Columbia Gorge Community College

Electro-Mechanical Technology

PROGRAM REVIEW 2023

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Introduction

Columbia Gorge Community College's (CGCC) Electro-Mechanical Technology (EM-Tech) program in its present configuration is the result of the continuous evolution and improvement of the previous Renewable Energy Technology (RET) program, itself a revised version of a traditional Electronics Engineering Technology (EET) program. As industries in the Columbia River Gorge changed so to did the program to meet the needs of the technical workforce. In addition to receiving the American Wind Energy Association (AWEA) seal of approval the EM-Tech program has been regularly involved with the National Science Foundation Advanced Technological Education (NSF ATE) and was awarded two grants to develop online resources to support the flipped classroom method of teaching technical subjects. This report provides comprehensive review of the period since the 2017 program review.

Section One: Mission and Goals

Mission

The mission of Columbia Gorge Community College's Electro-Mechanical Technology program is to offer premier workforce training for students interested in a career in power generation and transmission, advanced manufacturing, avionics, engineering, and other industries that make extensive used of automated electro-mechanical technologies. To that end, the program provides hands on training using real industrial equipment and instrumentation and applications.

Program Alignment with CGCC Mission/Strategic Priorities

CGCC Mission: Columbia Gorge Community College builds dreams and transforms lives by providing lifelong educational programs that strengthen our community.

The EM-Tech program provides students at all stages of life with solid exposure to core technical skills valued by numerous technical industries that make their home in the Columbia River gorge. Graduates of the EM-Tech program obtain high wage jobs and contribute to the economic success of the larger community.

Strategic Priorities: CGCC Strategic Priorities provide a direction for the college's continued development in order to meet the needs of an always evolving student population and community.

- Fiscal Responsibility and Sustainability — EM-Tech classes emphasize efficiency, maintenance, and cost benefit analysis scenarios as they relate to various industrial applications. Students are encouraged to develop effective trouble shooting strategies and think how technicians support the larger business model of a company.

- Student Success — EM-Tech classes are designed to expose students to not only theory but also practical hands on application of these concepts using real world industrial equipment, instrumentation, and applications. Hands on labs and troubleshooting exercises are an essential component of instruction. Based on feed back from the advisory committee and the NSF ATE the EM-Tech program continually updates class content to reflect changes in industry and technology.

- Diversity, Equity and Inclusion — The EM-Tech program was an early adopter of the flipped classroom approach to teaching technical subjects whereby theoretical content is presented using free online lectures and hands-on application takes place in a safe and supportive lab environment. The online lectures reduce text book expense and can be revisited to support the learning process.

- Community Connections — The EM-Tech advisory committee consists of numerous technical industries that make their home in the Columbia River gorge. The advisory committee keeps faculty informed of industry trends and necessary skill sets for technicians as well as provide feedback about how the program can meet those goals most effectively.

Previous Review's Goals, Action, and Analysis

A. 2017 EM-Tech Program Review

2017 Goals	Actions	Results	Analysis
1. Apply for and receive a second NSF ATE grant to continue to develop flipped classes in the second year of the program and to purchase state of the art equipment aligned with local industry.	2018 and 2019 grant submissions were denied funding. 2020 application was awarded however was not funded until January 2021. 4 days after receipt of grant Building 10 experienced a major flood. Grant progress was significantly delayed for a period of one year.	Goal met with a significant delay	Grant will fund continued development of online content for second year. Equipment grant not funded. Delayed award and flood will cause a significant delay in consolidation and course development.
2. In collaboration with SOAR, target market the program to incumbent workers including USACE and partner businesses such as Cardinal Glass.	USACE has established a formal relationship with the EM-Tech program for power plant trainees. Cardinal Glass, Full Sail, and Turtle Island continue to send technicians to program. This was due to efforts within the EM-Tech program and not a result of college level marketing effort.	Goal met	Hybrid (flipped classroom) format is an attractive option for incumbent workers and apprentices. Second year courses need to adopt this format. CGCC needs to develop a solid college lead marketing effort and web presence.
3. Continue with course development, consolidation and exploring offering specialized options.	Two first year mechanics classes have been consolidated into one class. First year Hydraulics course expanded to include pneumatics. New classes include technical math, industrial computing, and mechatronics classes in the first year. New instructor has updated course content and labs for semiconductor devices and circuits series, PLCs, and industrial control	Goal met for first year courses. Continued development must occur for second year.	Second year PLC, digital logic, and industrial control classes should be consolidated. Power generation and transmission course should be expanded. Specialized options remain financially and operationally out of reach at this point.
4. With double labs for all first-year courses and some second year, consider a third full-time faculty for the program to meet instructional needs.	Low pandemic and post pandemic enrollment have resulted in a limited number of double labs. Chris Spengler was hired as a part time instructor. Kalie Brunton was hired as a full-time instructor to replace an	Goal met	Low post pandemic enrollment is allowing an opportunity for course development and update.

