

California State Polytechnic University, Pomona



**Abbreviated Academic Program Review Self-Study
College of Engineering
Department of Mechanical Engineering
BS Mechanical Engineering
(ABET accredited)**

AY 2023-2024

February 22, 2025

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1 PROGRAM EVALUATION – BS MECHANICAL ENGINEERING

Table 1 provides data associated with high non-passing rates. It is important to note that the numbers reported below are based on filtering the data by major, so only students enrolled as a Mechanical engineering major are included in the counts.

Table 1 – High – DFW’s by Non-Pass Rates for 2018-2023¹

Non-Passing					
Year Term	Course Code	Course Title	Enrollment	Non-passing Rate	Impact
All Academic Years - Semester	ME4160	Intermediate Dynamics	45	56%	25
All Academic Years - Semester	ME2150	Vector Dynamics	1926	37%	708
All Academic Years - Semester	ME3190	Stress Analysis	1969	33%	643
All Academic Years - Semester	ME2191	Mechanics of Materials	2038	29%	599
All Academic Years - Semester	ME2141	Vctr Statics Strength of Mtrls	1836	28%	514
All Academic Years - Semester	ME4110	Heat Power	153	22%	34
All Academic Years - Semester	ME3011	Thermodynamics	1741	21%	373
All Academic Years - Semester	ME4080	Nuclear Engineering	186	21%	39
All Academic Years - Semester	ME4120	Internal Combustion Engines	87	20%	17
All Academic Years – Semester	ME2990	Spec Topic For Ld Students	284	17%	47
All Academic Years – Semester	ME3121	Int Thermal-Fluids Egr	1327	16%	212
All Academic Years – Semester	ME4131	Mechanical Vibrations	275	16%	45
All Academic Years – Semester	ME2990A	Spec Topic For Ld Students Act	94	15%	14
All Academic Years – Semester	ME3401	System Dynamics	1626	14%	235
All Academic Years – Semester	ME4150	Heat Transfer	1347	14%	187
All Academic Years - Semester	ME4060	Finite Element Analysis	1319	14%	185
All Academic Years - Semester	ME4060A	Finite Element Anlys Activity	1318	14%	181
All Academic Years - Semester	ME4050	Acoustics and Noise Control	29	14%	4
All Academic Years - Semester	ME3111	Fluid Mechanics	1498	11%	167
All Academic Years - Semester	ME4271	Thermal Systems Design	1170	10%	118
All Academic Years - Semester	ME4990L	Spec Topic For Ud Students Lab	91	10%	9
All Academic Years - Semester	ME1001L	Egr Graphics and Vslztn Lab	1847	9%	175
All Academic Years - Semester	ME4391	Control of Mechanical Systems	1288	9%	117
All Academic Years - Semester	ME1101	Computer-Aided Computations	1554	8%	130
All Academic Years - Semester	ME1101L	Cmptr-Aided Computations Lab	1559	8%	130

¹ CSU Dashboard “In Which Courses Do They Struggle” Report
<https://csusuccess.dashboards.calstate.edu/public/faculty-dashboard/where-do-they-struggle>

Figure 1 depicts the Mechanical courses with the largest equity gaps for URM and non-URM students for all terms from 2018-2023. Figure 2 depicts the Mechanical courses with the largest equity gaps for Pell recipients and non-Pell recipients. The scale uses grades (1 = D; 2 = C; 3 = B; 4 = A).

Figure 1– Courses with the Largest Equity Gaps by URM Status for Mechanical²

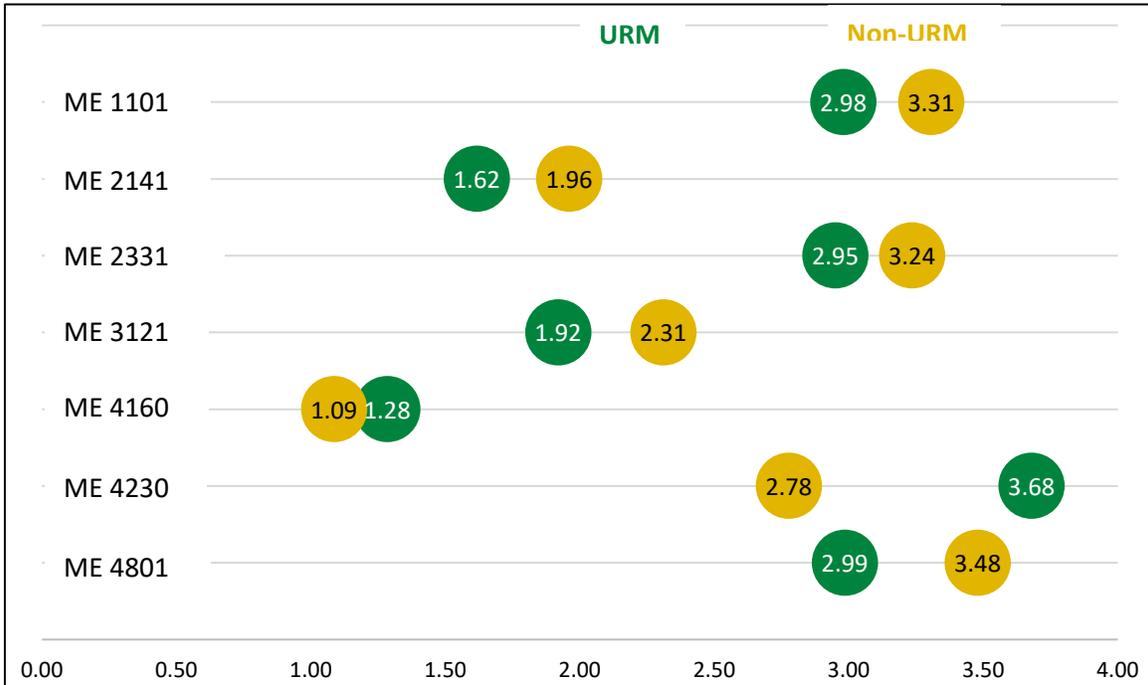
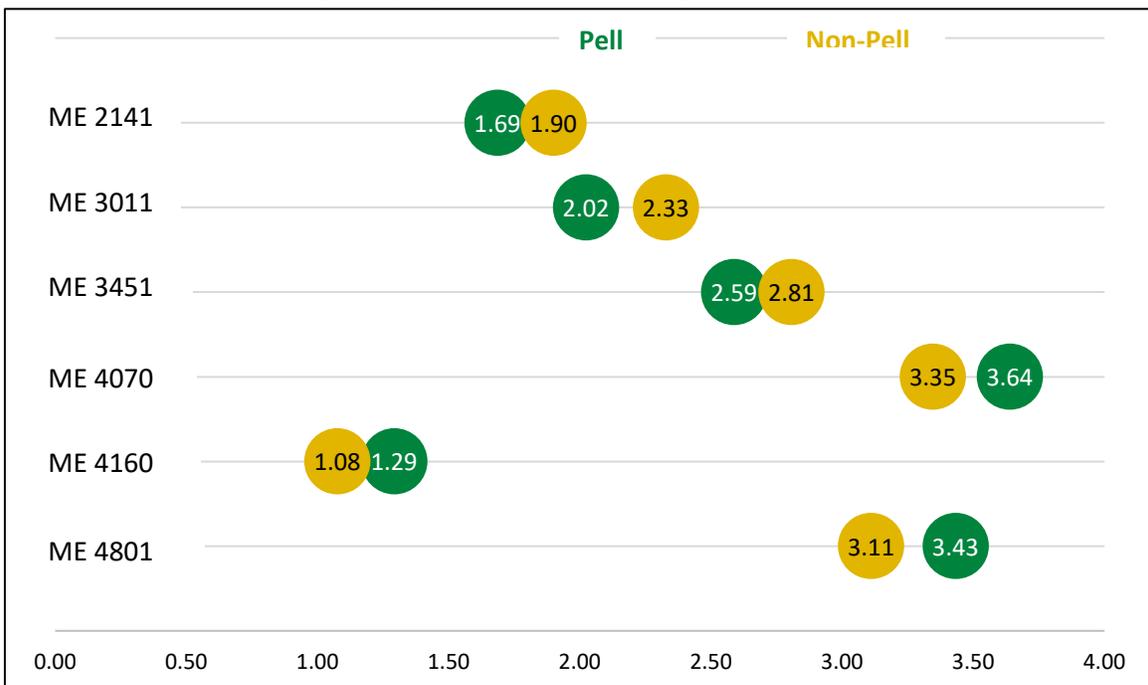


