: Renski and Wallace 2014. Abridged by author

Table 7 shows the key occupations in the Food and Processing and Production sector reported by Renski and Wallace: *A Profile of Advanced Manufacturing in the Commonwealth: Key Industry and Occupational Trends (July 2014)* that we used in analyzing the relevance of the programs listed under this subsector.



Current Curriculum Settings Relevant to Advanced Manufacturing in the Vocational Technical Schools in the Southeast Region

Table 2-a & 2-b report the curriculum settings relevant to the Advanced Manufacturing sub-sectors that were identified in the Vocational Technical schools in the Southeast region of Massachusetts. All the programs listed under each subsector are Chapter 74 approved. Chapter 74-approved vocational technical education programs are programs that meet the definition of vocational technical education contained in Massachusetts General Law Chapter 74, and are approved by the Department of Elementary and Secondary Education pursuant to Chapter 74 and the Vocational Technical Education Regulations.

Table 2-a
Current Curriculums Relevant to Advanced Manufacturing in Vocational Technical Schools

Advanced Manufacturing Subsector Definitions	Vocational Technical Schools			
	Bristol-Plymouth Regional Vocational Technical	Cape Cod Regional Vocational Technical	Greater Fall River Regional Vocational Technical	Greater New Bedford Regional Vocational Technical
Chemicals and Plastics (Including Pharmaceutical)	-Biotechnology	-Engineering Technology		-Engineering Technology
Computers and Electronic	-Drafting -Electricity	-Electricity -Engineering Technology	-Drafting -Electricity -Electronics	-Engineering Technology
Fabricated Metal Products & Machinery	-Drafting -Electricity -HVAC -Machine Tool Technology -Metal Fabrication & Joining Technologies	-Electricity -Engineering Technology -HVAC -Metal Fabrication & Joining Technologies	-Drafting -Electricity -Electronics -HVAC -Machine Tool Technology -Metal Fabrication & Joining Technologies	-Drafting -Electrical Technology -Engineering Technology -HVAC -Metal Fabrication & Joining Technologies -Stationary Engineering
Food Processing and Production	-Culinary Arts	-Culinary Arts	-Culinary Arts	-Culinary Arts

Advanced Manufacturing Subsector Definitions	Vocational Technical Schools			
	Bristol-Plymouth Regional Vocational Technical	Cape Cod Regional Vocational Technical	Greater Fall River Regional Vocational Technical	Greater New Bedford Regional Vocational Technical
Medical Equipment and Supplies	-Electricity -Machine Tool Technology	-Electricity -Engineering Technology	-Electricity -Electronics -Machine Tool Technology	-Electrical Technology -Engineering Technology -Stationary Engineering
Paper and Printing	-Design & Visual Communications -Graphic Communications	-Graphic Communications	-Graphic Communications	-Design & Visual Communications

Source: Massachusetts Department of Elementary and Secondary Education (ESE), author's summarization



Table 2-b

Current Curriculums Relevant to Advanced Manufacturing in Vocational Technical Schools