	instructor who retired at the end of the 21-22 academic year.		
5. Provide relevant faculty development opportunities.	Faculty attended NSF ATE funded training for Low Cost Mechatronic Trainer (LCMT) and solar power. COVID prevented attendance at the Hands on Relay School. Faculty will be attending NSF ATE high vacuum pump and instrumentation training summer 2023.	Goal met	LCMT project was abandoned during COVID. Solar and battery chargers incorporated into power generation. Instrumentation trainer will be incorporated into industrial controls class.

Additional goals from EM-Tech mid-review Progress Reports:

Mid-Review Goal	Actions	Results	Analysis
Include a technical math class in the first year. Consult with math department to determine exact skills relevant to EM-Tech program. Streamline math skills and prerequisites for students entering the program.	Worked with math department to identify specific math skills relevant to EM-Tech program and developed MTH110 Technical math course.	Goal met	MTH110 Technical math course continues to evolve to meet the needs of the students enrolled in the EM-Tech program.

B. Additional actions taken by EM-Tech faculty not based on prior review goals:

Early in this review period as the RET program transitioned into the present EM-Tech configuration contents of RET101 and RET102 were rolled into the RET223 Power Generation class.

Based on feedback from the EM-Tech advisory committee the course content and outcome guides of the semiconductor devices and circuits series (EET221 and 231) and Industrial Computing (EET180) courses were revised to reflect updated applications and increase relevancy. Additionally, UAS101 was updated to include photogrammetry and allowed as a substitute for EET242 Microcontrollers which was not valued by members of the advisory committee.

SAF188 Industrial Safety dropped to 1 credit and delivered using 2 day compressed format by OSHA instructor. This allows individuals outside of the EM-Tech program to enroll in class.

Section Three: Current Department Assessment – Describe, Assess, Analyze & Identify Needs

A. Student Learning

1. EM-Tech Course-Level Outcome Achievement

Course: RET223 Power Generation
Term: Fall 2017
Instructor: Pytel
Outcome Achievement: 100%
Assessment Driven Changes Required: Too many subjects to fit in one class. Should be expanded.
Adjustments Made: Gauge interest level of students to determine topics of focus. Hybrid format with a heavy focus on lab seems to work well.

Course: MEC122 Mechanics 2
Term: Spring 2017
Instructor: Lieurance
Outcome Achievement:
Assessment Driven Changes Required: Poorly organized and implemented course. Can be consolidated into one well taught mechanics course.
Adjustments Made: Course terminated.

Course: MEC123 Industrial Mechanics
Term: Fall 2018
Instructor: Spengler
Outcome Achievement: 100%
Assessment Driven Changes Required: First attempt at consolidated mechanics course.
Adjustments Made: Presentations enhanced and labs reorganized for smaller groups to allow more exposure to equipment.

Course: EET221 Semiconductor Devices and Circuits 1
Term: Fall 2018
Instructor: Lieurance
Outcome Achievement: 80%
Assessment Driven Changes Required: Students did not engage well using existing format and structure. Labs disorganized and excessively lengthy.
Adjustments Made: Instructor recognized the need to place theoretical content online and make lab time more efficient. Did not implement these changes.

