

# Civil and Mechanical Engineering Technology

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Program Review 2018-2019

Jenna Bell

Greg Gerstner

Peter Kazarinoff - SAC Chair

Tara Nelson - Department Chair

Todd Sanders

Linda Browning - Perkins Funded Advisor

Richard Dawes - Laboratory Technician

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## Table of Contents

1. Program/Discipline Overview:	5
A. Program Goals and Objectives	5
i. What are the educational goals or objectives of this program/discipline?	5
ii. How do these compare with national or professional program/discipline trends or guidelines?	5
iii. Have they changed since the last review, or are they expected to change in the next five years?	6
B. Briefly describe curricular, instructional, or other changes that were made as a result of your SAC's recommendations in the last program review and/or the administrative response.	7
Recommendation A: Adding full-time faculty	7
Recommendation B: Assistance with marketing the program	7
Recommendation C: Stable funding for ET Advisor	8
Recommendation D: Assistance with curriculum development	8
Recommendation E: More hands on activities	8
Recommendation G: More break-out class for MET and CET	8
Recommendation H: New equipment	9
2. Outcomes and Assessment:	9
A. Course-Level Outcomes:	9
i. What is the SAC process for review of course outcomes in your CCOGs to ensure that they are assessable?	9
ii. Identify and give examples of changes made in instruction, to improve students' attainment of course outcomes or outcomes of requisite course sequences	9
B. Addressing College Core Outcomes	10
C. Assessment of Core Outcomes (LDC) or Degree and Certificate (CTE) Outcomes.	10
i. Reflecting on the last five years of assessment, provide a brief summary of one or two of your best assessment projects	10
ii. Do you have evidence that the changes made were effective by having reassessed the same outcome? If so, please describe briefly.	11
iii. Evaluate your SAC's assessment cycle processes. What have you learned to improve your assessment practices and strategies?	11
iv. Are there any Core Outcomes that are particularly challenging for your (LDC-DE) SAC to assess, or difficult to align and assess within your (CTE) program?	11
v. CTE only: Briefly describe the evidence you have, determined by direct assessment, that students are meeting your Degree and/or Certificate outcomes.	11

3. Other Instructional Issues	12
A. Enrollments	12
B. Grades	13
C. Online Courses versus On-Campus	13
D. Curricular changes as a result of educational initiatives	13
E. Dual Credit	14
F. SAC Course Evaluations	14
4. Needs of Students and the Community	14
A. Student Demographics	14
B. Facilitating success for students with disabilities	16
C. Facilitating success for online students	16
D. Implementation of Feedback for curriculum/instructional changes	17
5. Faculty: reflect on the composition, qualifications, and development of the faculty	17
A. Faculty strategic intentions for diversity, equity, and inclusion	17
B. Instructor Qualifications	18
C. Faculty Professional Development	18
6. Facilities, Instructional, and Student Support	19
A. Describe how classroom space, classroom technology, laboratory space, and equipment impact student success.	19
B. Describe how students are using the library or other outside-the-classroom information resources	22
C. Does the SAC have any insights on how students are using Student Resource Centers	22
7. Career and Technical Education (CTE) Programs only: To ensure that the curriculum keeps pace with changing employer needs and continues to successfully prepare students to enter a career field...	23
A. Evaluate the impact of your program’s advisory committee on curriculum and instructional content methods, and/or outcomes.	23
B. Describe current and projected demand and enrollment patterns for your program. Include discussion of any impact this will have.	23
C. How are students selected and/or prepared (e.g., prerequisites) for program entry?	23
D. Review job placement data for students over the last five years, including salary information where available. Forecast future employment opportunities for students, including national or state forecasts if appropriate.	24

