NEW PROGRAM PROPOSAL FORM

Name of Institution:

Greenville Technical College

Name of Program (include degree designation and all concentrations, options, or tracks):

Bachelors of Applied Science with a major in Advanced Manufacturing Technology

Program Designation:

- ☐ Associate's Degree
- ☐ Master's Degree
- ☒ Bachelor's Degree: 4 Year
- ☐ Specialist
- ☐ Bachelor's Degree: 5 Year
- ☐ Doctoral Degree: Research/Scholarship (e.g., Ph.D. and DMA)
- ☐ Doctoral Degree: Professional Practice (e.g., Ed.D., D.N.P., J.D., Pharm.D., and M.D.)

Consider the program for supplemental Palmetto Fellows and LIFE Scholarship awards?

- ☐ Yes
- ☒ No

Proposed Date of Implementation: **Fall 2019**

CIP Code: **14.4201**

Delivery Site(s): **Greenville, SC; Greenville Technical College's Center for Manufacturing Innovation**

Delivery Mode:

- ☒ Traditional/face-to-face
  *select if less than 25% online
- ☐ Distance Education
  - ☐ 100% online
  - ☐ Blended/hybrid (50% or more online)
  - ☐ Blended/hybrid (25-49% online)
  - ☐ Other distance education (explain if selected)

Program Contact Information (name, title, telephone number, and email address):
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Institutional Approvals and Dates of Approval (include department through Provost/Chief Academic Officer, President, and Board of Trustees approval):

Departmental Approval: February 2, 2018

Academic Curriculum Committee Approval: August 14, 2018
Chief Academic Officer Approval: August 15, 2018
President August 15, 2018
Area Commission Approval: August 15, 2018
SC Technical College System Board Approval: November 8, 2018

Background Information

State the nature and purpose of the proposed program, including target audience, centrality to institutional mission, and relation to the strategic plan.

The mission of Greenville Technical College is to transform students' lives and help our community thrive by providing a world-class, affordable education to students and building an educated, engaged workforce committed to life-long learning. The Applied Baccalaureate in Advanced Manufacturing Technology is aligned with this mission as the program offers students an affordable option to advance their technical knowledge and competency, while providing local employers the advanced manufacturing talent they need to grow and prosper in the region. Employers throughout our area continue to point to the critical need for a workforce with higher technical expertise and ability to lead complex manufacturing operations. Manufacturing firms in the region typically develop high-performing employees through two advancement paths: managerial or technical leadership. The Applied Baccalaureate in Advanced Manufacturing Technology (ABMT) program will prepare students to move into areas of technical leadership within their organizations, with the skills to manage and implement advanced manufacturing processes and equipment, leading teams to execute new process development projects.

As manufacturing becomes increasingly automated, area employers are seeking graduates who can apply advanced technology to improve plant performance and efficiency. On the horizon, sophisticated technology will drive the competitiveness of US manufacturing firms as they compete globally for customers and investment. The state and region must be prepared to educate the next generation of talent to deploy these technologies, or investment and jobs will go to communities that can.

Offering flexible scheduling, evening classes, and hybrid formats where appropriate, the ABMT would be well suited for employed manufacturing associates seeking career advancement. This program will provide a 2+2 path to a technical baccalaureate degree for current technical college manufacturing students and the thousands of program completers in the community who wish to further their education. Greenville Technical College has a long history of meeting the continuing education needs of incumbent employees, adult learners, and traditional students.

Assessment of Need

Provide an assessment of the need for the program for the institution, the state, the region, and beyond, if applicable.

Numerous factors of the economy, demographics and technology have combined to create a dire need for highly-skilled, technically-trained manufacturing professionals in the Upstate and South Carolina. The "diversified manufacturing" sector is the top target workforce development sector identified by South Carolina's Workforce Study submitted to the SC General Assembly by the State Board for Technical and Comprehensive Education in collaboration with the SC Department of Commerce and the SC Department of Employment and Workforce. These bodies identify a workforce shortage as a critical limiting factor to the continued growth of manufacturing in the

state. Since 2013, 170 manufacturing economic development projects have been announced in SC, which will require 14,539 new employees over the coming years (source: SC Department of Commerce).

According to a program market demand analysis via the Economic Modeling Specialists International (EMSI) economic modeling tool, Greenville County saw on average 248 new job postings per month for occupations related to this program. Meanwhile, on average, only 121 hires were made, indicating there was approximately 1 hire for every 2 unique job postings pointing to a dire shortage in trained manufacturing and industrial engineers and technologists. Projections from EMSI for the county suggest a 7.1 percent employment growth in these occupations over the next decade, with 226 annual openings per year.

At the national level, The Manufacturing Institute and Deloitte Consulting's study of the economy paints a similar picture. Over the next decade, they predict that "nearly 3.5 million manufacturing jobs likely need to be filled and the skills gap is expected to result in 2 million of those jobs going unfilled." The demographics of the manufacturing workforce further complicate matters. Of the approximately 30,000 people employed in manufacturing in Greenville County, approximately 7,200 are age 55 or older, pointing to greater opportunities for new entrants in this labor market. Finally, as manufacturing becomes increasingly automated, area employers are seeking graduates who can implement advanced technology to improve plant performance and efficiency. Many of the firms that are new to the region manufacture sophisticated products, including aerospace, automotive and medical devices using advanced manufacturing technology, including additive manufacturing, intelligent automation systems, vision and laser measurement applications, among others. These technical skills extend beyond what can be covered in an associate degree.

Transfer and Articulation
Identify any special articulation agreements for the proposed program. Provide the articulation agreement or Memorandum of Agreement/Understanding.

There are no articulation agreements at this time. Greenville Technical College is actively working with the SC Technical College System Office to develop a system-wide MOA for this program for all sister institutions in the system. We will provide a copy of the completed MOA to CHE once it's completed.

Employment Opportunities

	State		National			
Occupation	**Expected Number of Jobs (2016)**	**Employment Projection (2016-2026)**	**Expected Number of Jobs (2016)**	**Employment Projection (2016-2026)**	**Occupational Openings (Avg. Annual)**	**Data Type and Source**
11-3051 Industrial Production Manager	3,305	10.46%	169,700	-.50%	11,600	State: SCDEW, LMI Division, Long Term Occupational Projections. National: USBLS, Long Term Projections

51-1011 Production Supervisor	14,295	9.17%	619,500	-.30%	59,300	State: SCDEW, LMI Division, Long Term Occupational Projections. National: USBLS, Long Term Projections
Manufacturing Technology Occupational Cluster	11,315	21.34%	455,500	7.78%	35,400	State: SCDEW, LMI Division, Long Term Occupational Projections. National: USBLS, Long Term Projections. Mfg. Tech Occupational cluster is an aggregate of SOC Codes 17-2111, 17-2112, 17-3026 and 41-9031

Supporting Evidence of Anticipated Employment Opportunities
Provide supporting evidence of anticipated employment opportunities for graduates.

Greenville Technical College completed a survey of industries within Greenville County. Below are survey results from 8 mid to large size organizations identifying to their workforce needs. Additionally, regional workforce data from EMSI is attached as additional support for this program, as well as letters of support from local manufacturers.

Job Openings (Estimate)	New Positions Due to Growth	Turnover Positions Due To Attrition	Total Position Openings
Next Year 20 19: Full-time openings	112	108	220
Part-time openings if applicable	N/A	N/A	N/A
Second Year 20 20: Full-time openings	139	86	225
Part-time openings if applicable	N/A	N/A	N/A
Third Year 20 21:	139	90	229

Next Year 20 19: Full-time openings	112	108	220
Full-time openings			
Part-time openings if applicable	N/A	N/A	N/A

Description of the Program

Year	Fall Headcount	Spring Headcount	Summer Headcount
2019	30		
2020	70	70	70
2021	110	110	110
2022	150	150	150
2023	150	150	150

Explain how the enrollment projections were calculated.

The program will only admit students in the fall semester. A minimum of 15 incumbent worker students from industry who've graduated with an AAS degree are expected, and 15 recently graduated or soon to be graduated (i.e. spring 2019) Greenville Tech students from one of our five identified entry programs: Mechatronics, CNC, Machine Tool Technology, Mechanical Engineering Technology or Electronics Engineering Technology. Given the demand of these graduates in the area, we believe enrollment will be greater in year two of the program given increased interest from incumbent workers of advanced manufacturing organizations, as well as increased interest from Greenville Tech's current student base. Additionally, in year two and future years, we expect some demand from students of our sister technical college institutions who may not offer this program.

Besides the general institutional admission requirements, are there any separate or additional admission requirements for the proposed program? If yes, explain.

☒ Yes

☐ No

1. Successful completion of an earned Associate in Applied Science Degree in one of the following majors:
    1. Mechatronics Technology (formerly Industrial Maintenance Technology)
    2. Machine Tool Technology
    3. Computer Numerical Control (CNC) Programming and Operations
    4. Mechanical Engineering Technology
    5. Electronics Engineering Technology
2. An overall minimum 2.5 GPA in all college-level coursework.
3. Students may apply for prior learning credit for individual courses. Guidelines on the process are provided in the Greenville Technical College catalog.