Figure 2– Courses with the Largest Equity Gaps by Pell Status for Mechanical³



² Source: Tableau <https://analytics.cpp.edu/#/site/production/views/CourseEquityGaps/EquityGaps?iid=1>

³ Source: Tableau <https://analytics.cpp.edu/#/site/production/views/CourseEquityGaps/EquityGaps?iid=1>

The CPP Mechanical Engineering program, like many mechanical engineering programs, has a large number of bottleneck courses with high DFW rates. Additionally, Figures 1 and 2 show that some bottleneck courses have significant equity gaps. The department is attempting to address bottleneck courses and equity gaps in the following ways:

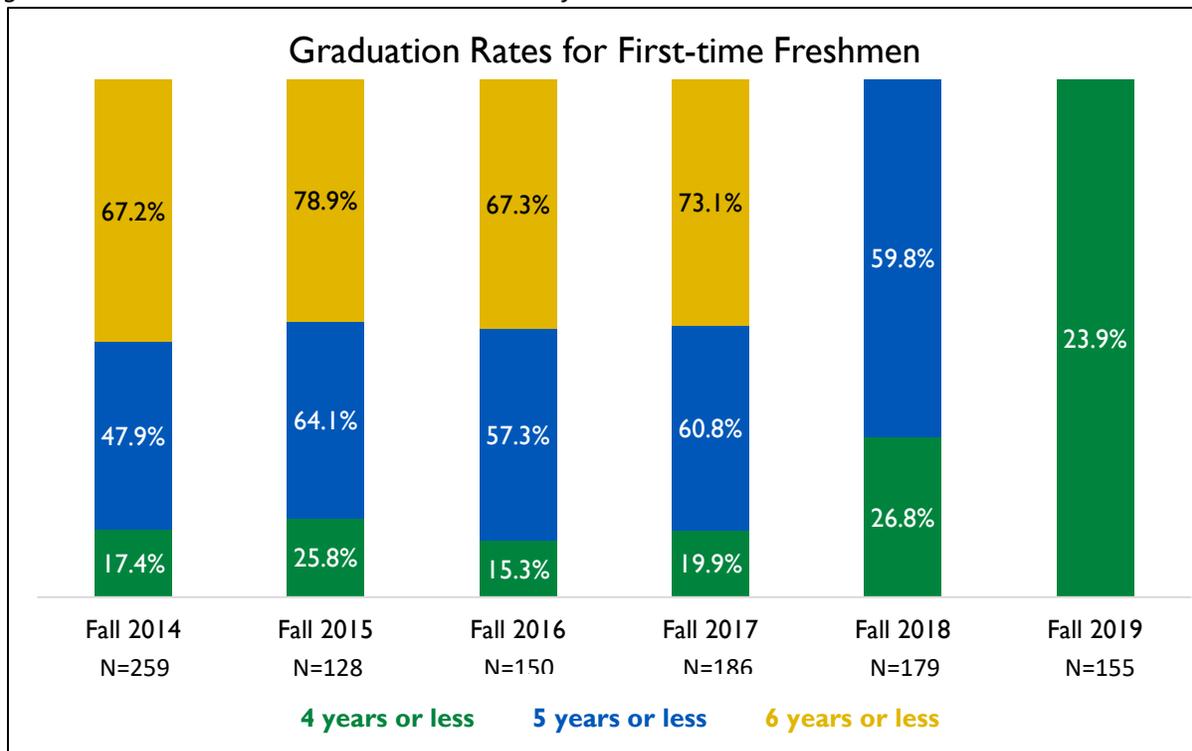
- The Mechanical Engineering (ME) Department offers multiple sections of required courses every semester (e.g., ME 2141, ME 3190, etc.), and opens new sections whenever needed. This allows students to retake courses every semester, if needed. The department also tries to offer at least one section of all required courses during the summer as well.
- The ME Department created a YouTube channel to host video tutorials created by CPP ME faculty (<https://youtube.com/@CPPMechEngTutorials>). Over the past decade, the video library has grown to over 600 videos covering topics in 16 courses, with all videos available to the public as an open educational resource. The video library contains a variety of styles including several full-length lecture series, short videos discussing concepts and example problems, and more. The channel has become quite popular among engineering students around the world, accumulating over 148,000 subscribers, 17 million views, and 1.6 million hours of total watch time over the channel's lifetime. The videos are organized in a user-friendly manner on the ME Online website (<https://www.cpp.edu/meonline/index.shtml>). Studies have demonstrated the benefits of ME Online on CPP ME students, and most students believe the video library makes a positive impact on their education, helps improve their grades in at least one course, and they plan on using ME Online as alumni for both professional and personal reasons. The videos were rated as especially helpful for courses with higher failure rates. Additionally, Latinx students and first-generation students used ME Online more frequently than other students, and generally rated the resource more highly than other groups.
- The ME Department encourages students to utilize MEP, supplemental instruction, and the university's Learning Resource Center to provide support as needed.
- Whenever possible, the ME Department tries to assign instructors who are well-respected by students and faculty to teach the bottleneck courses.
- One ME faculty member (Dr. Brian Ramirez) was a College of Engineering Champion for Accessibility and Inclusivity (CHAI). He completed the following tasks:
 - a. Facilitated learning opportunities for College of Engineering Faculty in Accessibility and Inclusivity
 - b. Led 2 academic workshops for faculty in Fall 2022 (one on accessibility and one on quality assessment)
 - c. Led a guided section of the Fundamentals of Accessibility e-Certificate course (2 weeks asynchronous) on Canvas for engineering faculty in Spring 2023
 - d. Completed CAFE's Fundamentals of Accessibility e-Certificate

2 STUDENTS – BS MECHANICAL ENGINEERING

2.1 Student Retention and Graduation Rates – Graduation Initiative 2025

Figure 3 provides graduation data for students entering the Mechanical major as First-Time Freshmen only. Any on-campus transfers who started in another major as a freshman are not accounted for in the First-Time Freshmen Graduation Rates for Mechanical. The figure below shows that 67.3% of students who started in 2016 graduated in six years or less, 57.3% of students who started in 2016 graduated in five years or less, and 15.3% of students who started in 2016 graduated in four years or less.