E.	Present data on the number of students completing degree(s) and/or certificate(s) in your program.	24
F.	Is the program Perkins-eligible? If so, answer the questions below.	25
i.	With which secondary school(s) does the program have aligned Programs of Study? Do PCC faculty meet with these HS program faculty on a regular basis?	25
ii.	Please describe the Technical Skill Assessments (TSAs) that are reported annually. Include information about the nature of the assessment, content covered, alignment of degree and certificate outcomes, when the assessment is taken by students, the number of completers, and the percentage of students meeting the identified benchmark(s) for the last 5 years.	25
iii.	What does the SAC consider to be the most impactful use of Perkins funding for your program?	26
G.	Describe opportunities that exist or are in development for graduates of this program to continue their education in this career area or profession.	26
8.	Recommendations	26
A.	What is the SAC planning to do to improve teaching and learning, student success, and degree or certificate completion, for on-campus and online students as appropriate?	26
B.	What support do you need from administration in order to carry out your planned improvements?	27
9.	Assurances	29
10.	Appendices	30
•	Appendix A: Core Outcomes Mapping Matrix	30
•	Appendix B: Communication Rubric	32
•	Appendix C: CMET Advisory Meeting Minutes	34
i.	CMET Advisory Minutes November 2018	34
ii.	CMET Advisory Minutes May 2018	37
iii.	CMET Advisory Minutes November 2017	40
	Appendix D: Course Outcome Mapping Matrix	43
	Appendix F: Advising Guides	45

# 1. Program/Discipline Overview:

## A. Program Goals and Objectives

### i. What are the educational goals or objectives of this program/discipline?

The objective of the Civil and Mechanical Engineering Technology (CMET) program is to provide a solid Civil and Mechanical Engineering education accessible to individuals possessing minimal math skills enabling graduates to build careers as Civil or Mechanical Engineering Technicians. The principal goal of the curriculum is to provide skills that will make the Associate of Applied Science (AAS) graduate successful in a wide variety of job roles. A secondary goal is to matriculate Mechanical Engineering Technology graduates to the Oregon Institute of Technology Mechanical Engineering Technology Bachelor of Science program.

### ii. How do these compare with national or professional program/discipline trends or guidelines?

When compared to national or professional program and discipline guidelines, CMET is unique. In a review of over two hundred Civil and Mechanical Engineering Technology AAS degree programs no other program in the US delivers a similar engineering technology education pedagogy. CMET students are required to give a significant amount of time and effort. As a result graduates achieve a level of academic success and personal confidence that initially seemed beyond their reach.

Since 2003 the CMET program has received over 1.2 million dollars in scholarship funding through the National Science Foundation Scholarship for Science Technology Engineering and Mathematics (S-STEM). The CMET program at PCC is one of only three programs in the nation (along with Ohio State and Auburn University) to receive 16 consecutive years of S-STEM funding. The S-STEM scholarship has provided the financial support necessary for CMET students to meet the extensive commitment challenges a student may face while maintaining responsibilities like family and housing. Conversely, to maintain external responsibilities like employment requires impressive levels of effort. In one example, a 2018 graduate worked from 3am-7am to stay with their longtime employer whilst completing the MET program.

Introducing students to real-world scenarios is common in technology training programs. Within the CMET program, Mechanical Engineering Technology students in Manufacturing Processes (ENGR 262) perform machine operations, and students in Machine Design (CMET 235) fabricate parts for design projects using 3D printing technology and use Computer Numeric Control systems to perform routing procedures. Civil Engineering Technology students in Plane Surveying (ENGR 226) and Surveying II (CMET 214) have done construction layouts for the learning gardens at Newberg, Sylvania, and SE campuses.

A current trend in engineering education is the use of introductory courses to build problem-solving skills and teamwork. For students in “traditional” 4-year engineering programs, the first two years of a BS engineering education are mostly math and science courses with application and projects only in junior and senior year. At some universities this has been revised such that student cohorts are assembled and given “realistic” engineering problems to work on, while they are still building the mathematical and scientific theoretical basis for the analysis. Within the CMET program, curriculum incorporates engineering problem-solving starting the first term. Math and science skills

are built within the context of engineering courses. Teamwork is emphasized in all courses with team-building activities in the classroom.

Nationwide, 2-year engineering technology programs offer an alternative path for students looking to rapidly join the technical workforce. Typically, they offer alternative schedules such as night and weekend courses or courses that only require students to come to campus once per week. Online courses or hybrid courses are often available. For schools on a cohort model, core technical courses may only be offered once per year, however non-departmental courses such as technical writing, speech, chemistry, physics, and mathematics may be taken any term. The CMET program follows a cohort model with core curriculum starting winter term and all departmental courses taught at the Sylvania campus. Many courses are taught internally including mathematics and physics, although some course substitutions are available for students that may have started in another program before joining CMET. Non-departmental courses such as GEO 265, COMM 215, and ENGR 102 add to flexibility in student schedules. For students seeking a Fall term or other “off-sequence” start, they can access the CMET program by starting with non-departmental courses before joining the Winter cohort. Some students may also start with engineering transfer coursework prior to joining the cohort in Fall of the second year.