Curriculum

New Courses
List and provide course descriptions for new courses.

MFG 300 Manufacturing Processes and their Application (3-0-3)
This course covers technologies and processes used in modern manufacturing. Engineering principles and technological concepts for diverse methods of production are introduced, including plastics processing, metal forming and other methods of manufacturing and materials processing.

MFG 401 Advanced Metrology (3-3-4)
The course covers geometric dimensioning and tolerance, accuracy and precision, and dimensional metrology to ensure quality fit of manufactured parts. Other destructive and nondestructive testing techniques to quantify mechanical properties of manufactured components are introduced.

MFG 402 Additive Manufacturing (3-3-4)
This course covers the skills required to design and manufacture a part using industrial 3D printing technology, including metal additive manufacturing. Topics will include metallurgy for additive manufacturing, post–processing design optimization, multi-jet printing, and fuse deposition modeling.

MFG 403 Robotics and Automated Controls III (3-3-4)
This course covers skills required to implement and program complex robotic systems, including integration with vision, welding, and other sensors, PLCs material conveyance, offline programming, and system design. Collaborative mobile and other advanced robotics technologies will be covered.

MFG 404 Programmable Logic Controllers III (3-3-4)
This course provides an overview of advanced programming techniques for controlling processes in today's industries as used by high level control engineers and PLC program designers.

MFG 310 Manufacturing Quality (3-0-3)
This course introduces the principles of quality control and quality management systems in manufacturing environments. Various technologies used for dimensional and mechanical inspection are introduced, as well as industry certifications for quality assurance.

MFG 311 Work Design, Ergonomics and Safety (3-0-3)
This course covers the role of manufacturing management in maintaining a safe work environment. Topics covered will include regulatory frameworks for safety and environmental management and the design of work cells and work plans to promote employee health and enhance productivity.

MFG 312 Manufacturing Enterprise Resource Management (3-0-3)
This course introduces students to concepts of enterprise resource planning (ERP) for manufacturing firms. Topics covered will include product lifecycle management (PLM), change management, bill of materials management, purchasing and procurement.

MFG 313 Strategic Sourcing and Procurement (3-0-3)
This course focuses on supplier management and purchasing in the global economy. Strategic management concepts to control cost and quality in the procurement of goods and services will be applied and aligned to the business objectives.

MFG 314 Finance for Manufacturing (3-0-3)
This course introduces basic concepts, terminology, and application of finance, accounting, and economics as applied to the management of manufacturing firms. Financial analyses will be performed to identify and resolve business problems.

MFG 321 Advanced Manufacturing Lab I (1-3-2)
This course introduces students to the principles of operation of metrology tools, CNC machine tools, and metal forming, and heat treatment.

MFG 322 Advanced Manufacturing Lab II (1-3-2)
This course introduces the principles of operation of the tools of automation and process control, including electrical circuits, mechanical systems, sensors, robotics, and programmable logic controllers.

MFG 323 Advanced Manufacturing Lab III (1-3-2)
This course provides advanced applications in the operation of plastics processing, metal casting and forging, 3D printing technologies, welding technologies, assembly, and fabrication tools.

MFG 330 Manufacturing Project Management (3-0-3)
This course covers the fundamentals of project planning and execution in manufacturing environments. Students learn to define project requirements, identify subtasks, develop, build, and manage a project schedule and budget, manage risk, and close out a project.

MFG 340 Computer Aided Design for Manufacturing Engineering (2-3-3)
This course covers construction and assemblies of three-dimensional objects using computer-aided design software, parametric modelling, and tolerance analysis. Principles of machine design will be applied to translate these models into dimensioned and annotated drawings for manufacturing.

MFG 350 Production Process Planning (3-0-3)
This course introduces the principles of planning, inventory control, and supply chain management in manufacturing environments. Topics include the economics of production, workflows and documentation, facility considerations, and overall operational efficiency.

MFG 360 Leadership in Manufacturing (3-0-3)
This course covers theories of leadership and modern strategies of leadership development as applied in manufacturing environments. Topics include leadership styles, managing and leading change, team communication, and ethics. Leadership concepts and skills will be applied in team settings.

MFG 370 Principles of Lean Manufacturing (3-0-3)
This course covers the evolution of manufacturing systems, the principles and design of lean manufacturing systems, and methods of continuous process improvement. Topics include operational models of manufacturing systems, statistical process control, and the DMAIC problem solving method.

MFG 481 Industry Capstone Project I (0-6-2)
This course introduces systematic manufacturing process design concepts and focuses on problem definition, solution ideation, research, intellectual property concepts, and risk assessment.

MFG 482 Industry Capstone Project II (0-6-2)

This course reinforces concepts of manufacturing technologies, lean manufacturing, project management, and professional communications through an industry-sponsored capstone project.

MFG 491 Advanced Manufacturing Senior Seminar I (2-0-2)
This course introduces selected topics in manufacturing technology through independent research and lectures, guest speakers and site visits, including contemporary use of digital manufacturing technologies, advanced materials, and modern software used by industry.

MFG 492 Advanced Manufacturing Senior Seminar II (2-0-2)
This course introduces selected topics in operational management principles, career skills, organizational development, and conflict resolution through faculty lectures and guest presentations.

General Education Requirements: 31 credit hours

ENG 101	3 credits	
ENG 102	3 credits	
SPC 205	3 credits	
MAT 110	3 credits	
MAT 120	3 credits	
Natural Science w/lab	4 credits	CHM 105, PHS 101, or PHY 201 (recommended)
Humanities	3 credits	
Social Science	3 credits	ECO 211 (recommended).
General Education electives	6 credits	
Total	**31 Credits**	

Technical Block Credits Requirements: 42 credit hours from one of five AAS programs of study

Mechatronics Technology
Mechatronics students cross-train in control systems, electronic systems, computers, and mechanical systems that integrate product design and automated manufacturing processes. Course work combines various skills to teach students a comprehensive approach to developing solutions for work-specific applications.

Machine Tool Technology
A machinist can take raw materials and produce a specialized finished product or item through knowledge that is a combination of theoretical information and hands-on experience. With practical experience in bench work, floor work, assembly layout, selected milling machine operations, lathe, shaper, drill press, computer numerical control programming and machining, and machine tool maintenance and inspection, students are prepared to handle a wide range of responsibilities in the metalworking industry.

CNC Technology
The CNC Technology curriculum prepares students to program and operate automated manufacturing equipment to produce parts at a high level of precision. Students are prepared to use metrology equipment, rapid prototyping tools, and advanced machining centers.

Mechanical Engineering Technology
The Mechanical Engineering Technology curriculum equips the graduate for performing a key role in the mechanical design process. Graduates learn to install, troubleshoot, and repair mechanical and electro-mechanical equipment;

program CNC machine tools, computers, programmable controllers, and robots; and perform general maintenance functions.

Electronic Engineering Technology
Skilled in the operation, troubleshooting, calibration, and repair of electronic instruments and systems found in process control, communications, computers, manufacturing, programmable logic controllers, and microprocessors, the graduate is not limited to one specific area of employment. Practical, hands-on experience on sophisticated electronic equipment provides the student with the skills necessary to assist in the basic design, construction, analysis, modification, inspection, and calibration of electronic circuits and systems.

Other Credits Requirement:
EGR 130, Engineering Technology Applications & Programming 3 credits

Core Requirements: 49 credit hours

Core curriculum:		**Core electives:**	
MFG 300	3 credits	MFG 401	4 credits*
MFG 310	3 credits	MFG 402	4 credits*
MFG 321	2 credits	MFG 403	4 credits*
MFG 322	2 credits	MFG 404	4 credits*
MFG 323	2 credits	MFG 311	3 credits+
MFG 330	3 credits	MFG 312	3 credits+
MFG 340	3 credits	MFG 313	3 credits+
MFG 350	3 credits	MFG 314	3 credits+
MFG 360	3 credits		
MFG 370	3 credits		
MFG 481	2 credits		
MFG 482	2 credits		
MFG 491	2 credits		
MFG 492	2 credits		
Total	**35 credits**	**Total**	**14 credits required**

*** Students are required to take two manufacturing technology electives (i.e. MFG 401, 402, 403, or 404)**
+ Students are required to take two operations management electives (i.e. MFG 311, 312, 313, or 314)

Other Credits Required: 3 credit hours:
EGR 130 Engineering Technology Applications & Programming - 3 credits

Total General Education Credits	31
Other Credits	3
Technical Block Credits	42
Core Course Credits	49
Total Credit Requirements	**125**

Mechatronics/CNC/MTT	MET	EET
MAT 170	MAT 110	MAT 110
ENG 165		
Social Science	Social Science	Social Science
Humanities	Humanities	Humanities
General Education		
	ENG 101	ENG 101
	SPC 205	SPC 205
	MAT 111	MAT 111
	PHY 201	PHY 201
	PHY 202 or CHM 110	PHY 202 or CHM 110
	MAT 120 or MAT 140	
Total General Education Credit Hours: 15	Total General Credit Hours: 29	Total General Credit Hours: 26
	EGR 130 (Other Credit)	EGR 130 (Other Credit)
Total Other Credit Hours: 0 Students will complete this in the first semester.	Total Other Credit Hours: 3	Total Other Credits Hours: 3
Total General Education Required after admissions into program:	Total General Education Required after admissions into program:	Total General Education Required after admissions into program:
ENG 101* ENG 102 MAT 110* MAT 120 Natural Science 6 hours of general ed elect. 22 General Ed Hours. *ENG 101 & MAT 110 may have previously been completed.	MAT 120** ENG 102 **MAT 120 may have previously been completed.	ENG 102 MAT 120