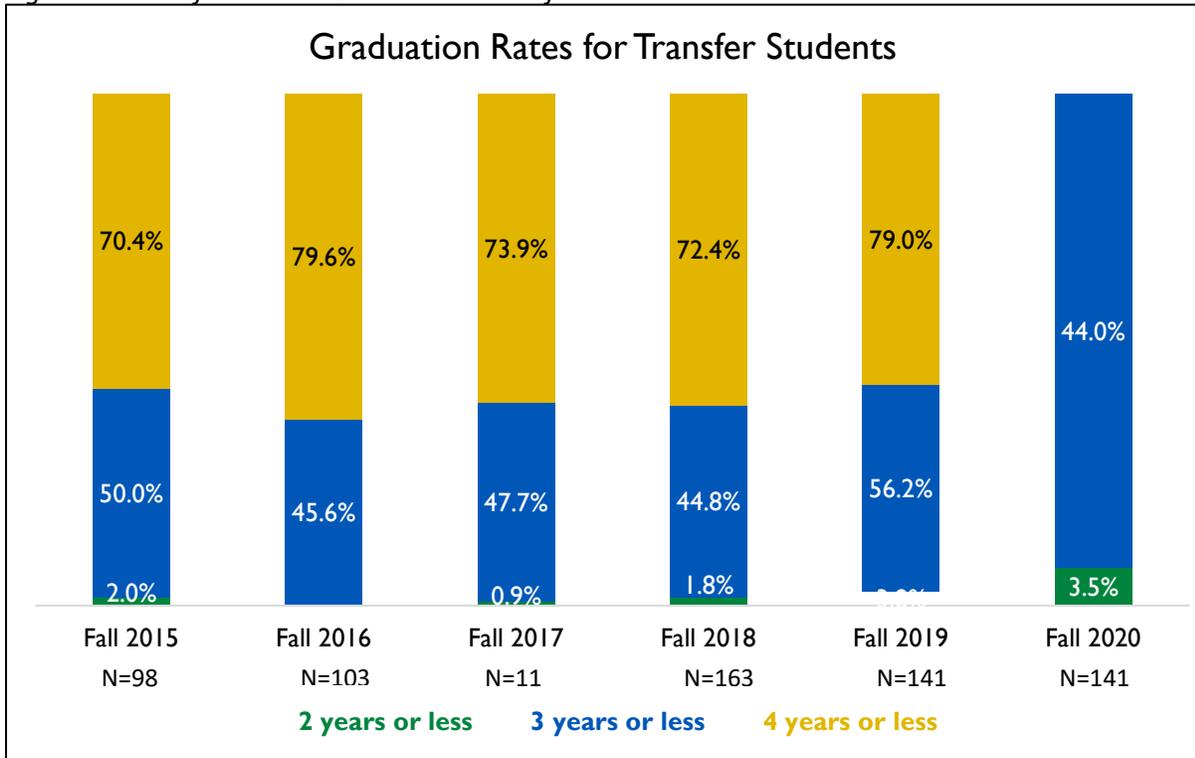
Figure 3 – First-time Freshmen Graduation Rates for Mechanical⁴



⁴ Source: Tableau <https://analytics.cpp.edu/#/site/production/views/GraduationRatesDashboard/FTFGradRates?iid=2>

Figure 4 provides graduation data for students entering as Mechanical major as off-campus fall term Transfers. Any transfers entering in a term other than fall or are on-campus transfers are not accounted for in the Fall Entering Transfer Graduation Rates for the Mechanical program. The figure below shows that 44.8% of transfer students who started in 2018 graduated in three years or less and 72.4% of those who started in 2018 graduated in four years or less.

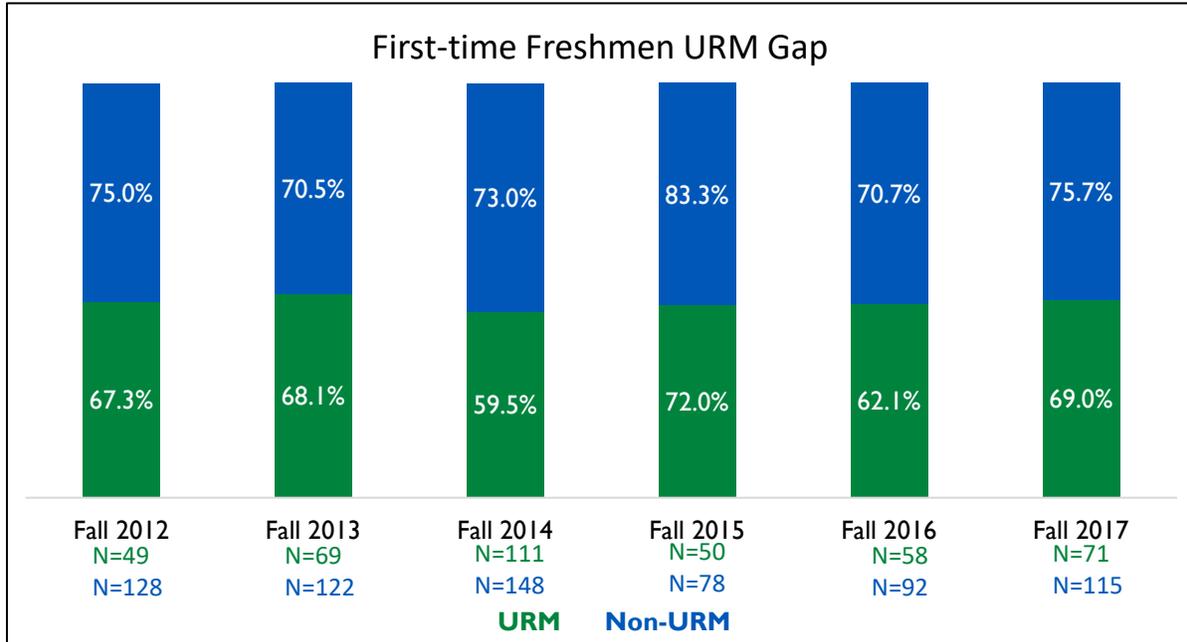
Figure 4 – Transfer Student Graduation Rates for Mechanical⁵



⁵ Source: Tableau <https://analytics.cpp.edu/#/site/production/views/GraduationRatesDashboard/FTFGradRates?iid=2>