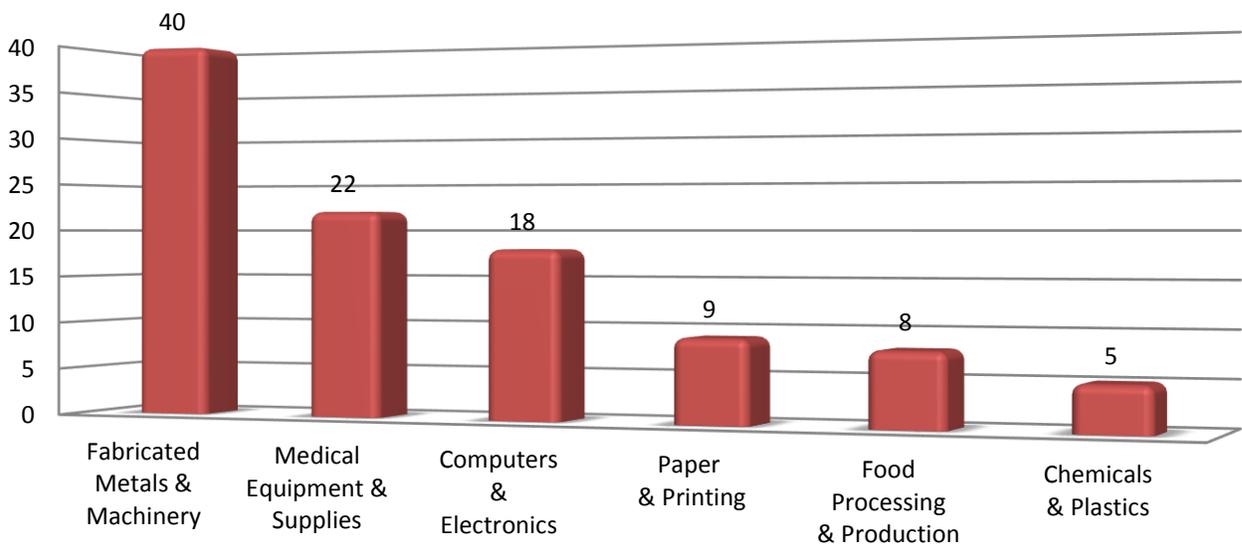
Advanced Manufacturing Subsector Definitions	Vocational Technical Schools			
	Old Colony Regional Vocational Technical	Southeastern Regional Vocational Technical	South Shore Regional Vocational Technical	Upper Cape Cod Regional Vocational Technical
Chemicals and Plastics (Including Pharmaceutical)		-Engineering Technology		-Engineering Technology
Computers and Electronic	-Drafting -Electricity -Electronics	-Electricity -Engineering Technology	-Drafting -Electricity -Electronics	-Electricity -Engineering Technology
Fabricated Metal Products & Machinery	-Drafting -Electricity -Electronics -Machine Tool Technology -Metal Fabrication & Joining Technologies	-Electricity -Engineering Technology -HVAC -Machine Tool Technology -Metal Fabrication & Joining Technologies	-Drafting -Electricity -Electronics -HVAC -Machine Tool Technology -Metal Fabrication & Welding -Precision Machine Technology	-Electricity -Engineering Technology
Food Processing and Production	-Culinary Arts	-Culinary Arts	-Culinary Arts	-Culinary Arts
Medical Equipment and Supplies	-Electricity -Electronics -Machine Tool Technology	-Electricity -Engineering Technology -Machine Tool Technology	-Electricity -Electronics -Machine Tool Technology -Precision Machine Technology	-Electricity -Engineering Technology
Paper and Printing	-Graphic Communications	-Design & Visual Communications -Graphic Communications	-Graphic Communications	

Source: Massachusetts Department of Elementary and Secondary Education (ESE), author's summarization

Chart 2 presents the total summary of programs that were identified in the vocational technical schools in our analysis. The categorization of the programs under each subsector in Chart 2 was listed utilizing the same standard of analysis in analyzing the higher education programs (Chart 1).

Chart 2

Summary of Vocational Schools Curriculum Settings Related to Advanced Manufacturing



Source: author's summarization

Highlight: Our study showed that the offered programs in the Vocational Technical schools in Southeastern Massachusetts have a large number of programs relative to the occupations found in the Fabricated Metal & Machinery and Medical Equipment & Supplies subsectors.

APPENDIX A

BRIDGEWATER STATE UNIVERSITY

<http://www.bridgew.edu/>

Bridgewater State University (BSU) is a public liberal-arts college located in Bridgewater, Massachusetts. With about 11,089 students, it is the largest university in the Massachusetts state university system, outside the University of Massachusetts system.

As of July 1, 2010, the former School of Arts and Sciences was split into the College of Humanities and Social Sciences and the Bartlett College of Science and Mathematics. The College of Humanities and Social Sciences currently contains fourteen different departments, while the Bartlett College of Science and Mathematics has seven departments. The College of Education and Allied Studies has five different departments, and the Ricciardi College of Business has three.

According to our analysis, BSU offers three Bachelor of Science degrees relevant to manufacturing in Chemistry, Biochemistry concentration, Computer Science, and in Management, Operations concentration.

Note: The program descriptions listed below were referenced directly from the academic catalog of the institution.

PROGRAMS:

Chemistry: Biochemistry Concentration

The chemistry major, with a concentration in biochemistry, environmental chemistry or professional chemistry, leads to the BS degree. These programs are designed for students who plan a career as a professional chemist or biochemist either immediately after graduation or after graduate work in a chemistry-related discipline.

Computer Science (BS)

This program provides a broad background in computer science and prepares students for employment in computer applications or for graduate studies in the field. Students gain an understanding of the professional and ethical responsibilities inherent in designing the software that runs our world today.