Curriculum Layout (Flexibility for Full-Time & Part-Time Instruction)

Course Name	Credit Hours	Course Name	Credit Hours	Course Name	Credit Hours
Year 3					
Fall		**Spring**		**Summer**	
MFG 300 Manufacturing Processes and their Application	3	Natural Science w/Lab^	4	MFG 350 Production Process Planning	3
MFG 310 Manufacturing Quality	3	MFG 340 Computer Aided Design for Manufacturing Engineering	3	MFG 323 Advanced Manufacturing Lab III	2
MFG 321 Advanced Manufacturing Lab I	2	ENG 101 English Composition I**	3	MFG 360 Leadership in Manufacturing	3
MAT 120 (Statistics)* or MAT 110 (Algebra)*	3	MFG 322 Advanced Manufacturing Lab II	2	General Education Elective I*** or ENG 102 English Composition II***	3
EGR 130 Engineering Technology Applications & Programming# or ENG 102 English Composition II#	3	MFG 330 Manufacturing Project Management	3		
Total Semester Hours	14	Total Semester Hours	15	Total Semester Hours	11
Year 4					
Fall		**Spring**		**Summer**	
Manufacturing Technology Elective +	4	MFG 482 Industry Capstone Project II	2	General Education Elective	3
MFG 370 Principles of Lean Manufacturing and Six Sigma Methodologies	3	Operations Management Elective ++	3	General Education Elective	3
MFG 481 Industry Capstone Project I	2	Operations Management Elective ++	3		
General Education Elective or MAT 120 (Statistics)****	3	Manufacturing Technology Elective +	4		
MFG 491 Senior Seminar I	2	MFG 492 Senior Seminar II	2		
Total Semester Hours	14	Total Semester Hours	14	Total Semester Hours	6

EGR 130 would be required for CNC/MEC/MTT students. MET and EET students are exempted from this course. MET and EET students would take ENG 102.

* MAT 120 would be required for EET students. CNC/MEC/MTT students would need to complete MAT 110. MET students are exempted from this course.
**ENG 101 would be required for CNC/MEC/MTT students. ENG 102 would be required for MET and EET students.
***ENG 102 would be required for CNC/MEC/MTT students. A general education elective would be required for MET and EET students.
****MAT 120 would be required for CNC/MEC/MTT students. A general education elective would be required for MET and EET students.
^Natural Science is required for CNC/MEC/MTT students.
+ Manufacturing Technology electives may include MFG 401 Advanced Metrology; MFG 402 Additive Manufacturing; MFG 403 Robotics and 404 Automated Controls
++ Operations Management electives may include MFG 311 Work Design, Ergonomics and Safety; MFG 312 Manufacturing Enterprise Resource Management; MFG 313 Purchasing and Strategic Sourcing; MFG 314 Finance for Manufacturing.

Similar Programs in South Carolina offered by Public and Independent Institutions

Identify the similar programs offered and describe the similarities and differences for each program.

Program Name	Institution	Similarities	Differences	Additional comments as it relates to program development in this area
B.S. Electronics Engineering Technology (Mechatronics)	ECPI University	2+2 path from certain AAS programs in manufacturing. Some overlap in technical content.	Focused solely on mechatronics systems and not broader technologies of manufacturing. Advanced technologies and lab exercises not a major component of program.	The proposed GTC program includes a broader number of technologies, some management fundamentals, and courses on technology applications.
B.A.S. Advanced Manufacturing Management	USC Upstate	2+2 path from certain AAS programs in manufacturing	Focused more on personnel and business management. Does not cover manufacturing technologies.	The proposed GTC program primarily develops students for positions of technical leadership, with a few core courses focused on manufacturing management. Technology is the principle focus.
B.S. Mechanical Engineering	Clemson University, Univ. of SC, Citadel	Focus on technical disciplines, some related to manufacturing.	Focuses on scientific and theoretical principles of engineering more than practical, hands-on application of technologies. Less focused on tools and processes of advanced manufacturing.	The proposed GTC program offers a 2+2 path from manufacturing AAS degrees, unlike traditional engineering programs, which require several calculus courses and other prerequisites. The BAS program is also more focused on practical applications, rather than theory.
B.S. Industrial Engineering	Clemson University	Focus on technical disciplines, some related to manufacturing.	Focuses on scientific and theoretical principles of engineering and industrial management more than practical, hands-on application of technologies. Less focused on tools and processes of advanced manufacturing.	The proposed GTC program offers a 2+2 path from manufacturing AAS degrees, unlike traditional engineering programs, which require several calculus courses and other prerequisites. The BAS program is also more focused on practical applications, rather than theory.

Faculty

Rank and Full- or Part-time	Courses Taught for the Program	Academic Degrees and Coursework Relevant to Courses Taught, Including Institution and Major	Other Qualifications and Relevant Professional Experience (e.g., licensures, certifications, years in industry, etc.)
Marco Luzzatti (F)	MFG 310 MFG 330 MFG 350 MFG 370	Lean Six Sigma (LSS) Master Black Belt Train-the-Trainer M.S. Chemical Engineering-University of Virginia B.S. Chemistry-Muhlenberg College	25 years of experience in teaching Lean Six Sigma and project management to corporate executives and international organizations.
David Lucero (F)	MFG 312 MFG 313	C.P.M. CPIM SAP© MBA- Webster University B.S.- Limestone College	Military experience in logistics & supply chain
David Clayton (F)	MFG 314	MBA in Finance-University of South Carolina B.S. Mechanical Engineering-Clemson University	Experience as mechanical engineer in industry as well as corporate experience in finance.
Philip Caruso (F)	MFG 300 MFG 311 MFG 340 MFG 322	PhD in Mechanical Engineering Purdue University M.S. in Mechanical Engineering Purdue University	Experience as a mechanical engineer with GE for over 28 years.

		B.S. in Mechanical Engineering Northeastern University	
Dale Hamm (F)	MFG 402 MFG 403 MFG 404 MFG 321 MFG 360	MBA-Franklin University B.S. in Electronics Management- Southern Illinois University A.S. in Electronics Technology- Washburn Valley College	*Certified Maintenance and Reliability Professional - Certified *Six Sigma Green Belt Training (2009), Advanced Technology Services *Advanced Achievement Leadership (2009), Bell Leadership Institute 16 plus years in industry in quality maintenance.
TBD-New Hire (F)	MFG 401 MFG 323 MFG 481 MFG 482 MFG 491 MFG 492	PhD in manufacturing, mechanical, industrial or systems engineering, operations management, or related field required	Multiple years of experience within a manufacturing environment. Preferred experience in advanced robotics, metrology, & computer aided design.

Total FTE needed to support the proposed program:
Faculty: 3.0
Staff: 0
Administration: .5

Faculty, Staff, and Administrative Personnel
Discuss the Faculty, Staff, and Administrative Personnel needs of the program.

The program will require one new full-time faculty member to start the program, who will also serve as the academic program director (i.e. program coordinator). The program will initially launch in the fall of 2019 (pending state and SACSCOC approval) with the first group of students taking a mix of general education and first semester courses of this program of study. The academic program director will be hired to begin January 2019. The five faculty members aforementioned are already in place to support the program and are credentialed to teach the classes assigned to them. No state funding is required to hire the new APD for the program of study. New full-time faculty would be added based upon the growth of the program. We anticipate, if enrollment targets are met that one faculty member will be hired at the start of the program; a second will be hired in January of the second year and a third will be hired in January of the fourth year.

Resources

Library and Learning Resources
Explain how current library/learning collections, databases, resources, and services specific to the discipline, including those provided by PASCAL, can support the proposed program. Identify additional library resources needed.

For 2016-2017, the last full fiscal year, GTC's library collection included 35,076 circulating and reference books, 2,439 DVDs, and 132 periodical subscriptions. In the technology subject area, GTC has approximately 3,200 titles covering general technology along with specialized topics such as engineering (various types), building construction, machinery, electronics, motor vehicles, aeronautics, metallurgy, chemical technology, and manufacturing that are likely to be of the greatest use to students. In addition to resources owned by GTC, students are able to get printed books and articles from two interlibrary loan programs. Using the PASCAL Delivers book delivery service, borrowers may use books owned by the state's participating college and university libraries. Students may also borrow materials from the OCLC ILL network; requests typically arrive in a week.

Online
Through purchasing, membership in the PASCAL consortium, and participation in the DISCUS Project, GTC libraries provide online resources that support students and faculty. Students have access to the content collections included in the A-to-Z listing of library databases. This includes electronic access to peer-reviewed manufacturing journals including: The International Journal of Advanced Manufacturing Technology, Journal of Manufacturing Science & Engineering, SAE International Journal of Materials & Manufacturing, Journal of Manufacturing Technology Research, and Journal of Automation Mobile Robotics & Intelligent Systems (all with access through Academic Search Premier) and Manufacturing & Service Operations Management (with access through Academic OneFile).