Course: EET113 Electrical Circuit Analysis 3
Term: Spring 2020
Instructor: Pytel
Outcome Achievement: 80%
Assessment Driven Changes Required: Very small COVID cohort and lacking in confidence. Labs isolated and did not work in teams. Need to revisit overlapping content in EET170 Industrial Computing to ensure students enter class with a basic understanding of spreadsheet software.
Adjustments Made: Industrial computing course content reorganized in Winter 23.

Course: EET111 Electrical Circuit Analysis 1
Term: Fall 2020
Instructor: Pytel
Outcome Achievement: 100%
Assessment Driven Changes Required: None.
Adjustments Made: None.

Course: EET222 Semiconductor Devices and Circuits 2
Term: Winter 2021
Instructor: Lieurance
Outcome Achievement: 94%
Assessment Driven Changes Required: As previously, students did not engage well using existing format and structure. Labs disorganized and excessively lengthy.
Adjustments Made: Instructor recognized the need to place theoretical content online and make lab time more efficient. Did not implement these changes.

Course: EET252 Digital Logic 2
Term: Winter 2021
Instructor: Spengler
Outcome Achievement: 90%
Assessment Driven Changes Required: Students necessitated more review of quizzes and exams.
Adjustments Made: Instructor added Moodle quizzes to assigned online lectures and started using Moodle grade sheet.

Course: EET221 Semiconductor Devices and Circuits 1
Term: Fall 2021
Instructor: Lieurance
Outcome Achievement: 75%
Assessment Driven Changes Required: As previously, students did not engage well using existing format and structure. Labs disorganized and excessively lengthy.
Adjustments Made: Instructor recognized the need to place theoretical content online and make lab time more efficient. Did not implement these changes. Former instructor retired and new instructor reformatted EET221 and included relevant modern power electronics applications.

Analysis and Adjustment Summary: The EM-Tech program necessitated a new faculty member to implement changes that have been suggested for a number of courses. The new instructor has reorganized the semiconductor devices and circuits series to reflect modern power electronics applications. Additionally, well organized labs strongly support the learning process. Finally, EET170 was terminated and an instructor with a computing background took over and reorganized the industrial computing class to better reflect advisory committee guidance resulting in the present EET180 configuration.

2. EM-Tech Degree/Certificate/Program-Level Outcomes

Outcome	2017-2018 Average Score 'C' or higher	2018-2019 Average Score 'C' or higher	2019-2020 Average Score 'C' or higher	2020-2021 Average Score 'C' or higher	2021-2022 Average Score 'C' or higher
1. Qualify for employment in the electromechanical field as entry-level operators.	90%	100%	100%	80%	100%
2. Assist technicians with the repair, servicing, and manufacturing of electro-mechanical systems by applying basic knowledge of electrical, electronic, mechanical, and hydraulic/pneumatic concepts.	90%	100%	100%	80%	100%
3. Communicate effectively both at the individual level and within team settings.	90%	100%	100%	80%	100%
4. Qualify for employment in the high tech field as electronics technicians.	90%	100%	100%	80%	100%

Table 1: EM-Tech Certificate Program Level Outcomes

Outcome	2017-2018 Average Score 'C' or higher	2018-2019 Average Score 'C' or higher	2019-2020 Average Score 'C' or higher	2020-2021 Average Score 'C' or higher	2021-2022 Average Score 'C' or higher
1. Qualify for employment in the electro-mechanical field as technicians.	100%	100%	100%	100%	100%
2. Service/repair electro-mechanical systems and assist engineers with the design of electro-mechanical systems by applying knowledge of electrical, electronics, mechanical, control systems and hydraulic/pneumatic concepts.	100%	100%	100%	100%	100%
3. Apply basic operations management practices and principles in an advanced manufacturing environment.	100%	100%	100%	100%	100%
4. Control computer-driven devices through programming in the C language.	100%	100%	100%	100%	100%

Table 2: EM-Tech AAS Degree Program Level Outcomes

Analysis: High success rate in degree is reflective of those individuals that did not succeed in certificate dropping out. The 2020 certificate cohort experienced a high withdraw and failure rate due to COVID related social and financial complications.