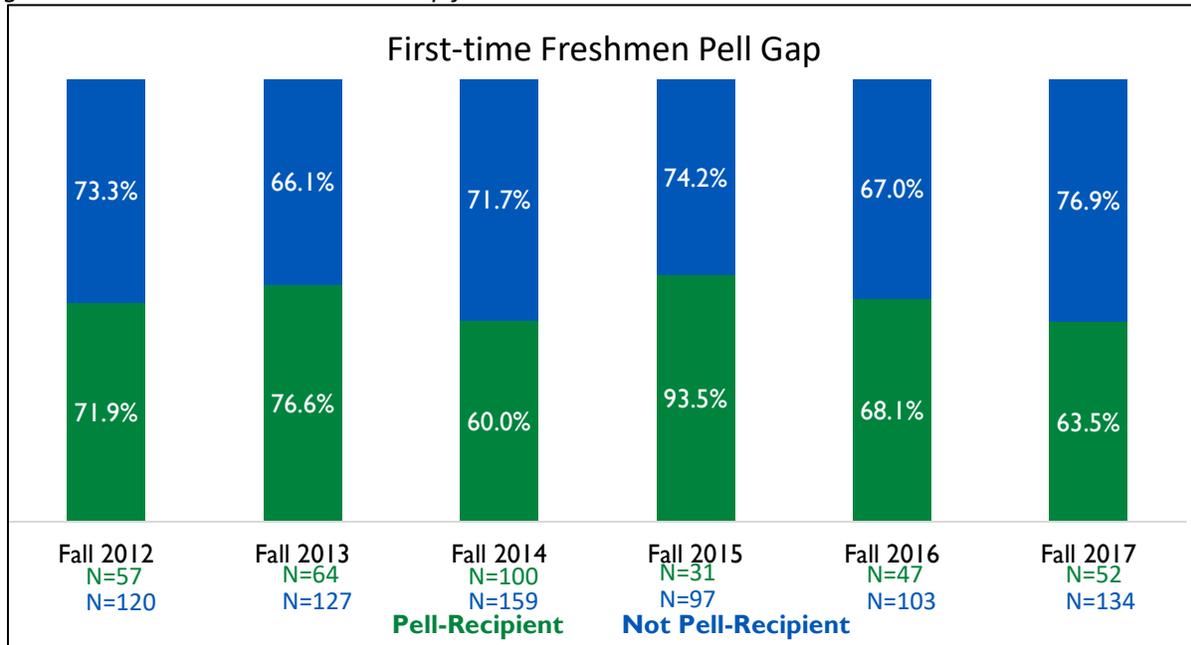
The figures below depict six-year graduation rates for underrepresented minorities (URM) and Pell-eligible First-time freshmen majoring in Mechanical. Figure 5 indicates that 62.1% of URM students and 70.7% of non-URM students who started in 2016 graduated in six years or less. Figure 6 below indicates that 68.1% of students who receive the Pell Grant and 67.0% of students who do not and started in 2016 graduated in six years or less.

Figure 5 – First-time Freshmen URM Gap for Mechanical⁶



⁶ Source: Tableau <https://analytics.cpp.edu/#/site/production/views/GraduationRatesDashboard/FTFGradRates?iid=2>

Figure 6 – First-time Freshmen Pell Gap for Mechanical⁷



The CPP Mechanical Engineering program is attempting to address student persistence and graduation rates in the following ways:

- The Mechanical Engineering (ME) Department offers multiple sections of required courses every semester (e.g., ME 2141, ME 3190, etc.), and opens new sections whenever needed. This allows students to retake courses every semester, if needed. The department also tries to offer at least one section of all required courses during the summer as well.
- The ME Department created a YouTube channel to host video tutorials created by CPP ME faculty (<https://youtube.com/@CPPMechEngTutorials>). Over the past decade, the video library has grown to over 600 videos covering topics in 16 courses, with all videos available to the public as an open educational resource. The videos are organized in a user-friendly manner on the ME Online website (<https://www.cpp.edu/meonline/index.shtml>). Studies have demonstrated the benefits of ME Online on CPP ME students, and most students believe the video library makes a positive impact on their education, helps improve their grades in at least one course, and they plan on using ME Online as alumni for both professional and personal reasons. The videos were rated as especially helpful for courses with higher failure rates. Additionally, Latinx students and first-generation students used ME Online more frequently than other students, and generally rated the resource more highly than other groups.
- The department encourages students to utilize MEP, supplemental instruction, and the university’s Learning Resource Center to provide support as needed.
- The College of Engineering Staff Advising Center has provided support to all degree programs. However, as the program grows, there is a concern that there may not be enough staff advisors

⁷ Source: Tableau https://analytics.cpp.edu/#/site/production/views/GraduationRates_0/FTFPellGap?iid=2

to adequately service all students.

- The department tries to create a sense of community through activities such as holding ME Forum every semester where faculty and students discuss important department issues, maintaining a department Canvas page where important department information is posted (such as available senior projects and job opportunities), and holding an annual banquet for ME students and faculty.
- The CARE Center supports students' basic needs and well-being.
- There are several student project clubs that students can join (e.g., SAE Baja, SAE Formula, etc.), which can foster a sense of camaraderie.
- The ME department is part of the National Science Foundation (NSF: #2225128) grant, the BRidging Institutions to Decrease Gaps in Engineering Education (BRIDGE) Project at California State Polytechnic University, Pomona (CPP) aims to create a sustainable transfer pathway program between Citrus College (Citrus), Mt. San Antonio College (Mt. SAC), and Victor Valley College (VVC). The objectives of the BRIDGE project are to: 1) identify the critical success factors (CSFs) that impact the academic and social integration of transfer students at a four-year institution; 2) create a framework to yield "transfer-ready" students by implementing various programs for transfer students and the assessment of each program's effectiveness; 3) resolve the lack of resources at community colleges by creating a faculty learning community; and 4) enhance students' academic performance and increase their sense of belonging and emotional attachment to their new institution.

The ME Department does not have targeted methods to specifically address URM and Pell graduation gaps. Additional resources from the university are needed to make sustainable efforts towards these goals. However, the department does encourage students to utilize MEP, supplemental instruction, and the university's Learning Resource Center to provide support as needed.

The ME Department could potentially improve student retention and graduation rates with the following support:

- More assistance in finding internships for students.
- If more tenure-track faculty members are hired, it would allow more project/research opportunities and potentially smaller class sizes.

3 INCLUSIVE POLYTECHNIC EDUCATION

Table 1- Alignment of Department Activities to the Inclusive Polytechnic Education

Department Activity (Curricular and Co-Curricular)	Elements of Inclusive Polytechnic Education							
	Application of Knowledge	Critical Thinking & Problem Solving	Creativity, & Discovery, & Innovation	Diverse & Multi-Disciplinary Perspectives	Integration of Technology	Collaborative Learning	Community & Global Engagement	Professional & Career Readiness
Senior Design Capstone Projects	X	X	X	X	X	X	X	X
Faculty-Led Research Projects	X	X	X	X	X	X	X	X
First Year Experience (e.g. EGR 1000/1000L)	X	X	X	X	X	X	X	X
Student Clubs and Participation in Engineering Competitions (e.g., ASME, Baja SAE, Formula Sae)	X	X	X	X	X	X	X	X
Laboratory-Based Courses	X	X			X			X

The Mechanical Engineering Department ensures students receive an Inclusive Polytechnic Education by integrating hands-on and collaborative learning experiences into both curricular and co-curricular activities. These efforts align closely with the definitions and rubrics developed by the Office of Academic Innovation to evaluate a PolyX experience.

Senior Design Capstone Projects and Senior Symposium:

The Senior Design Capstone sequence (EGR 4810, EGR 4820, EGR 4830) exemplifies an Inclusive Polytechnic Education. These courses require students to apply interdisciplinary knowledge to real-world challenges, often incorporating mentorship from faculty. Students gain critical thinking and problem-solving skills by working collaboratively in teams to develop innovative solutions. Additionally, the Senior Symposium allows students to present their work to peers, faculty, and industry professionals, emphasizing dissemination and professional readiness as outlined in the PolyX rubric.