Students also have access to a robust collection of eBooks in two separate databases, EBSCO eBooks, and ProQuest EBL. A quick search in EBSCO yielded 1,964 hits, using the phrase "manufacturing," and 1,792 hits in EBL, using "advanced manufacturing."

Student Support Services
Explain how current academic support services will support the proposed program. Identify new services needed and provide any estimated costs associated with these services.

Greenville Technical College (GTC) provides a robust cadre of support services for its entire student body. While some of the services are tailored to specific groups, all GTC students benefit from the rising level of academic excellence as these educational reinforcements are applied to individual students. These support services are offered to all students and the same would be applicable to students in the Applied Baccalaureate Degree in Advanced Manufacturing Technology (ABMT) program.

The Student Services Division offers assistance to students in the areas of enrollment services, career development, personal counseling, assistance for students with disabilities, federally funded educational opportunity programs, leadership development initiatives, new student orientation, student activities, student records, and services to our veteran population.

The college's Finance Division offers financial aid services to all students and has additional resources specifically for veterans who need assistance with understanding Veterans Affairs benefits. Additional core services are offered through the Academic Support Division. These services include academic advising, academic coaching, library support, tutoring, and writing and math centers.

Many of the existing services offered by GTC will undergird the ABMT degree program. Since this program is for students moving from the current Associate in Applied Science – Mechatronics Technology to ABMT, very little strain on the existing system is expected; i.e., current student support services will be adequate for the additional (ABMT) student population.

Physical Resources/Facilities
Identify the physical facilities needed to support the program and the institution's plan for meeting the requirements.

No new physical or facilities resources are needed to support the program. Classes for the degree will be offered at Greenville Technical College's Center for Manufacturing Innovation, which offers the capacity for both technical, hands-on training and classroom courses on theory. CMI represents a $32 million investment by state and local governments in the future of regional manufacturing. The ABMT degree is the next logical step in meeting the needs of area employers, offering advanced technical training beyond the level a two-year degree can provide. The ABMT program will be offered by the Advanced Manufacturing and Engineering Department of Greenville Technical College.

Equipment
Identify new instructional equipment needed for the proposed program.

No new equipment is needed to support the program. CMI has over $7 million in the latest manufacturing technology. Below are examples of technologies available in CMI and partner organizations.

Technologies	**Companies**
Rapid Prototyping, Machine Tool, Additive Manufacturing Lab	Haas, Sandvik, and Renishaw
Metrology Lab, Coordinate Measuring Machine	Renishaw, Mitutoyo, and Master Gage and Tool
Mechatronics Lab and Vehicle Assembly	BMW, Siemens and the Advanced Robotics for Manufacturing Institute
Advanced Robotics	ABB and Kuku Robotics

Impact on Existing Programs

Will the proposed program impact existing degree programs or services at the institution (e.g., course offerings or enrollment)? If yes, explain.

☐ Yes

☒ No

Financial Support

0												
	1st		2nd		3rd		4th		5th		Grand Total	
Category	**New**	**Total**	**New**	**Total**	**New**	**Total**	**New**	**Total**	**New**	**Total**	**New**	**Total**
Tuition Funding	216,000	216,000	484,700	484,700	790,400	790,400	1,088,100	1,088,100	1,154,400	1,154,400	7,251,200	7,251,200
Program-Specific Fees	5,400	5,400	13,020	13,020	21,120	21,120	29,700	29,700	31,680	31,680	196,440	196,400
Special State Appropriation	0	0	0	0	0	0	0	0	0	0	0	0
Reallocation of Existing Funds	0	0	0	0	0	0	0	0	0	0	0	0
Federal, Grant, or Other Funding	0	0	0	0	0	0	0	0	0	0	0	0
Total	221,400	221,400	497,720	497,720	811,520	811,520	1,117,800	1,117,800	1,186,080	1,186,080	7,447,640	7,447,640
Estimated Costs Associated with Implementing the Program by Year												
	1st		2nd		3rd		4th		5th		Grand Total	
Category	**New**	**Total**	**New**	**Total**	**New**	**Total**	**New**	**Total**	**New**	**Total**	**New**	**Total**
Program Administration and Faculty/Staff Salaries	145, 375	179,629	231,191	272,702	273,607	322,516	346,490	395,399	413,072	461,981	2,579,977	2,896,583
Facilities, Equipment, Supplies, and Materials	5,850	5,580	13,650	13,650	21,450	21,450	29,250	29,250	31,200	31,200	171,600	196,950
Library Resources	0	800	0	1600	0	$2400	0	$3000	0	3,300	0	11,100
Other (specify)	0	0	0	0	0	0	0	0	0	0	0	0

Total	151,225	186, 275	244,841	287,952	295,057	346,366	375,740	427,649	444,272	496,481	2,759,377	3,104,633
Net Total (Sources of Financing Minus Estimated Costs)	70,175	35,125	252,879	209,768	516,463	465,154	742,060	690,151	741,808	689,599	3,723,583	4,343,007

Note: New costs - costs incurred solely as a result of implementing this program. Total costs - new costs; program's share of costs of existing resources used to support the program; and any other costs redirected to the program.

***N/A - The** first two years of the program, students are completing their AAS Degree. This degree offers the second half of a 2+2 program.

Budget Justification

Provide an explanation for all costs and sources of financing identified in the Financial Support table. Include an analysis of cost-effectiveness and return on investment and address any impacts to tuition, other programs, services, facilities, and the institution overall.

The budget for the Applied Baccalaureate degree is based on 30 third year students in year 1, 40 in year 2, 70 in year 3 and 80 in years 4 and 5. It is assumed all the students will complete the third year and continue in the fourth year. Tuition funding is based on the enrollment projections and assumes students enroll in 40 hours in their third year and 34 hours in their fourth year. Since this program is new, and uses existing course capacity in the existing courses, all tuition is assumed to be "new" funding. Tuition is assumed to be 180 per credit hour in year 1 and will increase 5 per credit hour in years 2, 3 and 4. Dedicated fees will be $180 in year 1 and will increase by $6 in years 2, 3 and 4.

In the costs section, personnel costs will be mostly new, either new hires or moving of existing employees into the new roles. Only the department head's salary currently exists. We anticipate, if enrollment targets are met that one faculty member will be hired at the start of the program; a second will be hired in January of the second year and a third will be hired in January of the fourth year. Faculty salaries are estimated to be $90,000 per year and 1% salary increases are budgeted in years 2, 3 and 5. Benefits are estimated at 37% of salaries. A department head will spend 25% of their time on the program in the first year and 35% of their time in the following years. It is estimated that there will be one lab assistant for every 30-35 students. There will be an occasional need to have a few courses taught by adjunct instructors. Those instructors are paid $5,000 per course. Students will be in 3 courses per year that require supplies. The supplies are estimated at $65 per course.

The college has sufficient space and has the required equipment to house this program at the Center for Manufacturing Innovation (CMI). There will not be any additional costs for facilities or equipment. There is already a marketing campaign in place for CMI and this program will be a part of the existing campaign.

Evaluation and Assessment

Explain how the proposed program, including all program objectives, will be evaluated, along with plans to track employment. Describe how assessment data will be used.

Program Objectives	Student Learning Outcomes Aligned to Program Objectives	Methods of Assessment
Develop and implement manufacturing technology to improve the efficiency and	**MFG 330**: Analyze risk assessment and risk mitigation,	Assignments, exams, and project in **MFG 330 and MFG 350** Capstone projects in **MFG 481 and MFG 482**

quality of manufacturing processes.	including qualitative and quantitative risk factors. **MFG 350**: Analyze manufacturing systems including cell formation, line balancing, and approaches to flexible manufacturing. **MFG 481**: Apply industry principles to solve manufacturing challenges for production environments. **MFG 482**: Apply lean manufacturing principles to a real-world production challenge.	
Lead interdisciplinary teams and manage complex manufacturing design and process improvement projects.	**MFG 330**: Organize and manage project teams, tasks, and control project activities. **MFG 370**: Summarize contemporary theories of lean production and apply in appropriate manufacturing contexts, using analytical tools including value stream mapping, setup time reduction, just-in-time manufacturing, and other approaches to process improvement. Interpret the DMAIC (Define-Measure-Analyze-Improve-Control) method of problem solving for manufacturing production, utilizing analytical tools to determine the root causes of process failures. **MFG 382**: Build manufacturing systems employing analytical	Assignments, exams, and project in **MFG 330 and MFG370**. Capstone projects in **MFG 481 and MFG 482**