3. EM-Tech Institutional Learning Outcomes

Insitutional Learning Objective	Term	Course	Evaluation Method
1) Communication: Communicate effectively using appropriate reading, writing, listening, and speaking skills.	Fall 2021	EET 221	Writen and oral reports, evaluate observed results and compare with theoretical expectations.
2) Critical Thinking and Problem Solving: Creatively solve problems by using relevant methods of research, personal reflection, reasoning, and evaluation of information.	Fall 2021	EET 221	Lab presents troubleshooting challenges. Challenges are examined using theoretical background and instrumentation.
3) Quantitative Literacy: Extract, interpret, evaluate, communicate, and apply quantitative information and methods to solve problems, evaluate claims, and support decisions in their academic, professional and private lives.	Fall 2021	EET 221	Electrical circuit analysis, recognize when observed results do not correlate with theoretical expectations. Predict outcome and record results.
4) Cultural Awareness: Use an understanding of cultural differences to constructively address issues that arise in the workplace and community.	Fall 2021	EET 221	Students work in group setting and interact with one another to achieve the same goal.
5) Community and Environmental Responsibility: Recognize the consequences of human activity upon our social and natural world.	Fall 2021	EET 221	Emphasizing energy efficiency in applications.

Table 3: Institutional Learning Objectives

Analysis: Too much emphasis is placed on a single course (EET221) to meet Institutional Learning Objectives. The contribution of other courses should be emphasized in later program reviews. For example Electrical Circuit Analysis 1 and Power Generation and Transmission both deal with efficiency and renewable energy (ILO 5) and Mechanics, Motor Control and Mechatronics place a heavy emphasis on working in groups (ILO 4).

4. EM-Tech Completion Rates

Completion data in RougeNet appears to be seriously flawed compared to personal records. Tables 4-5 present RougeNet data. Table 6 presents personal data.

Cohort Term	150% Grad Term	Cohort Headcount	Graduation Headcount	Graduation Rate
Fall2018	Winter2019	1	1	100%
Fall2019	Winter2020	1	0	0%
Fall2022	Winter2023	1	NA	NA

Table 4: EM-Tech Certificate Completion Rates

Cohort Term	150% Grad Term	Cohort Headcount	Graduation Headcount	Graduation Rate
Fall2017	Summer2020	9	6	66.67%
Fall2018	Summer2021	11	7	63.63%
Fall2019	Summer2022	12	3	25%
Fall2020	Summer2023	5	1	20%
Fall2021	Summer2024	5	NA	NA
Fall2022	Summer2025	7	NA	NA

Table 5: EM-Tech AAS Degree Completion Rates

COHORT	ENROLLED	AAS	CERTIFICATE	WORKER	FAIL WITHDRAW DECEASED	COMPLETION RATE
2017	21	12	4	0	5	76%
2018	21	10	4	2	5	76%
2019	30	19	3	4	4	87%
2020	12	4	1	1	6	50%
2021	12	10	1	0	1	92%

Table 6: EM-Tech Completion Rates from Personal Records

Cohort Term	Graduated Headcount	Average GPA
Fall2018	1	3.72
Fall2019	0	
Fall2022	NA	

Table 7: EM-Tech Certificate Average GPA

Cohort Term	Graduated Headcount	Average GPA
Fall2017	6	3.38
Fall2018	7	3.63
Fall2019	3	3.79
Fall2020	1	3.44
Fall2021	NA	
Fall2022	NA	

Table 8: EM-Tech AAS Degree Average GPA

Analysis: Several cohorts experienced major financial and social challenges during COVID. The completion rates are shockingly low and I suspect the data is flawed. For this reason, I researched personal records and presented this data as a comparison in Table 7. Similar conclusions were reached. The challenges of COVID resulted in low completion rates for the 2020 cohort. Completion rates seem to have recovered for the most recent cohorts. Average GPAs remain relatively high. The flipped classroom approach allows repeat exposure to theoretical content. Individuals that pass the course do so with As or Bs. Individuals that fail a course do so with Fs. Very few, if any, Cs are earned in courses employing this method.