- **Application of Knowledge:**
 - Students apply knowledge gained throughout their academic journey to address real-world engineering design problems.

- **Critical Thinking and Problem-Solving:**
 - Through the design process, students integrate critical thinking to identify and analyze issues/problems. They evaluate literature, design manuals, and other resources to develop informed positions and create engineered design solutions.
- **Creativity, Discovery, and Innovation:**
 - The design process connects theory, practice, and research, encouraging students to develop innovative and creative solutions to complex engineering challenges.
- **Diverse and Multi-Disciplinary Perspectives:**
 - Projects incorporate engineering standards and constraints, requiring teams to engage with multi-disciplinary perspectives to achieve comprehensive solutions.
- **Integration of Technology:**
 - Students utilize advanced software tools (e.g., AutoCAD 3D, SolidWorks, ANSYS, FEMAP/NASTRAN) to enhance their analysis and design processes.
- **Collaborative Learning:**
 - Teamwork is integral, with students working in groups and receiving mentorship from faculty advisors and industry partners to guide their projects.
- **Community and Global Engagement:**
 - Teams present their projects to peers, faculty, and industry professionals, fostering stakeholder engagement. All projects have connections to industry partners, ensuring real-world relevance.
- **Professional and Career Readiness:**
 - The capstone experience equips students with the skills and confidence necessary to transition seamlessly into their professional careers.

Faculty Support for Undergraduate Research and Competitions:

Faculty play a pivotal role in mentoring students through research projects and competitions. These projects encourage creativity and innovation while integrating advanced technology and community engagement. Faculty-led initiatives culminate in students presenting their work at conferences or publishing findings, ensuring students experience the full cycle of a project. Undergraduate research experience exemplifies an Inclusive Polytechnic Education and covers all eight areas. However, it is important to note though that due to available resources and available department support, only some faculty within the department are active with undergraduate research with some students. Below are more details on how each of these areas are reflected in the undergraduate research experience:

- **Application of Knowledge:**
 - Students use information and tools they have learned through their academic experience to identify, formulate, and provide alternative solutions for a research topic, with intense mentorship from their faculty advisors.
- **Critical Thinking and Problem Solving:**
 - Students through these research experiences are provided opportunity to critically think and evaluate alternative solutions within provided constraints (code, standards, regulatory framework, or social constraints)
- **Creativity, Discovery and Innovation:**
 - The undergraduate research experience involves students in a dynamic process of

inquiry where they engage with real-world problems, refine their ability to think independently, creatively propose innovative solutions, and contribute to the advancement of knowledge in their chosen fields.

- With their produced products, many students present their work in locally, national, and international conferences, such as CARS, RSCA, SCCUR, ASCE, and TRB conferences
- **Diverse & Multi-Disciplinary Perspectives:**
 - Depending on the research topic explored by students, their investigations may span a wide range of fields (mechanics, machine design, energy systems, fluid flow, heat transfer, and thermodynamics), integrating concepts and methodologies from various disciplines. This approach encourages students to analyze problems from multiple viewpoints, fostering a deeper understanding and innovative solutions that transcend traditional academic boundaries.
- **Integration of Technology:**
 - Students use technology and software pertinent to their research topics, such as these mentioned above.
- **Collaborative Learning:**
 - Some projects include multiple students who work on one single topic, or sometimes students build on each other's findings in consecutive semesters.
- **Community and Global Engagement:**
 - Collaborating on engineering solutions for real-world challenges, such as clean water systems, renewable energy projects, or infrastructure improvements in underserved communities.
 - Presenting research or projects at conferences, local schools, community groups, or public events to educate, solicit feedback, or inspire interest in engineering and its societal impact.
- **Professional & Career Readiness:**
 - Depending on the student aspirations for graduate school, such research experiences have been proven as high impact practices that prepare them for graduate and academic careers. Some of the students involved in these projects end up joining our master's degree program or master programs in other universities.

First Year Experience:

College of engineering freshmen and some transfer students enroll in a one semester lecture and laboratory course, EGR 1000/1000L in which they complete a project work that satisfies all the requirements for First Year Experience. The course aims to engage students in the design cycle, understand an engineer's role in society, explore the various disciplines of engineering, and develop skills that will help them in their academic career both in and out of engineering.

- **Application of Knowledge:**
 - Students apply their knowledge of the design cycle to understand failures and successes and develop engineering solutions to problems.
 - Students apply mathematical skills and critical thinking skills to model data, make

statements about trends and performance and make predictions about designs of experiments.

- **Critical Thinking and Problem-Solving:**
 - Students engage in research in their field to develop an understanding of current advancements and where they might find themselves in the field.
 - Students are presented various multidisciplinary problems and asked to develop solutions to these problems in teams and judge the success of the solution.
- **Creativity, Discovery, and Innovation:**
 - Students work in multidisciplinary groups to solve community issues in new and unique ways drawing from the holistic composition of the group.
 - Students also work in the lab to develop a foundational understanding of underpinning physics concepts to be able to apply in later classes.
- **Diverse and Multi-Disciplinary Perspectives:**
 - Every activity in the course is done in a multi-disciplinary group. Students are taught how to gather input for various stakeholders to define the scope of a project and how to best serve all stakeholders with equitable solutions that draw from each discipline.
- **Integration of Technology:**
 - Students use technology to model data and various desktop applications to present various technical projects (posters, presentations, and reports).
- **Collaborative Learning:**
 - Students work in multidisciplinary groups on each project in the lab and discuss solutions to issue in the lecture in a cross-discipline perspective.
 - Students are taught how to work in an effective team focusing on valuing learning styles, communication styles, and psychological safety.
- **Community and Global Engagement:**
 - When possible, students work on real world problems to engage communities (see PolyX).
- **Professional and Career Readiness:**
 - Students learn about each discipline of engineering and how they contribute to society, where the field is leading, and how they can contribute to the field. During this exploration, students learn about the other disciplines and how their discipline with interact with the others.
 - Students work on professional skills such as a resume, and LinkedIn page as well as speaking to potential employers.

Student Club Activities and Competitions:

The department actively supports and encourages participation in student-led engineering organizations such as the ASME Student Chapter, SAE Aero, SAE Formula, SAE Baja, etc. Many of the clubs are focused around building a vehicle and competing against other universities. These clubs provide opportunities for students to engage in hands-on learning, collaborate with peers, and compete in national and international competitions like SAE International (<https://www.sae.org/attend/student-events>). These

activities foster professional readiness, critical thinking, and creativity, hallmarks of the PolyX experience.