Management: Operations Concentration

Courses such as production and operations management, and supply chain management provide students broad knowledge on goods production, manufacturing, inventory, sourcing and lean manufacturing. In addition, students gain valuable background knowledge on the principles and methods of supply chain, outsourcing, and materials management.

Advanced Business Logistics Program

Bristol Community College (BCC) is a two-year community college with its main campus located in Fall River, Massachusetts. Bristol Community College offers associate degrees and certificates in over 150 academic programs, ranging from Associate of Science degrees, Associate of Arts degrees, Associate of Applied Science degrees, and a wide range of certificates.

BCC has about 16 programs of study with relevance to manufacturing. These are programs in Computer Information Systems (Computer Programming Concentration), Engineering Technology (Architectural and Structural Technology Career, Advanced Manufacturing Technology Career, Biomedical manufacturing Technology career, Civil Technology Career, Electrical Technology with Solar Energy Career, Electro-Mechanical with Green Energy Technology Career, and Mechanical Technology with Wind Power Career), and Liberal Arts and Sciences (Biotechnology/Biomedical Technology Transfer).

As far as certificates are concerned, BCC offers certificate programs in Automated Systems with Robotics, Biotechnology, Computerized Numerical Control (CNC) Machining and Programming, Computer Programming, Computer-Aided Design and Drafting, Computer-Aided Design and Manufacturing (CAD/CAM), and Solar Energy.

Note: The program descriptions listed below were referenced directly from the academic catalog of the institution.

PROGRAMS:**Computer Information Systems/Computer Programming**
(Computer Programming Concentration)

Prepares students for entry-level programming positions in business and industry by knowing and being able to demonstrate the skills to analyze problems and develop computerized solutions using multiple programming languages.

Engineering Technology/Architectural and Structural Technology Career
(Architectural and Structural Technology)

This concentration prepares students to work as technicians for engineering consulting firms, structural engineers, architects, bridge inspectors, contractors and structural manufacturing companies.

Engineering Technology/Advanced Manufacturing Technology Career
(Automation Technology Concentration)

This concentration prepares students to enter highly automated manufacturing industries as automation specialists and manufacturing technicians. Students learn to solve complex manufacturing problems using computer-aided design, evaluation and simulation techniques, and engineering principles. The curriculum covers such aspects of manufacturing engineering as materials processing (traditional and CNC), industrial

automation, material science, hydraulics, computer-aided design and manufacturing (CAD/CAM), and computer-integrated manufacturing (CIM).

Engineering Technology/Biomedical Manufacturing Technology Career
(Biomanufacturing Technology)

This concentration prepares students for technical positions in biotechnology and pharmaceutical manufacturing industries. Students learn to use manufacturing equipment and to understand biological and chemical processes in a hands-on, practical environment.

Engineering Technology/Electrical Technology with Solar Energy Career
(Electrical Technology with Solar Energy Concentration)

This program prepares students to work as technicians in many positions for which training in electricity and electronics technology are required. Some of the most common areas with job opportunities are solar energy, industrial manufacturing, research and development laboratory, field service, technical writer, and technical sales.

Engineering Technology/Electro-Mechanical with Green Energy Technology Career
(Electro-Mechanical with Green Energy Concentration)

This program prepares students to work in high-tech industries as technical employees who can work on equipment that uses both electrical and mechanical engineering principles. Students, by selecting the recommended electives, can prepare themselves for employment in the expanding Green Technology industries of Solar Energy and Wind Power. Graduates, by selecting the recommended electives, may prepare themselves for transfer to a Bachelor of Science in Engineering Technology program.

Engineering Technology/Mechanical Technology with Wind Power Career
(Mechanical Technology with Wind Power)

This concentration prepares students as technicians and mechanical designers. Students learn aspects of mechanical engineering such as strength of materials, materials science, fluid systems, computer-aided design and wind power technology.

Liberal Arts and Sciences/Biotechnology/Biomedical Technology Transfer
(Biotechnology/Biomedical Technology Concentration)

This program is designed to provide the student with the biological and chemical background to seek employment as a lab technician in some biotechnology/biomedical sectors.

CERTIFICATES:

Automated-Systems with Robotics
(Certificate of Accomplishment in Automated Systems with Robotics)

This certificate program is to develop students with skills to analyze and apply their knowledge of electrical & mechanical systems, as a technician working with engineers on automated systems used in industry and entertainment. Topics will include pneumatics, hydraulic, electrical and mechanical sensors, switches, motors and other automation hardware, process controllers and programmable logic.