B. EM-Tech Curriculum

1. Alignment with professional and national standards and/or university transfer

EM-Tech courses are continually updated to meet the evolving needs of industry and technology. An effort was made to streamline program structure to allow students to rapidly progress through the 9 month certificate. The 2 first year mechanics courses were consolidated into one well organized industrial mechanics course. Pneumatics was added to the fluid power course. The mechatronics course was developed to be a synthesis of electrical, mechanical, fluid power, and motor control courses. Safety was redesigned to be delivered by an OSHA certified instructor in a compressed 2 day format. The poorly received EET170 course was scrapped and completely redesigned by the business pathways department to better reflect those skills desired by the EM-Tech advisory committee. Lastly, technical math was developed by the math department to concentrate exclusively on those math skills necessary for success in the EM-Tech program.

Major changes were recently instituted in the semiconductor devices and circuits series to reflect a modern approach to relevant power electronics applications. The remaining second year courses need this level of inspection. The digital logic, PLCs, and industrial control courses can be consolidated and use the PLC as the instructional platform. The Power Generation and Transmission class could be expanded to allow students more exposure to DFIG, PM synchronous generation, HVDC, industrial wind power, and protective relays.

The EM-Tech advisory committee was recently reformed 31 May 23. The attendees appreciated the updates to the program and supported the proposed consolidation and expansion proposals.

2. EM-Tech Enrollment

Table 8, below, represents total enrollment in all EET, MEC, SAF, and RET courses in the EM-Tech program.

2017-18	2018-19	2019-20	2020-21	2021-22
460	365	476	362	229

Table 8: EM-Tech Enrollment

Analysis: The EM-Tech program experienced low enrollment during the COVID pandemic however seems to have returned to half capacity. Members of the advisory committee routinely have more technician positions available then CGCC is capable of producing graduates. Positive efforts are underway at CGCC to develop an outreach and marketing effort however these efforts may not yield results until next, next academic year (24-25). Additionally, CGCC's web and social media presence necessitates significant work to emphasize EM-Tech offerings.

Age, Gender and Race: EM-Tech cohorts have historically been populated with young, white males. The 2019 cohort welcomed a group of displaced incumbent workers from Work Source Oregon as part of the Trades Act. They were above the average age of a typical cohort. Their professional demeanor was appreciated and they integrated well with the rest of the group. Females represent only 8.3% of the population. Hispanic enrollment over the 5 year review period was 18.8% however the 2021 cohort was 33.3% Hispanic. It is not known if this will be a continuing trend.

During the 31 May 23 EM-Tech advisory committee meeting numerous employers mentioned the inability of incoming workers to find housing. For this reason, they have tried to promote from within their existing workforce. Unfortunately, a significant percentage of their workers do not speak English. For this reason, several are considering establishing English language classes at the workplace to prepare these individuals for future technical roles. As part of a disability survey the EM-Tech program requested assistance in translating and transcribing contents of the online lectures into Spanish.

C. EM-Tech Teaching and Faculty Development

1. Incorporation of instructional best practices and effectiveness on student learning.

EM-Tech faculty stay up to date and employ best practices in both course content, design and delivery. Faculty keep course content relevant by teaching skills as they are used in industry today. Additionally, a majority of first year courses are delivered in the hybrid format using OERs allowing students repeat exposure to theoretical content and more flexibility to accommodate their daily life.

2. Professional development activities and effectiveness to improve teaching and learning.

EM-Tech faculty have taken advantage of numerous professional development offerings at the NSF ATE including but not limited to solar power, batteries, HMI design, IoT, high vacuum, and instrumentation workshops. While a majority of this training is funded by the NSF ATE, CGCC is typically tasked with travel expenses if the workshop is remote.