- **Application of Knowledge:**
 - Theory is taught through a variety of methods and then reinforce those concepts through active hands-on activities that relate to today's opportunities and challenges.
- **Critical-Thinking and Problem-Solving:**
 - Competitions provide opportunities for students showcase their skills, talents, and knowledge. They encourage creativity and teamwork. They strengthen understanding of the subjects matter. Students get opportunities to solve complex engineering problems.
- **Creativity, Discovery, and Innovation:**
 - Student competitions provide students a platform to apply their knowledge in a practical way, encourage them to think outside the box, collaborate with peers, solve real-world and complex problems, do literature review, acquire new knowledge and skills that are not taught in classrooms, and develop solutions that might not be explored in traditional classroom settings. Competitions also help develop entrepreneurial mindset and drive them to discover new ideas and approaches.
- **Diverse & Multi-Disciplinary Perspectives:**
 - Most clubs are open to all engineering majors allowing students from various disciplines—mechanical, electrical, civil, computer, and aerospace engineering—to work together.
 - This inclusivity promotes diverse viewpoints in problem-solving and design, enabling teams to approach challenges from multi-disciplinary angles.
 - Example: In SAE Formula, electrical engineering students may design wiring for telemetry systems, while mechanical engineers focus on drivetrain.
- **Integration of Technology:**
 - Students get opportunities to extensively use engineering technologies to participate in competitions such as using advanced finite element method (FEM) and computational fluid dynamics (CFD) program, computer programming, working with experimental equipment such as 3D printing, advanced sensors, robotics, augmented realities, and analyzing the experimental and numerical data for industry-relevant applications.
- **Collaborative Learning:**
 - Club projects are team-oriented, requiring students to share skills and collaborate to achieve a unified goal, such as building a competition-ready vehicle or a functioning prototype.
 - Members are encouraged to innovate, combining theory and practice to create cutting-edge designs.
 - These experiences foster mutual respect, creativity, and the ability to navigate group dynamics, ultimately preparing students for real-world collaboration.
- **Community and Global Engagement:**
 - Clubs often engage in outreach activities, inspiring the next generation of engineers

- by hosting workshops or mentoring K-12 students in junior chapters.
- Community Nights provide opportunities to connect with the local public, demonstrate projects, and discuss the engineering process.
- Members present their work at national and international competitions and conferences, fostering global awareness and networking with professionals and peers worldwide.
- **Professional & Career Readiness:**
 - Through participation in student clubs and competitions, students apply theoretical knowledge to real-world problems relevant to society and the engineering industry, gaining hands-on experience in design, testing, and building—preparing them to tackle challenges in their future careers in industry or government agencies.
 - We invite guest speakers, organize industry tours, and collaborate with campus clubs to expose students to various engineering fields and industries.
 - Our technical and professional development workshops provide students with essential technical and soft skills for career success.
 - Social events and networking sessions connect students with fellow engineers and professionals, offering insights into potential career paths.

Laboratory-Based Courses:

The Mechanical Engineering program consists of lecture and laboratory courses. Laboratory courses are also taught by faculties and geared towards experience in the types of analysis used in real engineering applications. Illustration of the concepts learned in the classroom and familiarization with actual mechanical hardware are also emphasized.

- **Application of Knowledge:**
 - Laboratory corequisites bridge theory and practice by allowing students to apply lecture concepts to hands-on experiments.
 - Students manipulate inputs, observe outcomes, and directly relate results to theoretical principles, reinforcing understanding through experiential learning.
- **Critical Thinking/Problem-Solving:**
 - Students are challenged to anticipate experimental results using theoretical frameworks, analyze discrepancies, and validate findings.
 - Design-based assignments require synthesis of solutions for complex engineering problems, fostering analytical and creative problem-solving skills.
- **Integration of Technology:**
 - Courses leverage state-of-the-art tools such as MATLAB/Simulink, ANSYS, SolidWorks, Python, and LabVIEW for simulation, modeling, and validation.
 - Hands-on exposure to industry-relevant software prepares students to effectively utilize advanced technologies in professional settings.
- **Professional and Career Readiness:**
 - Experiments and projects align with real-world engineering practices, equipping students with skills directly transferable to industry.
 - Students gain experience in iterative design, testing, and validation processes, mirroring tasks encountered in professional roles.

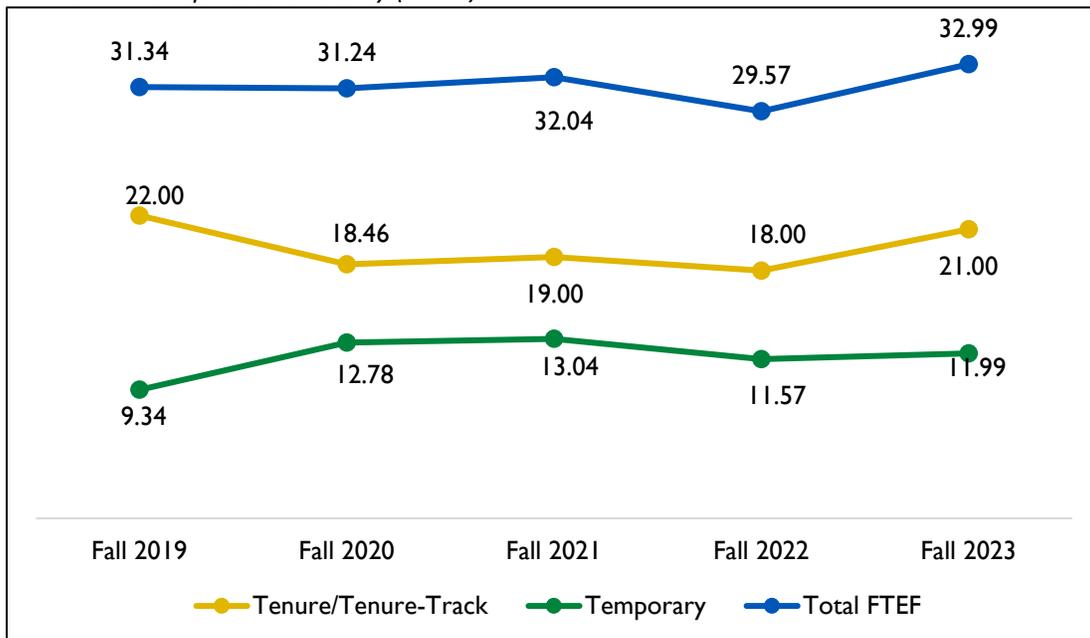
4 FACULTY

4.1 Overview of Faculty

Figure 7 to Figure 10 provide data over 5 years on the historical Full Time Equivalent-Faculty (FTE-F), Full Time Equivalent-Student (FTE-S), Student to Faculty Ratio (SFR), and Major to Faculty Ratio (MFR). The following definitions are from the Office of Academic Resources. Full Time Equivalent-Faculty is an aggregate measure of faculty workload based on payroll appointment fractions. Student to Faculty Ratio is an aggregate measure of students served based on units in course sections and student level. For FTE-S reporting, graduate student (master or doctoral) is considered full-time with 12 units; all others are considered full-time with 15 units. Student Faculty Ratio is FTE-S divided by FTE-F. Lastly, Major Faculty Ratio is the number of stateside degree-seeking students enrolled at census by the FTE-F for tenure-line faculty in the department.

Please note that the data for the following contains information for both undergraduate and graduate programs.

Figure 7 – Full Time Equivalent-Faculty (FTE-F)⁸



⁸ AR "FTE-Faculty with Status Detail Tenure-Track and Temporary Faculty" <https://www.cpp.edu/academic-resources/budget-and-finance/faculty-reports.shtml>

The Office of Academic Resources no longer provides a break down the FTE-S data for Tenure/Tenure-track and Temporary faculty at the time our office conducted the data pull.