Biotechnology

(Certificate of Achievement in Biotechnology)

Students learn essential knowledge and develop lab skills for entry-level biotech positions, including setting up sample analysis, maintaining automated instruments, and preparing materials for research scientists.

CNC Machining and Programming

(Certificate of Recognition in Computerized Numeric Control Machining and Programming)

Students learn to use standard machine-shop equipment and operate and program CNC machinery to become manufacturing technicians. Students also understand the materials to be processed and technical drawing using AutoCAD.

Computer Programming

(Certificate of Accomplishment in Computer Programming)

A certificate in Computer Programming gives students mastery of basic programming concepts. The student becomes literate in at least three programming languages and achieves advanced mastery of more sophisticated concepts in at least one programming language.

Computer-Aided Design and Drafting

(Certificate of Recognition in Computer Aided Design and Drafting)

This one-year certificate program provides students with the needed skills to become a professional computer-aided architectural draftsman, civil draftsman, mechanical designer, or manufacturing operator in the engineering industry. Students learn fundamental concepts of engineering drawing through advanced computer-aided design techniques.

Computer-Aided Design and Manufacturing (CAD/CAM)

(Certificate of Accomplishment in Computer Aided Design & Manufacturing (CAD/CAM))

This certificate program provides students with the needed skills to become a professional computer-aided draftsman, mechanical, or manufacturing technicians in the engineering industry. Students learn fundamental concepts of engineering drawing through advanced computer-aided design techniques and CAD/CAM. They will utilize and set up standard machine-shop equipment and operate and program CNC machinery. Students also understand the materials to be processed and technical drawing using AutoCAD, SolidWorks, Inventor, and CamWorks.

Solar Energy

(Certificate of Recognition in Solar Energy)

This certificate is designed to help individuals understand the fastest growing form of power generation in the world - solar power. Students will learn about design requirements, installation guidelines, materials, and resources of green energy systems. Key concepts include the basics of electrical circuits, sustainable practices, and conservation measures. Students will also be trained in energy assessment, auditing and efficiency. Upon completion of this certificate, graduates will be prepared to work in entry-level positions in energy-related fields.

Cape Cod Community College, known locally as "4Cs", is a two-year community college located in West Barnstable, Massachusetts. It awards Associate in Arts and Associate in Science degrees and various academic certificates in a wide variety of programs. With relevance to manufacturing, Cape Cod Community College offers programs in Engineering (Engineering Technology, Green Design & Engineering, and Robotics & Manufacturing Automation) and Computer Science (Programming Concentration).

Note: The program descriptions listed below were referenced directly from the academic catalog of the institution.

CERTIFICATES:**Engineering Technology Certificate**

The Engineering Technology Certificate is a one-year program of study that is designed to give students the basic skills and knowledge for initial employment in today's engineering and manufacturing environments. Students learn and practice the theoretical and physical steps associated with the computer aided design (CAD), analysis, and production of mechanical parts.

Green Design & Engineering

This certificate program prepares students to successfully incorporate sustainability concepts into the design, manufacture, and support of electro-mechanical devices used in industry and construction. Green design engineering technologists typically work in the following economy sectors: Manufacturing and Research (This sector covers activities related to industrial manufacturing of technology as well as energy efficient manufacturing processes), Design, and Consulting Services (This sector encompasses "indirect jobs" which includes activities such as energy consulting or research and other related business services).

Robotics and Manufacturing Automation

This certificate program is designed for students who wish to develop and enhance their skills in these areas for employment at companies who have robotic devices or for students who intend on pursuing a Bachelor's degree in engineering or manufacturing. In earning this certificate, students demonstrate competency in designing, building, programming, and testing increasingly complex electromechanical robots and manufacturing automation devices.

Computer Science: Programming

Using hands-on projects and teamwork, Computer Science students learn to design, implement, and test programs in Java, C++, and assembly language. Students analyze and use various software development models and basic software engineering principles. Object-oriented programming methodology, systems software, and data structures are studied in depth. Students also complete concentrated course work in Calculus and Physics.