3. Faculty contributions to CGCC's mission and vision via outreach.

EM-Tech instructors are active members of the greater Gorge community and routinely interact with employers and the NSF ATE, Gorge Technical Alliance (GTA), Renewable Northwest Project (RNP), and other advocacy groups. Faculty submitted letters of support for the proposed solar project and pumped hydro facility in Goldendale as well as the proposed underwater HVDC cable.

4. Balance of full- and part-time faculty.

The EM-Tech program directly employs 2 full time faculty and 1 part time faculty. The program additionally necessitates a contracted OSHA certified instructor for the Safety class, a math instructor for the Technical Math class, a business pathways instructor for the Industrial Computing class and an instructor for the UAS class.

- **Jim Pytel – Full Time Instructor**
  - Electrical Engineering, Clarkson University, Potsdam, NY
- **Kalie Brunton – Full Time Instructor**
  - Renewable Energy Technology, CGCC, The Dalles, OR
- **Chris Spengler – Part Time Instructor**
  - Renewable Energy Technology, CGCC, The Dalles, OR

As EM-Tech courses are consolidated in the near future Chris Spengler has expressed his interest in teaching less. When he does make the decision to end his relationship with CGCC the EM-Tech program will need to find a part time mechanics instructor as the 2 full time faculty have expressed their inability to properly teach this course. Chris would consider staying on as part time if he was capable of acquiring employee funded insurance.

EM-Tech Budget

Equipment - During this review period the EM-Tech program experienced a flood in Building 10 that resulted in the almost total destruction of the 2 bench labs and central storage room. While the flood did significantly delay progress on the NSF ATE grant deliverables and complicate instructional delivery for over a year the insurance settlement ultimately resulted in a significantly better equipped program moving forward. Additionally, Green Diamond donated $22k to the program to acquire equipment. Not only was the program capable of updating the bench top instrumentation it also purchased electromechanical simulation software and pneumatic trainers that will be used as a platform to instruct basic and advanced skills such as electrically controlled pneumatics, PLC controlled applications, and pneumatic proportional valves or servo systems. Ordinarily such a quantum leap in technology would have taken several years or several grants to acquire. For this reason, the large equipment needs of the program will be unusually low for the near future. This pause is only temporary in nature. As technology continues to evolve we will require investments in the future to keep the program up to speed. Budget will still need to be allocated for maintenance and repair as usual. In the near future, when the program adopts an updated Industrial Controls course, money will need to be allocated for small instrumentation trainers. The trainers are part of the NSF ATE iMEC program and cost approximately $1200 each. The program may necessitate 12 of these trainers for a total of approximately $15,000. Some of this might be funded via the Perkins grant.

Faculty – Kalie Brunton's full time position is presently grant funded. She replaced Tom Lieurance's school funded full time position that retired in 2022. As part of the grant application, CGCC's president signed a letter of support indicating the school would hire her full time upon completion of the grant. During the period of the grant she will be consolidating and updating several courses and expanding others. Once this effort is completed a part time instructor will still be required for the mechanics course preferably the program can retain Chris as a part time instructor.

Travel/Training – EM-Tech faculty have attended numerous NSF ATE funded workshops. The cost for these workshops are ordinarily covered by the NSF ATE however travel is customarily not covered. For this reason, the EM-Tech program needs to budget for at least one annual travel for each faculty member. Brookfield Renewables recently gave the EM-Tech program a donation of $10k. These resources are being used to fund travel to training events. It is not known at the time if Brookfield will continue this annual donation.

Section Four: Goals

The EM-Tech goals for the next five-year period are as follow:

1. **Expand Power Generation and Transmission class:**

   Employers at the EM-Tech Advisory committee involved in renewable energy production and transmission strongly recommended the existing RET223 Power Generation to include PM synchronous generators, DFIG, HVDC transmission, protective relays, and industrial wind power.