Figure 8 – Full Time Equivalent-Student (FTE-S)⁹

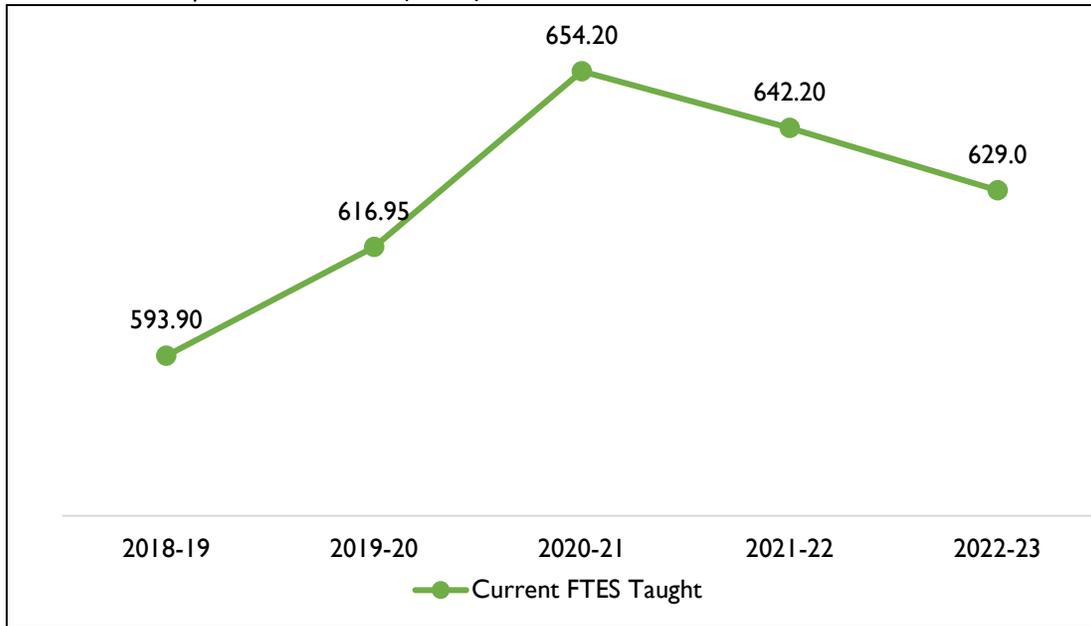
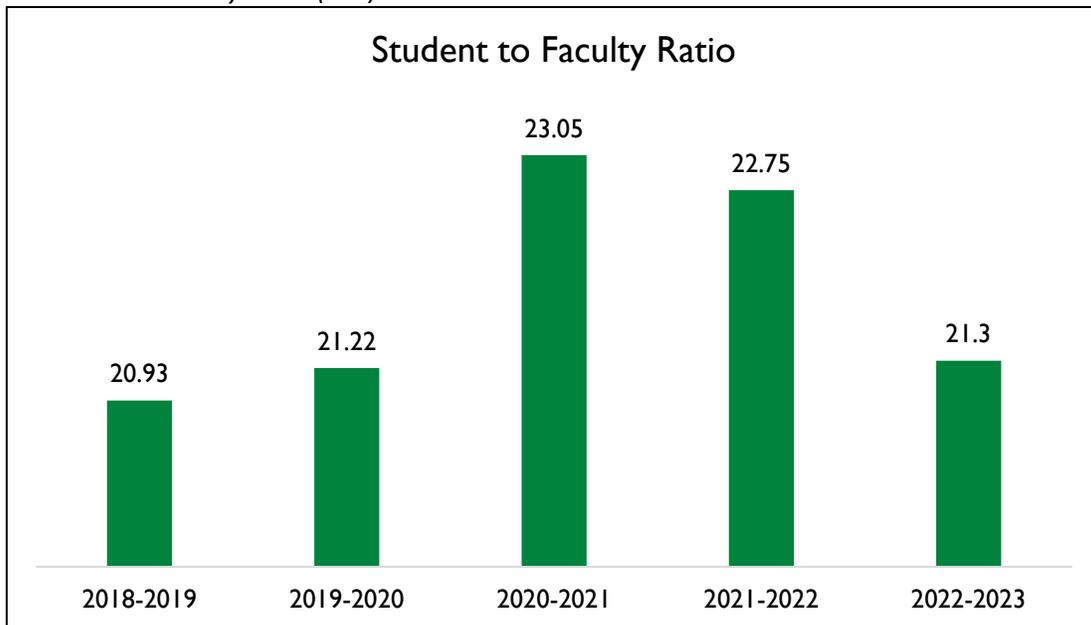


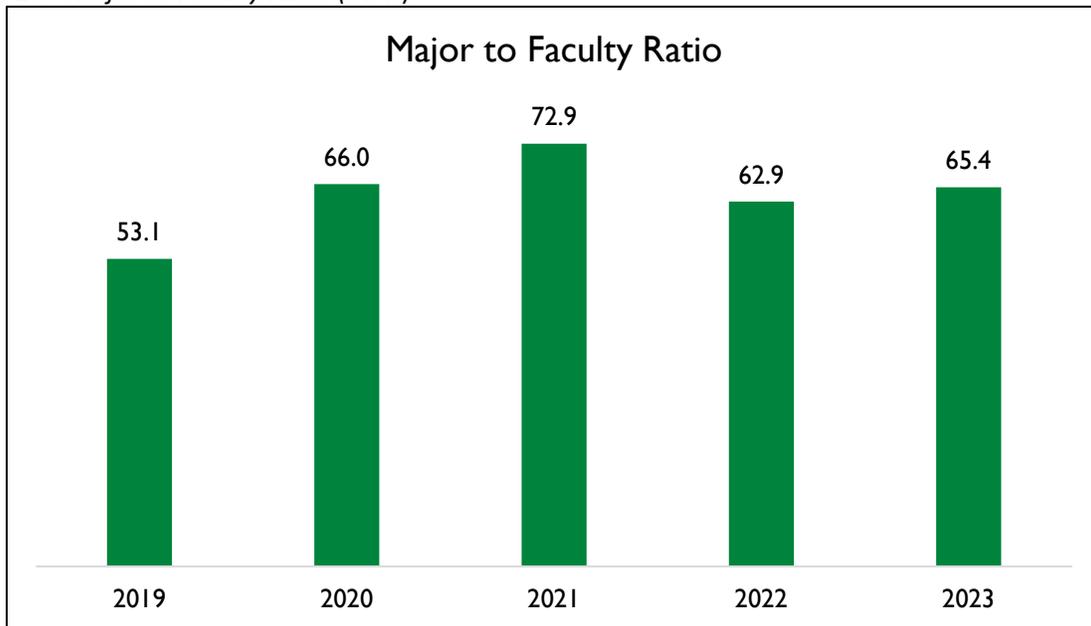
Figure 9 – Student Faculty Ratio (SFR)¹⁰



⁹ AR "Student to Faculty Ration Reports" <https://www.cpp.edu/academic-resources/budget-and-finance/faculty-reports.shtml>

¹⁰ AR "Student to Faculty Ration Reports" <https://www.cpp.edu/academic-resources/budget-and-finance/faculty-reports.shtml>

Figure 10 - Major to Faculty Ratio (MFR)¹¹



The Mechanical Engineering Department relies heavily on adjunct lecturers to deliver a significant portion of its coursework. These part-time instructors, many of whom are alumni and practicing engineers, bring industry expertise to both lecture and laboratory courses, enriching the educational experience by bridging the gap between academia and real-world applications. However, adjunct faculty do not teach some key components of our curriculum, such as the senior design capstone projects, which are exclusively led by tenure-line faculty.