MASSACHUSETTS MARITIME ACADEMY

<https://www.maritime.edu/>

Massachusetts Maritime Academy (also called Maritime, Mass Maritime, MMA or Mass (when differentiating between the other Maritime Academies) is a regionally accredited, coeducational, state college offering undergraduate degrees in maritime-related fields, as well as graduate degrees and professional studies. The Academy offers Bachelor of Science degrees in Marine Transportation, Marine Engineering, Environmental Protection & Safety, Facilities Engineering, International Maritime Business, Emergency Management, and Energy Systems Engineering, with Facilities Engineering being the only program having relevance to manufacturing.

Note: The program description listed below was referenced directly from the academic catalog of the institution.

PROGRAM:

Facilities Engineering

The Facilities Engineering (FENG) program prepares graduates for careers in facilities engineering, management, and operations. Facilities engineers are responsible for the safe, economical, compliant and sustainable operation of various equipment and systems in large facilities such as manufacturing plants, office buildings, hospitals, and power plants.

Massasoit Community College has three campuses, located in Brockton, Canton, and Middleborough. Massasoit Community College offers associate degree programs in arts, sciences, and applied sciences, and one-year and short-term certificates for a range of occupations and interests.

Note: The program descriptions listed below were referenced directly from the academic catalog of the institution.

PROGRAMS:**Architectural Technology**

The Architectural Technology program is designed to develop marketable competence in a wide variety of skills within the building design profession. Leading objectives include developing the ability to apply technology to building design and to communicate practical solutions. This comprehensive program prepares the student in architectural and graphic design and the application of structural and heavy construction principles. The ability to apply codes to building design is developed, while emphasizing life safety. Skills in applying steel framing, plumbing, HVAC, electrical, and other engineering principles to building design are also stressed. Analysis of construction materials, understanding job management, scheduling, specifications, and application of contract documents to typical building construction round out the curriculum.

Electronic Technology Program (Electronic Circuit Technology)

Electronic Circuit Technology provides the student with the understanding and skills of electronics as it applies to analog, digital, and industrial circuits. Students in this program obtain solid fundamentals in electronic theory and then take courses to apply these fundamentals in various applications found in the electronics industry. These applications include integrated circuit technology, computer circuitry and basic architecture, and industrial process automation control.

Engineering Transfer Program

Massasoit Community College was granted permission to offer an Associates of Science Degree for Engineering on October 14th, 2014 by the Massachusetts Board of Higher Education. This two-year program will allow students to earn an Associate's Degree of Science with options concentrating in Mechanical, Chemical, Electrical, and Civil Engineering. The program is designed to prepare students for transfer to 4-year institutions for completion of their Bachelor's Degree. The Engineering Transfer program at Massasoit is also Massachusetts Transfer compliant.

Computer Technology (Computer Information Systems - Programming Option)

The Computer Information Systems - Programming Option (Associate of Applied Science) prepares students for an entry-level position as a computer programmer. A student's program includes programming languages (Java, Visual Basic, C++, Cobol), databases, data communication, and computer

organization and operating systems. The program also provides students with general knowledge of computer hardware as well as software and network operation.

**Heating, Ventilation, & Air Conditioning (HVAC) Technology
(Building Systems Energy Management Option)**

Through lecture and lab procedures, the HVAC program provides students with the theoretical and practical knowledge necessary to enter this growing and vital field. The major courses combine the mechanical and electrical concepts with engineering design and apply these principles to residential, commercial and industrial applications. Special emphasis is put on computer applications and the utilization of design and business software for the HVAC industry. The diverse training gives the student a broad base from which they can enter the industry in any number of professional occupations such as designer, CAD operator, estimator, project manager, sales representative and service & installation technician.

UNIVERSITY OF MASSACHUSETTS DARTMOUTH <http://www.umassd.edu/>

The University of Massachusetts Dartmouth (UMD) is one of five campuses and operating subdivisions of the University of Massachusetts (UMass). It is located in North Dartmouth, Massachusetts, in the center of the South Coast region, between the cities of New Bedford to the east and Fall River to the west.

Note: The program descriptions listed below were referenced directly from the academic catalog of the institution.

PROGRAMS:

Biochemistry

The biochemistry option prepares students for professional (pre-Medical, pre-Pharmacy, pre-Veterinary) school, for employment in the pharmaceutical industry, and for graduate study in biochemistry, molecular biology, pharmacology, nutrition and other areas of life science.

Bioengineering

The undergraduate bioengineering program provides rigorous, multidisciplinary training that integrates the engineering sciences, life sciences, bio-research, and material design.