	and process improvement techniques. Apply environmental and sustainability considerations as part of a solution.	
Demonstrate technical expertise in myriad manufacturing processes, including established technologies such as CNC machining, welding, PLC programming and robotics applications as well as new and evolving technologies including additive and subtractive manufacturing, intelligent manufacturing systems and advanced metrology.	**MFG 321**: Demonstrate the principles of operation of basic metrology tools, basic hand tools, coordinate measuring machines and non-contact measuring tools, computer numerically controlled machine tools, and metal forming, heat treatment, and metalworking tools. **MFG 322**: Demonstrate the principles of operations of: mechanical systems, electrical circuits, motors and drives, hydraulics and pneumatics, electromechanical sensors, robotics and programmable logic controllers. **MGT 323**: Demonstrate the principles of operation of welding equipment, plastics process (including injection molding), metal casting and forging, metal bending, assembly and fabrication, 3D printing technologies.	**MFG 321, MFG 322, MFG 323**: Lab exercises and reports
Analyze data and apply established problem solving techniques and design for manufacturing methodologies.	**MFG 340**: Create bills of material for assemblies, work instructions and detailed two-dimensional drawings for manufacturing	**MFG 340**: project **MFG 350**: assignments, exams, and project **MFG 482**: Capstone project

	processes based on three-dimensional models. **MFG 350**: Analyze manufacturing systems including cell formation, line balancing, and approaches to flexible manufacturing. **MFG 482**: Create manufacturing solutions using process control methods, process documentation and training plans.	
Apply basic financial principles to typical manufacturing processes and decisions, including capital projects, strategic sourcing, and "make versus buy" decision making.	**MFG 330**: Determine need and motivation for projects, identify and prioritize projects using tools such as comparative benefit models and quality functional deployment. Utilize project management software applications. **MFG 481**: Apply project management principles to draft a comprehensive project plan and budget.	**MFG 330**: assignments, exams, and project **MFG 481**: Capstone project
Manage complex projects and manufacturing operations, including the application of lean six sigma quality, safety principles, 5S and inventory control techniques.	**MFG 481**: Apply project management principles to draft a comprehensive project plan and budget. Analyze project and solution constraints to develop proofs-of-concept. Apply industry principles to solve manufacturing challenges for production environments.	**MFG 481 and MFG 482**: Capstone project

	MFG 482: Apply lean manufacturing principles to a real-world production challenge. Apply human factors, safety and ergonomics principles in a manufacturing environment. Apply environmental and sustainability considerations as part of a solution. Build manufacturing systems, employing analytical and process improvement techniques. Create manufacturing solutions using process control methods, process documentation and training plans.	
Improve and implement intelligent manufacturing process design including process workflow, plant layout and inventory control.	**MFG 481**: Apply project management principles to draft a comprehensive project plan and budget. Analyze project and solution constraints to develop proofs-of-concept. Apply industry principles to solve manufacturing challenges for production environments. **MFG 482**: Apply lean manufacturing principles to a real-world production challenge. Apply human factors, safety and ergonomics principles in a manufacturing environment. Apply environmental and sustainability considerations as part of a solution. Build manufacturing systems,	**MFG 481 and MFG 482**: Capstone project

	employing analytical and process improvement techniques. Create manufacturing solutions using process control methods, process documentation and training plans.	

Accreditation and Licensure/Certification

Will the institution seek program-specific accreditation (e.g., CAEP, ABET, NASM, etc.)? If yes, describe the institution's plans to seek accreditation, including the expected timeline.

☐ Yes

☒ No

Will the proposed program lead to licensure or certification? If yes, identify the licensure or certification.

☐ Yes

☒ No

Explain how the program will prepare students for this licensure or certification.
N/A

If the program is an Educator Preparation Program, does the proposed certification area require national recognition from a Specialized Professional Association (SPA)? If yes, describe the institution's plans to seek national recognition, including the expected timeline.

☐ Yes

☒ No

Rexroth
Bosch Group

March 28, 2017

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Fountain Inn, SC 29644-9018
Tel. 1 864 967-2777
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www.boschrexroth-us.com

Dr. Keith Miller
President
Greenville Technical College
PO Box 5616
Greenville, SC 29606

Dear Dr. Miller:

Bosch Rexroth has been a business partner with Greenville Technical College since our start here in 1989. Over these many years, our business has grown as has our partnership with your organization. We do not consider this a coincidence but rather a model for partnership that has brought many other world class manufacturers to this region. In our business, a highly skilled, flexible and motivated workforce is absolutely essential to our success. Our associates are truly our key success factor. As you know, we are strong proponents of the Center for Manufacturing Innovation (CMI). We see CMI as your commitment to continue this partnership ensuring our continued success for the next 28 years here in Greenville, SC.

We were recently made aware of a proposal to add a four year bachelorette program to Greenville Technical College focused directly at the needs of the growing manufacturing sector of our region. We would welcome the 'hands-on' approach that a technical college would bring to such a program. Our manufacturing engineers must be capable to work hands-on in the operations with highly skilled technicians. This ability is difficult to find today and normally comes only after engineers have completed many years of experience. However a technical college BS degree program has the potential to greatly accelerate this process. Furthermore, we could foresee a Greenville Technical College BS degree program focused on high tech manufacturing as a more viable option for our most skilled production associates to further their education. That is, a program designed around and for highly skilled and experienced technicians bringing them the skills necessary to advance their careers to the next level. This fits with our nearly three decade journey from a manufacturing-only facility into a fully global business including: R&D, supply chain mgmt., logistics, sales, and service. To successfully complete this journey, our workforce must be further developed while they continue to work full time in demanding roles.

Therefore as with the CMI, we would like to be a partner with you in the curriculum design for such a BS degree program.

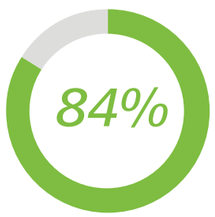
Sincerely,

Mike McCormick
Vice President
Bosch Rexroth Corporation

Over the next decade nearly *3 1/2 Million* manufacturing jobs likely need to be filled
The skills gap is expected to result in *2 Million* of those jobs being unfilled

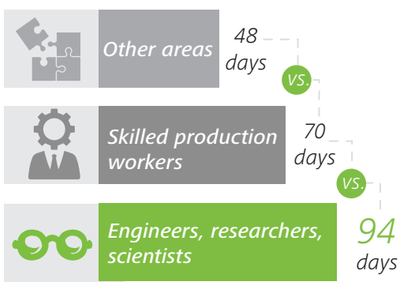
CEOs and manufacturing executives around the world identify talent-driven innovation as the number one determinant of competitiveness.[1] Yet, manufacturing executives report a significant gap in their ability to find talent with required skills. More troubling...the skills gap is expected to grow substantially over the next decade. What impact could the gap have on company performance and how large is the gap likely to grow? The Manufacturing Institute and Deloitte conducted a study[2] to understand the impact and extent of the skills gap, and the study results are as follows:

Filling jobs is no easy task



of executives agree
there is a talent shortage in U.S. manufacturing

It takes 90+ days
to recruit highly skilled workers



80% of manufacturing companies **are willing to pay more** than the market rates in workforce areas reeling under talent crisis

SIX out of TEN

open skilled production positions are unfilled due to talent shortage

Deloitte.

MANUFACTURING Institute

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Sources include: Bureau of Labor Statistics (BLS) and Deloitte analysis

[1] Deloitte LLP and U.S. Council on Competitiveness, 2013 Global Manufacturing Competitiveness Index
[2] A nationally representative sample of 450 executives from companies of varying sizes and industries responded to the Skills Gap Survey.
[3] Milken Institute and Economic Planning Institute.
[4] The U.S. Department of Commerce, Bureau of Economic Analysis.

The skills gap is widening

Over the next decade nearly 3 ½ million manufacturing jobs will likely be needed and

2015 **2 Million** *2025*

are expected to go unfilled due to the skills gap

The implications are significant

Every job in manufacturing creates another 2.5 new jobs in local goods and services[3]

For every $1 invested in manufacturing, another $1.37 in additional value is created in other sectors[4]

2.7 Million
baby boomer retirements

+

700K **manufacturing jobs expected from economic expansion**

3.4 Million
manufacturing jobs are likely to be needed over the next decade

*Only **1.4 Million** jobs are likely to be filled*

leading to an expected
2 Million
manufacturing jobs unfilled due to the skills gap

By 2025 the skills gap is expected to grow to ***2 million***

In 2011, ***600K*** jobs were unfilled due to the skills gap

The ***retirement*** of baby boomers, **strength of the economy** and *attractiveness of the industry* are ranked among leading factors impacting the talent shortage.

Developing talent is essential

Adding to the complexity is finding workers with the skills required to meet today's advanced manufacturing requirements

The most effective skilled production workforce development strategies cited by executives

94%	*72%*	*64%*	*49%*
Internal employee training and development	Involvement with local schools and community colleges	External training and certification programs	Creation of new veteran hiring programs

Percentage of executives that indicate current employees are not sufficient in key skills

70% technology/ computer skills

67% basic technical training

69% problem solving skills

60% math skills

Talent shortage impact to the business

82% of executives believe the skills gap will impact their ability to meet customer demand

executives also feel it will impact their ability to...

78% implement new technologies and increase productivity
69% provide effective customer service
62% innovate and develop new products
48% expand internationally

About Emsi

Emsi—an affiliate of the Strada Education Network—is a labor market analytics firm that is passionate about providing meaningful data for colleges and their students.

Our data is trusted by a breadth of users including researchers at colleges and universities, economic development organizations, and Fortune 500 companies.