Enrollment in the Mechanical Engineering program has grown over the past five years, reflecting strong student interest. However, this growth has not been met with a corresponding increase in tenure-line positions. While the FTEF (which includes temporary faculty) has increased, the major-to-faculty ratio has increased, placing a heavier teaching, service, and advising burden on tenure-line faculty.

Our capacity for growth is reaching its limits due to the lack of additional tenure-line faculty and other university resources. Without increased support, the department is constrained in its ability to expand enrollment further or implement quality control measures to ensure the highest academic standards. Strategies for accommodating more students without additional resources would include expanding online or hybrid course offerings and increasing reliance on adjunct faculty, and hiring more student graders. However, these approaches may compromise the quality of education and faculty engagement with students.

With additional resources, the ME Department could hire more tenure-line faculty to improve the major-to-faculty ratio, support program development, and accommodate growing demand while maintaining educational quality. The ME Department appreciates the tenure-line faculty positions allocated to us in recent years and urge the university to continue and expand this support. Additional

¹¹ ARAR "Major to Faculty Ratio",
<https://www.cpp.edu/academic-resources/budget-and-finance/faculty-reports.shtml>

tenure-line hires would allow us to grow enrollment, improve student-faculty interactions, and help the university better meet its enrollment targets. As the program grows in size, the ME Department also will need more access to classroom space – the department barely has enough classroom space assigned to us to ensure all ME classes can be scheduled before intra-college scheduling opens.

5 CONCLUSION

The Mechanical Engineering program has several key strengths:

1. **Hands-on Learning:** The program emphasizes a hands-on approach to learning. Students engage in laboratory work, design projects, and experiential learning opportunities. This practical experience enables them to apply theoretical concepts to real-world engineering problems, enhancing their problem-solving and critical thinking skills.
2. **Comprehensive and Rigorous Curriculum:** The program offers a comprehensive and rigorous curriculum that covers a wide range of fundamental and advanced topics in mechanical engineering. Students gain a strong foundation in the field. This is reflected in CPP ME students consistently performing better than the national average in the FE Exam, and industry representatives consistently expressing that CPP ME graduates are much more industry-ready compared to graduates from other universities.
3. **Dedicated and Experienced Faculty:** The program is supported by a highly qualified and experienced faculty who are dedicated to student success. The faculty members are actively involved in research, industry collaborations, and professional organizations, providing students with valuable insights and mentoring.
4. **Student Competition Teams/Clubs:** Clubs participate in design competitions, host guest speakers, assist with job placement, provide professional development, provide tutoring, offer services to the department, and provide for the social and recreational needs of Mechanical Engineering students.
5. **State-of-the-Art Labs:** The department's laboratories contain a mix of state-of-the-art technology and fundamental experiments. Students have access to equipment and software tools, enabling them to conduct experiments, simulations, and projects using industry-standard technology. The department is committed to upgrading the labs as technology changes in the future.
6. **Teamwork and Communication Skills:** The program emphasizes teamwork and effective communication, preparing students to collaborate successfully in multidisciplinary and diverse engineering environments. Through group projects and presentations, students develop strong interpersonal and communication skills, which are vital in the professional world.
7. **Open Educational Resources:** The Mechanical Engineering Departments YouTube channel (<https://youtube.com/@CPPMechEngTutorials>) contains over 600 videos covering topics in 16 courses, with all videos available to the public as an open educational resource. The channel has accumulated over 148,000 subscribers, 17 million views, and 1.6 million hours of total watch time over the channel's lifetime. The videos are organized in a user-friendly manner on the ME Online website (<https://www.cpp.edu/meonline/index.shtml>). Studies have demonstrated the benefits of ME Online on CPP ME students, and most students believe the video library makes a positive impact on their education, helps improve their grades in at least one course, and they plan on using ME Online as alumni for both professional and personal reasons. The department is committed to growing this resource in the years ahead.

In summary, the strengths of the Mechanical Engineering Department lie in its hands-on learning approach, comprehensive curriculum, experienced faculty, state-of-the-art labs, and emphasis on teamwork and communication skills. These factors contribute to producing well-rounded graduates who

are prepared to excel in various Mechanical Engineering roles and contribute to technological advancements in the field.

Opportunities for Improvement and Planned Actions

While the Mechanical Engineering Department has significant strengths, there are several opportunities for improvement to address challenges and further enhance the programs.

1. Faculty Resources and Quality Control:

- *Opportunity:* The increasing reliance on adjunct faculty poses challenges in maintaining consistency and quality across all courses, especially with growing enrollment.
- *Action:* Advocate for additional tenure-line faculty positions to better balance the major-to-faculty ratio and strengthen mentorship and quality control in both lecture and laboratory courses. Additionally, implement standardized course materials and periodic reviews of adjunct-taught courses to ensure alignment with program objectives.

2. Supporting Student Success and Reducing Equity Gaps:

- *Opportunity:* Despite strong overall performance, URM students and Pell-eligible students face equity gaps in retention and graduation rates.
- *Action:* Expand support services such as tutoring, mentoring, and outreach through programs like *Maximizing Engineering Potential (MEP)*. Strengthen faculty participation in inclusive teaching workshops and develop targeted interventions for at-risk students, such as early alert systems and proactive advising.

3. Capacity for Growth:

- *Opportunity:* With increasing demand for the Mechanical Engineering program, the department is nearing its capacity to accommodate more students without compromising quality.
- *Action:* The department is repurposing and renovating existing space to create a workspace for senior design projects, department competition teams (ASME, etc.), and faculty led research. Collaborate with the university to secure additional resources, such as tenure-line faculty positions, upgraded facilities, and expanded classroom and laboratory space.

4. Student Engagement and Career Readiness:

- *Opportunity:* Although students benefit from hands-on learning, greater emphasis on industry engagement and interdisciplinary experiences can further enhance their career readiness.
- *Action:* Strengthen partnerships with industry to increase internship and co-op opportunities and integrate real-world projects into the curriculum. Expand student involvement in interdisciplinary competitions and collaborative projects across engineering disciplines. Student achievements can be monitored to track the effectiveness of the action through club competitions, papers published/presented, internships attended, and comments from students on the department's annual Senior Exit Survey.

5. Lecture Classroom Modernization:

- *Opportunity:* Currently, most engineering lecture classrooms have significant issues that impact the quality of education. For example, in many classrooms the instructor cannot use both the white board and projector at the same time, some classrooms only have a single non-dimmable light switch, and the desks are often too small for students. Students have frequently

complained about the quality of lecture classrooms in the department's Senior Exit Surveys.

- *Action:* The Mechanical Engineering Department does not control facilities maintenance and upgrades. However, the College of Engineering Dean is aware of the issues with lecture classroom space, and he has stated that he has brought the issues to the attention of the university. The department will continue to use Senior Exit Surveys to determine if the issues are being addressed.

6. Curriculum Alignment with ABET and Industry Standards:

- *Opportunity:* Update the ME curriculum to ensure alignment with ABET accreditation requirements, evolving industry trends, and stakeholder expectations.
- *Action:* Revise the curriculum to integrate ABET learning outcomes, address emerging industry needs, and incorporate feedback from students, alumni, faculty, employers, and Industry Advisors Council (IAC) members. This includes updating course content, introducing relevant technical electives, and enhancing experiential learning opportunities.