Biotechnology

Biotechnology is a broad term used to describe an industry that uses a vast range of biological and engineering principles to improve the human condition. This industry performs activities that range from pharmaceutical therapies to the development of instruments or methods that detect disease.

Students in the biotechnology option take classes that focus on molecular biology, statistics, chemistry, and other medical laboratory science topics. This combination of courses combined with a final practicum experience at a biotechnology industrial site will prepare the student for practice within this rapidly advancing field.

Chemistry

The chemistry option prepares students for graduate school programs leading to MS and PhD degrees in sub-divisions of Chemistry and Biochemistry or for employment in a variety of settings in industry, education or government. This degree can be customized to suit the needs of students who wish to focus on environmental chemistry.

Computer Engineering

Computer Engineering encompasses a broad spectrum of challenging activities including research, design, and development of computer systems hardware and software, as well as the electronic or software components that comprise these systems. The Computer Engineering program prepares students to meet

the changing high-technology needs in the computer engineering area, and for graduate study, by imparting a strong background in science, mathematics, and engineering.

Electrical Engineering

Electrical Engineering encompasses a broad range of specialties including communications, signal processing, instrumentation, control and automation, power conversion and distribution, radio frequency and microwave devices and systems, and digital and analog techniques. In any of these specialties, electrical engineers work with devices and/or systems to perform various functions such as research and development, systems analysis, management, production, testing, quality control, or sales. They may pursue careers in many areas such as monitoring and control of the environment, space exploration, aerospace and defense, ocean engineering, energy resources, biomedical engineering, information technology, law, or medicine.

Industrial and Systems Engineering

The Professional Master's program in Industrial and Systems Engineering provide practicing engineers with the knowledge and skills needed by to advance their careers. The program provides students the critical tools of optimization, modeling, and quality assurance, and refines their management skills, in order to support the business objectives of their organization.

Mechanical Engineering/Manufacturing

The Mechanical Engineering program at UMass Dartmouth is structured to provide their graduates with a broad technical background that is grounded in fundamental principles as well as modern tools of engineering.

Operations Management

Operations management is the study of transformation processes: how to get things done and produced, with minimal time, effort, cost, and maximum quality. Operations management is at the center of an organization. It's a growing field that draws on skills in communications, computer technology, decision-making, planning, problem-solving, quantitative methods, and team building—with career paths such as: business process analyst, distribution management, healthcare management, import/export operations, logistics, purchasing, supply chain management, quality management, transportation.

Software Engineering, B.S.

The Computer and Information Science Department offers a BS degree in computer science with an option in software engineering: the systematic approach to the development, operation, and maintenance of software.

Software engineers analyze, design, and program software. They are concerned with issues that play a vital role in software development, such as quality, novelty, creativity, standards, teamwork, and professional practice.

Quincy College (QC) is a public junior college located in Quincy, Massachusetts. It is an open admission commuter school that offers associate's degrees and certificate programs in professional fields of study. Founded in 1958, Quincy College is a two-year, municipally affiliated college serving approximately 4,000 students at campuses located in Quincy and Plymouth, Massachusetts.

Note: The program descriptions listed below were referenced directly from the academic catalog of the institution.

PROGRAMS:**Biotechnology and Compliance**

Quincy College's Biotechnology Program prepares students for entry-level positions in the biomanufacturing industry. Students develop a broad laboratory science-based background through courses focused in the life and chemical sciences, and obtain industry-specific knowledge in the areas of quality control (QC), process development (PD), and upstream and downstream processing, all while following current, good manufacturing practices (cGMP). In addition, students learn valuable laboratory techniques and instrumentation, and develop critical thinking skills. Upon successful completion of the program, students may enter the workforce directly as entry-level laboratory technicians or research assistants, or may transfer to a four-year university to continue their studies at the baccalaureate level.

Computer Science: Programming

The Computer Science Program prepares students for a variety of entry-level positions in a networked environment within the computer science industry, and to provide additional training or further advancement to those already employed in the computer science profession. The program design includes the core curriculum, a general computer science core, skills courses, and courses specific to the computer science areas like Robotic Programming.

Engineering Technology

The Engineering Technology Associates Degree provides students with the knowledge base required to become Engineering Technicians in the areas of electrical and electronic systems. Additional coursework in electromechanical principles and robotics are included in the design to aid students who are pursuing employment opportunities in the emerging 3D printing and robotics engineering fields. Upon successful completion of the program, students will be able to provide the technical knowledge to assist and support design engineers that develop new products in a variety of different fields. Although the curriculum is designed to facilitate those students wishing to develop a career in engineering technology, some students may find opportunity in continuing their education at institutions offering a Bachelor of Science degree in engineering.