Emsi data offers a three-pronged approach to labor market information:

1. Our traditional LMI combines dozens of government sources from agencies like the Bureau of Economic Analysis, U.S. Census Bureau, and Bureau of Labor Statistics into one dataset that details industries, occupations, demographics, academic programs, and more.

2. Emsi's job posting analytics give a real-time look into the needs of employers in today's labor market. Each month, millions of postings are scraped from employer sites and job boards, de-duplicated, and compiled into an actionable dataset.

3. Emsi also leverages workforce profiles—an innovative database of more than 100 million resumés and professional profiles that are aggregated from the open web. These profiles unify information for workers—such as education, employment history, skills, and more—to reveal robust detail on what is happening in today's workforce.

Together, these data related to labor market demand, relevant skills, and the competitive landscape help colleges and universities make informed decisions about their program offerings.

Competitive Landscape

Institution Sectors

Description
Administrative Unit Only
Public, 4-year or above
Private not-for-profit, 4-year or above
Private for-profit, 4-year or above

Award Levels

Description
Bachelor's Degree

Program Modality

Description
Distance Offered Programs
Non-Distance Offered Programs

Region

Code	Description
24860	Greenville-Anderson-Mauldin, SC

Additional Competing Programs

No selection

Competitive Landscape - Cont.

Program Overview

0
Completions

	Completions (2017)	% Completions	Institutions (2017)	% Institutions
All Programs	0	0%	0	0%
Distance Offered Programs	0	0%	0	0%
Non-Distance Offered Programs	0	0%	0	0%

No institutions with completions found in this region.

Regional Trends

	2013 Completions	2017 Completions	% Change
Distance Offered Programs	0	0	0.0%
Non-Distance Offered Programs	0	0	0.0%
All Programs	0	0	0.0%

Competitive Landscape - Cont.

Rank as a Talent Provider

Emsi's workforce profile data shows Greenville Technical College has 229 alumni working regionally in the occupations *Architectural and Engineering Managers, Cost Estimators, Engineers, All Other,* and *Industrial Engineers.* These 229 alumni represent 4.27% of regional profiles working in these occupations, which ranks your institution 2nd among regional talent providers.

229	4.27%	2
Your Alumni in Region Working in Target Occupations	Percent of Regional Profiles Working in Target Occupations	Your Rank as a Regional Talent Provider

Top Talent Providers

The top regional institutions supplying the labor market with workers employed in the target occupations listed above, based on Emsi's workforce profile data.

School	Profiles	Percent
Clemson University	1,130	21.06%
Greenville Technical College	229	4.27%
University of South Carolina-Columbia	160	2.98%
Georgia Institute of Technology-Main Campus	108	2.01%
North Carolina State University at Raleigh	93	1.73%
Tri-County Technical College	85	1.58%
Virginia Polytechnic Institute and State University	54	1.01%
University of South Carolina-Upstate	52	0.97%
Purdue University-Main Campus	49	0.91%
Pennsylvania State University-Main Campus	48	0.89%

Labor Market Demand - Cont.

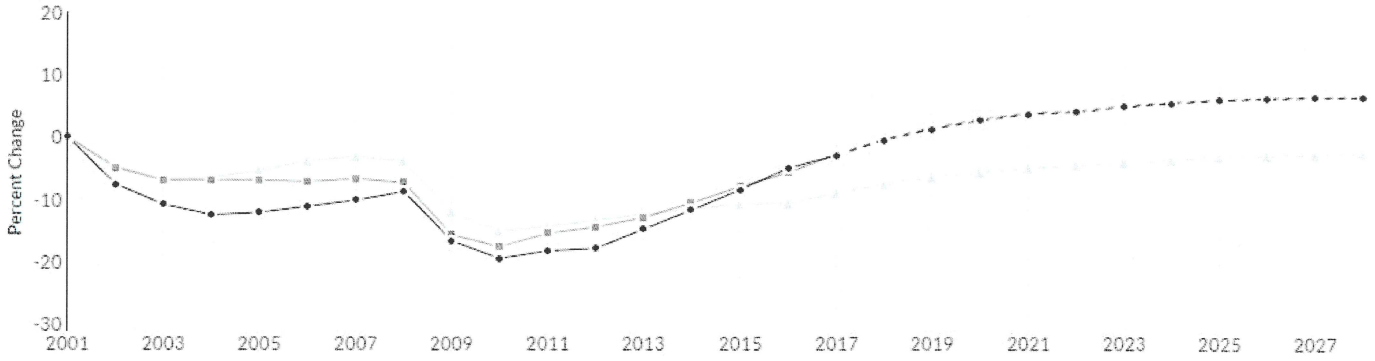
Target Occupations

6,794	+7.2%	$32.29/hr	711
Jobs (2017)	% Change (2017-2022)	Median Hourly Earnings	Annual Openings
35% above National average	Nation: +4.8%	Nation: $34.26/hr	

Occupation	2017 Jobs	Annual Openings	Median Hourly Earnings	Growth (2017 - 2022)
First-Line Supervisors of Production and Operating Workers	2,978	319	$29.22/hr	+4.00%
Industrial Engineers	1,354	125	$38.50/hr	+12.33%
Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products	764	97	$25.32/hr	+10.60%
Cost Estimators	695	77	$28.56/hr	+5.47%
Industrial Production Managers	626	52	$50.53/hr	+5.91%
Industrial Engineering Technicians	226	24	$24.17/hr	+8.85%
Engineers, All Other	152	15	$39.42/hr	+15.79%

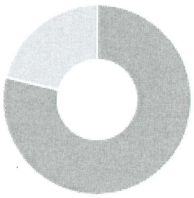
Labor Market Demand - Cont.

Regional Trends



Region	2017 Jobs	2022 Jobs	Change	% Change
Region	6,794	7,281	487	7.2%
State	31,531	33,802	2,271	7.2%
Nation	1,873,269	1,962,319	89,050	4.8%

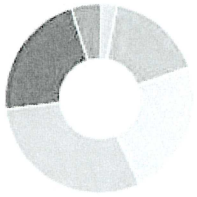
Occupation Gender Breakdown



Gender	2017 Jobs	2017 Percent
Males	5,354	78.8%
Females	1,439	21.2%

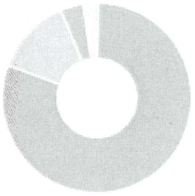
Labor Market Demand - Cont.

Occupation Age Breakdown



Age	2017 Jobs	2017 Percent
14-18	2	0.0%
19-24	186	2.7%
25-34	1,135	16.7%
35-44	1,590	23.4%
45-54	2,047	30.1%
55-64	1,490	21.9%
65+	344	5.1%

Occupation Race/Ethnicity Breakdown



Race/Ethnicity	2017 Jobs	2017 Percent
White	5,456	80.3%
Black or African American	899	13.2%
Hispanic or Latino	264	3.9%
Asian	128	1.9%
Two or More Races	37	0.6%
American Indian or Alaska Native	9	0.1%
Native Hawaiian or Other Pacific Islander	1	0.0%

Labor Market Demand - Cont.

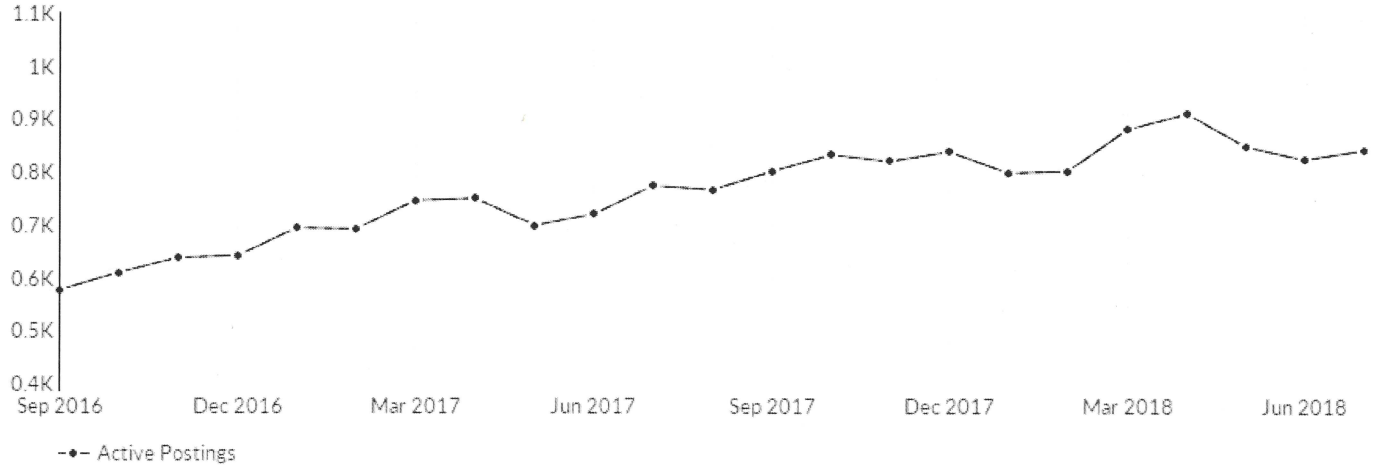
Job Postings Summary

3,803	4 : 1	35 days
Unique Postings	**Posting Intensity**	**Median Posting Duration**
17,095 Total Postings	Regional Average: 4 : 1	Regional Average: 30 days

There were **17,095** total job postings for your selection from August 2017 to July 2018, of which **3,803** were unique. These numbers give us a Posting Intensity of **4-to-1**, meaning that for every 4 postings there is 1 unique job posting.