2. **Consolidate PLCs, digital, and industrial control into a cohesive 3 course series:**

   No regional employers make use of TTL or FPGA digital logic hardware on a technician level however a majority of them do make use of PLCs. For this reason, the digital logic course should be taught using the PLC platform with occasional use of alternate platforms. Additionally, the PLC can be used in the industrial controls course. This series will allow students to be exposed to not only LAD but also SFC, STL, FBD, and HMI programming.

3. **Adopt hybrid format for second year courses**

   Building off the success of adopting the hybrid format for the first-year courses, the EM-Tech program needs to adopt this same format for the second-year classes. Classes should incorporate video lectures, interactive online quizzes, take home exercises, and well-organized hardware labs.

4. **Incorporate Electro-Mechanical simulation software into instruction:**

   As part of the insurance settlement the EM-Tech program purchased an electro-mechanical simulation software program, Automation Studio. This software allows a student to remotely build and simulate electrically controlled systems. The intent would be incorporate this tool into a majority of classes and labs to allow more exposure to electro-mechanical applications.

5. **Increase enrollment in EM-Tech program:**

   Work with CGCC marketing and recruitment team and website developers to increase enrollment in EM-Tech program. Host facility tours for local high schools and shop instructors. Research non-traditional enrollment possibilities such as incumbent worker training and Work Source. Collaborate with ESOL and Community Education to develop ESOL classes with regional employers. Recruit female students to the EM-Tech program.

6. **Research technical electives:**

   Employers in the EM-Tech advisory committee represent numerous divergent technical fields. While a majority of the skill set is shared (electrical, mechanical, hydraulics, pneumatics, motor control) different industries require different specialized skills. For this reason, the EM-Tech program should research the feasibility of offering technical electives. The advisory committee suggested the following possibilities: programming (Python), instrumentation and process control, load handling and forklift certification, Network+ certification, IPC certification, HVAC and refrigeration, robots, 3d modeling software, and welding.

7. **Develop general electives relevant to technician roles:**

   Employers in the EM-Tech advisory committee requested general electives relevant to technician roles specifically technical writing, interpersonal communication, business practices, and project management. The EM-Tech program is in close communication with the Business Pathways department to develop these suggested courses. Opportunities exist in both departments to be supportive of these goals. For example EM-Tech students can be tasked to do a presentation in a technical class or asked to write about a technical topic in a general education class.

8. **Rewrite EM-Tech program outcomes:**

   With EM-Tech Advisory committee assistance rewrite EM-Tech program outcomes to better reflect the updated course content and outcomes.

Section Five: Achievements, Celebration, and Recognition

1) Achievement of the second NSF ATE grant will see more of the program placed in the hybrid format. Additionally, the grant has brought a fresh, motivated instructor to the program with relevant experience in modern power electronics applications. The PIs attendance at the annual NSF ATE PI Conference has resulted in an invitation to attend NSF ATE sponsored high vacuum pump training

2) Adoption of the hybrid format for a majority of first year classes and employing OERs has contributed greatly to student success. Students are allowed repeat exposure to theoretical content and class time can be devoted to hands on applications. Those individuals that pass a class often do so with As or Bs. Students genuinely seem to enjoy this approach and allows incumbent workers to enroll in the program.

3) Outsourcing the technical math, safety, and industrial computing course to subject matter experts in the math, safety, and business pathway realms allows for extremely high-quality instruction and frees EM-Tech faculty to work on their own areas of expertise.

4) Recovering from the flood has positioned the EM-Tech program with updated equipment and instrumentation to meet modern challenges. Significant progress has already been made in updating the semiconductor devices and circuits and PLCs classes to incorporate the new hardware and applications.

5) USACE has entered a formal relationship with the EM-Tech program to enroll power plant trainees in the program on a part time basis.

6) EM-Tech graduates continually experience high employment rates. Members of the EM-Tech advisory demonstrate preference in hiring CGCC graduates. First year students have gained internships at ANPC, Trillium, and HP.