Stonehill College is a private, non-profit, coeducational, Roman Catholic, liberal arts college located in Easton, Massachusetts. Stonehill College was founded in 1948 by the Congregation of Holy Cross, whose members established the University of Notre Dame (1842).

Note: The program descriptions listed below were referenced directly from the academic catalog of the institution.

PROGRAMS:**Biochemistry**

The Biochemistry major conforms to the recommendations of the American Society of Biochemistry and Molecular Biology, and the American Chemical Society. Through a rigorous course of study with a strong emphasis on the learn-by-doing approach, the Biochemistry Program is committed to providing the practical knowledge and skills necessary for graduate study in biochemistry, chemistry, molecular biology, genetics and biotechnology, or admission to professional school. It will also enable students to obtain skilled technical positions after graduation in research laboratories in universities, biotechnology or pharmaceutical development industries, hospitals and government agencies.

Chemistry, Bachelor of Science (BS)

The B.S. in Chemistry is an American Chemical Society certified degree and is designed for the student desiring a thorough background in chemistry; one who plans to attend graduate school in chemistry or closely related field, or seek immediate employment in the field of chemistry. Students completing the B.S. in Chemistry will graduate with an American Chemical Society certified degree.

Computer Science, Bachelor of Science (BS)

The Bachelor of Science program in computer science is designed to prepare students for entry-level positions in the computer industry or graduate study in computer science. This major offers a selection of courses covering software development, design and analysis of computer systems, computer architecture and computer applications. The B.S. in computer science requires the completion of twenty-two courses.

CHEMISTRY, Bachelor of Art (BA) / CHEMICAL ENGINEERING, Bachelor of Science (BS) DUAL DEGREE

Stonehill College offers an Engineering Program in collaboration with The University of Notre Dame. Students in this 3+2 Engineering Program with the University of Notre Dame receive a B.A. in Chemistry from Stonehill College and a B.S. in Chemical Engineering from the University of Notre Dame.

COMPUTER SCIENCE, Bachelor of Art (BA) /**COMPUTER ENGINEERING, Bachelor of Science (BS) DUAL DEGREE**

The B.A. in Computer Science is awarded only to those students who successfully complete the 3+2 cooperative computer engineering program. Students in this program receive a B.A. in Computer Science from Stonehill College and a B.S. in Computer Engineering from University of Notre Dame.

PHYSICS, Bachelor of Art (BA) / ELECTRICAL ENGINEERING, Bachelor of Science (BS) DUAL DEGREE

The B.A. in Physics is awarded only to those students who successfully complete the 3+2 cooperative physics program. Students in this program receive a B.A. in Physics from Stonehill College and a B.S. in Electrical Engineering from University of Notre Dame.

PHYSICS, Bachelor of Art (BA) / MECHANICAL ENGINEERING, Bachelor of Science (BS) DUAL DEGREE

Stonehill College offers an Engineering Program in collaboration with The University of Notre Dame. Students in this 3+2 Engineering Program with the University of Notre Dame receive a B.A. in Physics from Stonehill College and a B.S. in Mechanical Engineering from the University of Notre Dame.

Wheaton College is a four-year, private liberal arts college with a student body of approximately 1,600. Wheaton's residential campus is located in Norton, Massachusetts, between Boston, Massachusetts, and Providence, Rhode Island.

Note: The program descriptions listed below were referenced directly from the academic catalog of the institution.

PROGRAMS:**Chemistry: Biochemistry**

The study of the structures, functions, and interactions between biological molecules forms the focus of the work of biochemists. Biochemistry majors will build and expand their capacity to think, work, and communicate as scientists. Majors will use biochemical knowledge for experimental design, data analysis and interpretation, scientific reports and presentations, and exposure to the research literature. Mastery in these essential areas will prepare biochemistry graduates for graduate study in the health professions or natural sciences, as well as for work in a research environment.

Mathematics & Computer Science:

The mathematics and computer science major brings together aspects of theoretical and applied work that reinforce each other well. This major provides sound undergraduate preparation for a world of work that increasingly involves computer use. The major also provides excellent preparation for graduate study in computer science or applied mathematics, as well as in quantitatively oriented programs in management or public policy.

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