This is close to the Posting Intensity for all other occupations and companies in the region (4-to-1), indicating that they are putting average effort toward hiring for this position.

Monthly Active Postings



Labor Market Demand - Cont.

Job Postings Regional Breakdown

County	Unique Postings (Aug 2017 - Jul 2018)
Greenville County, SC	2,776
Anderson County, SC	562
Pickens County, SC	238
Laurens County, SC	227

Labor Market Demand - Cont.

Top Companies Posting

Company	Total/Unique (Aug 2017 - Jul 2018)	Posting Intensity	Median Posting Duration
Plastic Omnium Auto Exteriors, L.L.C.	277 / 75	4 : 1	35 days
84 Lumber Company	483 / 58	8 : 1	3 days
Abbott Laboratories	148 / 47	3 : 1	43 days
RANDSTAD HOLDING nv	374 / 46	8 : 1	55 days
Management Recruiters International, Inc.	164 / 43	4 : 1	27 days
First Quality Products, Inc	287 / 42	7 : 1	63 days
GNC Holdings, Inc.	244 / 42	6 : 1	44 days
Think Resources, Inc.	94 / 41	2 : 1	26 days
AVX Corporation	80 / 38	2 : 1	40 days

Labor Market Demand - Cont.

Top Cities Posting

City	Total/Unique (Aug 2017 - Jul 2018)	Posting Intensity	Median Posting Duration
Greenville, SC	8,745 / 1,902	5 : 1	33 days
Anderson, SC	2,179 / 481	5 : 1	41 days
Greer, SC	1,828 / 404	5 : 1	40 days
Simpsonville, SC	1,020 / 171	6 : 1	41 days
Fountain Inn, SC	480 / 147	3 : 1	34 days
Gray Court, SC	433 / 107	4 : 1	33 days
Liberty, SC	412 / 93	4 : 1	48 days
Piedmont, SC	275 / 88	3 : 1	20 days
Easley, SC	277 / 73	4 : 1	32 days
Clinton, SC	283 / 59	5 : 1	45 days

Top Posted Occupations

Occupation (SOC)	Total/Unique (Aug 2017 - Jul 2018)	Posting Intensity	Median Posting Duration
Industrial Engineers	7,102 / 1,513	5 : 1	38 days
First-Line Supervisors of Production and Operating Workers	5,257 / 1,136	5 : 1	33 days
Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products	1,484 / 408	4 : 1	33 days
Industrial Production Managers	1,061 / 260	4 : 1	31 days
Industrial Engineering Technicians	833 / 205	4 : 1	42 days
Engineers, All Other	764 / 154	5 : 1	35 days
Cost Estimators	594 / 127	5 : 1	33 days

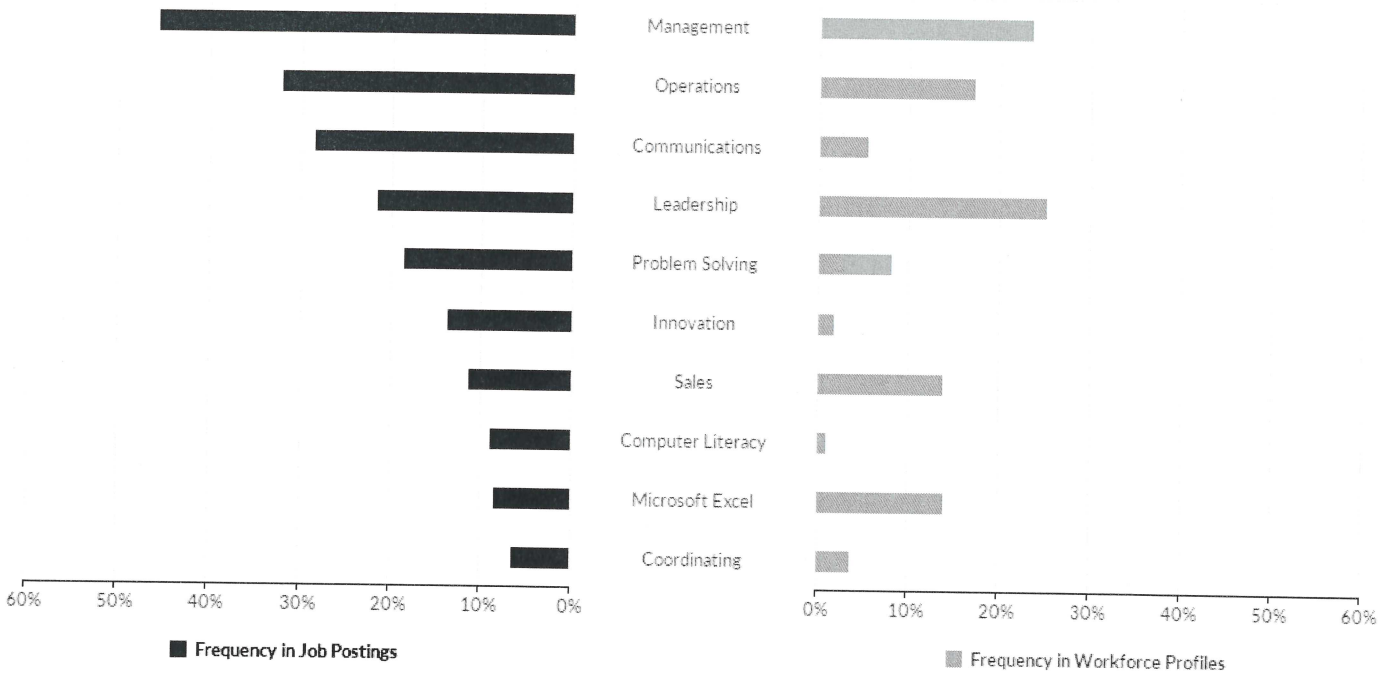
Relevant Skills

Top Hard Skills

Skill	Frequency in Postings	Postings with Skill / Total Postings (Aug 2017 - Jul 2018)	Frequency in Profiles	Profiles with Skill / Total Profiles (2016 - 2018)
Continuous Improvement Process	14%	535 / 3,803	26%	1,829 / 7,012
Lean Manufacturing	14%	525 / 3,803	27%	1,895 / 7,012
Quality Management	13%	486 / 3,803	15%	1,069 / 7,012
Product Quality Assurance	11%	401 / 3,803	8%	534 / 7,012
Auditing	10%	399 / 3,803	7%	466 / 7,012
Packaging And Labeling	10%	394 / 3,803	7%	463 / 7,012
Six Sigma Methodology	8%	321 / 3,803	19%	1,345 / 7,012
Corrective And Preventive Actions	8%	312 / 3,803	4%	294 / 7,012
Pharmaceuticals	8%	308 / 3,803	3%	223 / 7,012
Automation	7%	271 / 3,803	5%	379 / 7,012

Relevant Skills - Cont.

Top Common Skills



Skill	Frequency in Postings	Postings with Skill / Total Postings (Aug 2017 - Jul 2018)	Frequency in Profiles	Profiles with Skill / Total Profiles (2016 - 2018)
Management	46%	1,740 / 3,803	24%	1,648 / 7,012
Operations	32%	1,227 / 3,803	17%	1,205 / 7,012
Communications	29%	1,086 / 3,803	5%	380 / 7,012
Leadership	22%	824 / 3,803	25%	1,772 / 7,012
Problem Solving	19%	709 / 3,803	8%	576 / 7,012
Innovation	14%	521 / 3,803	2%	122 / 7,012
Sales	11%	433 / 3,803	14%	970 / 7,012
Computer Literacy	9%	337 / 3,803	1%	79 / 7,012
Microsoft Excel	8%	323 / 3,803	14%	982 / 7,012
Coordinating	7%	250 / 3,803	4%	266 / 7,012

Relevant Skills - Cont.

Top Qualifications

Qualification	Postings with Qualification
Certified Quality Engineer	66
(American Society For Quality) ASQ Certified	41
Certified Quality Auditor	20
Certified Quality Technician	17
Professional Engineer	12
Master Of Business Administration (MBA)	11
Certified Quality Manager	8
Certified Reliability Engineer	5
Six Sigma Green Belt Certification	5
Licensed Practical Nurse	3

February 16, 2017

Dr. Keith Miller, President
Greenville Technical College
P.O. Box 5616,
Greenville, SC 29606

Dear Dr. Miller and Area Commission Board Members:

Flame Spray North America, Inc. strongly supports the addition of a Bachelors of Applied Science degree in Advanced Manufacturing Technology being offered by Greenville Technical College. Our organization values the strong relationship we have developed with Greenville Tech, through the continuous training we've received for our employees via their Economic Development and Corporate Training divisions.

The content of the program contains many areas that would benefit my organization since we have a highly technical manufacturing process. I'm very excited about the opportunity to see this program is geared toward building strength in mechanical aptitude and teamwork, as well as STEM core knowledge. The quality principles, metrology, process control and improvement, and robot programming built into your curriculum are vital for our long-term success. There is great competition within the Upstate South Carolina region for knowledgeable, flexible individuals with good technical skills.

Our need for qualified advanced manufacturing professionals is only expected to grow. In order to meet this industry need, our employees may require more post-secondary options for advancing their skill level along their career path (going beyond basic operator or even Mechatronics certified). This proposed program is critical and necessary component of that pathway.

Thank you for your time and thoughtful consideration.

Sincerely,

Kathleen S. Edwards

Kathleen Edwards
Quality Manager
Flame Spray North America, Inc.

GE Power & Water

Kurt Goodwin
General Manager
Advanced Manufacturing Works

301 Feaster Road
Greenville, SC 29615
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kurt.goodwin@ge.com

Dr. Keith Miller, President
Greenville Technical College
P.O. Box 5616
Greenville, SC 29606

Dear Dr. Miller:

Greenville Technical College (GTC) has long served as an important partner with General Electric to educate skilled technicians ready for hire and to train our incumbent workforce. From the longstanding Machinist Apprentice Program, and the new Technical Scholars program for maintenance technicians, to the recently opened Center for Manufacturing Innovation, Greenville Tech continues to develop innovative programs to meet our evolving needs.

As General Electric continues to invest in Brilliant Factory technology, to more efficiently and effectively run our manufacturing operations, the technical requirements of incoming graduates continue to increase, especially among manufacturing engineers and others working in the production environment. A four-year degree, focused on advanced manufacturing technology, would provide the multidisciplinary skills needed to thrive in a modern, digitally connected manufacturing plant. A bachelor's degree is also required for promotion to many management or advanced technical positions. I believe an affordable program, offered with flexibility in mind, would be an attractive offering for many of our employees wishing to advance from an associate's degree to a bachelor's degree, furthering their capabilities and careers with the company.

Looking around industry in the US, I expect this will be true for many companies, not just GE.

Greenville Technical College would be the natural choice to deliver this type of program, building on the two-year degrees in industrial trades to a four-year degree in advanced manufacturing technology. A clear and seamless educational progression would be an attractive offering for our associates. Furthermore, with the new CMI facility, Greenville Technical College has the resources and faculty to offer both the theoretical knowledge and hands-on skills required for success in a manufacturing career.

The applied baccalaureate degree at Greenville Technical College would help fill a significant deficit in trained associates, capable of both solving challenging technical problems and implementing real-world solutions. With this new degree offering, we would feel more confident that the local community and our workforce development partners will be able to supply the talent needed for continued investments in advanced manufacturing technology and future employment growth. Of course, there is no guarantee of any specific hiring level or timeline associated with this recommendation, as markets continue cycle in ways we can't fully predict.

Kurt Goodwin, GM
GE Power, Advanced Manufacturing Works

JTEKT Koyo
7 Research Drive
Greenville, SC 29607

Dr. Keith Miller, President
Greenville Technical College
P.O. Box 5616
Greenville, SC 29606

February 15, 2017

Dear Dr. Miller,

JTEKT North America, with 5,400 people and 14 manufacturing facilities, is comprised of companies doing business since 1958, supplying bearings, driveline components, steering systems, and machine tools into a variety of industries. With North American headquarters and a technical center located at Clemson's International Center for Automotive Research, JTEKT North America is very interested in leveraging collaborations around the ICAR campus and the Greenville area.

JTEKT's Greenville Technical Center develops new products and process technologies to maintain competitiveness globally. Part of our role is identifying and developing the capabilities that we need to advance or add in order to meet the needs of current markets or move into new markets. To fulfill that role, then, we need to continually advance the capabilities of our people across a variety of skill sets at a time when we are finding it increasing difficult to find the right depth or mix in certain technical skills.

Our technical experts are typically either graduates of 4 year engineering colleges or technicians that worked their way up from manufacturing and/or have a 2 year technical college degree. Being a manufacturing company, we need our technical experts to either be "hands on" or to apply advanced engineering with a background grounded in real-world manufacturing issues. Given the competition for engineers from traditional 4 year engineering schools, we are having difficulty finding the right candidates quickly enough to meet our needs. In addition, we find that in trying to advance technicians to fill what have traditionally been engineering roles, in technical specialties or technical management, it can be difficult to supplement their capabilities with the skills typically learned in engineering school.

Greenville Technical Colleges' Bachelor of Applied Science in Advanced Manufacturing Technology is attractive to us because it adds study lacking in many 2 year programs, including process control, quality, metrology, and financial concepts. It also offers study in areas of growing importance to us, such as robotics, sensors, and additive manufacturing. In addition, those extra 2 years of study in more advanced subjects help build the problem solving and communication skills of the candidates.

Finally, the affordability and flexibility offered by the program will be an advantage in developing existing employees with 2 year degrees as well as offer a new source of technical talent who want to live and work in the area and are familiar with our brand. We are excited by the potential offered by this degree program.

Lance A. Ferguson

Lance A. Ferguson
Director, Innovation & Capability Development
JTEKT North America – Koyo Bearings

March 17, 2017

Dr. Keith Miller, President
Greenville Technical College
P.O. Box 5616
Greenville, SC 29606

Dear Dr. Miller:

Since Michelin North America made South Carolina our home, we have relied upon Greenville Technical College (GTC) to provide an education that allows us to hire skilled and talented people. Our support for the college's Center for Manufacturing Innovation was an outgrowth of that relationship. We recognize the need to develop innovative solutions to solve many of this state's potential workforce skills gaps. We feel strongly that there is a growing demand to provide for a new degree that would benefit Michelin as well as many other manufacturers in the state if GTC could offer this program.

While the associate degree provides students the skills needed to get hired, a bachelor's degree can support future promotions to management or advanced technical positions. Many of our current employees are interested in a seamless, affordable, and flexible pathway from the associate degree they currently have to the bachelor's degree they wish to obtain.

We would like to see Greenville Technical College offer a Bachelor of Applied Science in Advanced Manufacturing Technology. Using the associate degree in industrial technologies as a building block, our employees could gain knowledge of quality management, advanced robotics, manufacturing management, process control, and other skills to earn a bachelor's degree and step into leadership roles. Employees with this skill set will give us a competitive advantage. Without this degree, those who have an associate degree in industrial technologies can advance to the bachelor's degree level only by starting their college education over in an engineering or business major. This obstacle prevents many promising employees from earning the degree and skillset they need to advance with Michelin, and it keeps our company from providing pathways to promotion for a number of valuable people.

We know that you see merit in meeting workforce needs, as we do, through innovative solutions. The applied baccalaureate degree at Greenville Technical College would allow employees with associate degrees to move from a two-year degree to a four-year degree in a continuous manner and thus strengthening our competitive edge. Equipped with this new educational option, Greenville Technical College would once again be positioned to help us meet our workforce needs and to ensure our company's future prosperity while at the same time continuing to make GTC a recognized leader in education.

Michael O. Williams
Workforce Development Coordinator

Michelin North America, Inc.

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RENISHAW
apply innovation

February 8th 2017

David Clayton

Executive Director
Center for Manufacturing Innovation
AVP, Greenville Technical College
PO Box 5616
Greenville, SC 29606-5616

Dear Mr. Clayton,

Upon reviewing the briefing document provided to us for the proposal of a Baccalaureate in Applied Science – Advanced Manufacturing Technology at Greenville Technical College, I am pleased to say that Renishaw Inc. would support and encourage this program.

With over 40 years supporting Apprenticeships in the United Kingdom, Renishaw strongly believe in the benefits of practical and classroom learning up to degree level.

Greenville Technical College have the facilities, the knowledge and the passion to deliver this program to a high standard ensuring the future needs of the regions manufacturing industry, including Renishaw are met.

Kind Regards,

Bill Cox
District Solutions Manager

Lucy Ackland
Senior Development Engineer

Southern Weaving
We have you covered.

February 20, 2017

President Keith Miller, PhD
Greenville Technical College
506 S. Pleasantburg Drive,
Greenville, SC 29607

President Miller:

I am writing on behalf of Southern Weaving Company in support of your proposed Bachelors of Applied Science degree in Advanced Manufacturing Technology. Southern Weaving has worked alongside Greenville Technical College for a number of years. We have employed graduates from your institution, and we have at least one employee currently enrolled in a two-year course of study. Moreover, your corporate and continuing education department has provided multiple workforce training sessions for our current employees in the areas of ISO, Problem Solving, Mechatronics, management and leadership, and a host of other areas of need.

We believe there is a compelling need for this program, and are in full support of the launching of this program of study. The proposed program is exciting as it seeks to unite two of the Upstate's most important needs: advanced hands on experience in the skill trades, and learning opportunities for students that integrates research and advanced technologies in your world class CMI facility.

The advanced manufacturing economy here in the Upstate could benefit greatly from this offering, and Southern Weaving in particular would be interested in the graduates the program would produce.

Thanks you for your attention to this letter of support, and please call on me anytime.

Sincerely,

Robyn Knox

Robyn Knox, SHRM-SCP, SPHR
Vice President of Human Resources
Southern Weaving

SOUTHERN WEAVING
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