As mentioned above, the CMET pedagogy is unique. Many CMET courses have higher contact hour/credit ratios than the same course taught within another engineering technology program. This offers students more time with the instructor in the classroom, but may limit access for students with obligations outside of school. The department has concerns about this limited student access. The courses with high contact time were designed to provide students support, and created a solid cohort model. This design has worked, but we recognize that our student needs have shifted and a longer courses may not be the best for our student. The department plans to spend time before the next program review investigating our courses and determining the appropriate contact time for the classroom and the current student.

### iii. Have they changed since the last review, or are they expected to change in the next five years?

The goals and objectives of CMET have not changed since the last review. However, as the need for competent technicians grows and the student demographic evolves adjustments will need to be made to the program. For Mechanical Engineering Technology students looking to continue their education at Oregon Tech, revisions to the BSMET program at the Wilsonville campus should be taken into account. There is a national trend, that more technology programs are including calculus based physics as well as seeking ABET (Accreditation Board for Engineering and Technology, Inc.) accreditation. If this is the direction the department goes it would be very costly in money and resources.

As the CMET program is highly integrated, even a small alteration to address contact hours and faculty workload requires time-intensive changes to the CMET program. The CMET Program contains courses taught with CMET coded and non-CMET coded courses. There are advantages and disadvantages in keeping courses “in-house”. In the next 5 years, which courses are taught “in-house” and which are taught by external departments is something the CMET SAC will review.

The CMET Department is committed to improve equitable access and inclusion for students. Examples of program modifications which may improve access for students include hybrid courses, flipped classrooms, greater flexibility in timing and location. Modifying the CMET program could

improve equitable access and inclusion for students, increase enrollments, reduce the budgetary cost of the program and allow proper compensation for effort of both full time and part time faculty. To best accomplish the change would require some support from the colleges' administration. Requests for support are listed in Section 8: Recommendations.

**B. Briefly describe curricular, instructional, or other changes that were made as a result of your SAC's recommendations in the last program review and/or the administrative response.**

In the Administrative Response from the last CMET Program Review of February 14th, 2014 total of 8 recommendations were made as follows:

**Recommendation A: Adding full-time faculty**

- The first suggestion by the Administration and Recommendation A by the CMET SAC was in regards to adding a Full-Time Faculty member, especially in light of the prevalence of 'long courses' in 2014. At that time, there were 3 'long courses' taught twice per academic year for a total of six 'long courses' per academic year. This FTE need for FT Faculty to teach the 'long courses' has been greatly reduced in that there is currently only one start (during Winter quarter) and that 2 of the 'long courses' have been converted to courses with shorter contact hours. CMET 110 Statics and CMET 121 Strength of Materials are now 4 credits with 3 lecture hours and 3 lab hours. CMET 121 Applied Calculus is the only 'long course' that remains and it is only taught once per year. This has reduced the FTE needed for an additional FT Faculty member.

**Recommendation B: Assistance with marketing the program**

- In the last program review we requested assistance with marketing our program. We understand that Greg Harris, PCC's new Director of Marketing and Communication, now has a plan to market CTE programs. CMET as well as other CTE programs provide family wage jobs in a short amount of time. Unfortunately, our program is not well known in the Portland area. We are excited about being a part of Greg Harris' marketing plan.
- In addition to College Marketing since the last program review we were able to secure a National Science Foundation S-STEM grant. The primary role of this grant is to provide scholarships to students. Built into the grant are funds for marketing of the program. We are working with an outside vendor to do a social media marketing plan. The vendor, works with our marketing department. Amy Petit, the PCC Sylvania MakerLab Coordinator, has marketing experience and was once an employee in the Marketing department. She is helping us coordinate these efforts through the support and approval of PCC's marketing department.

### **Recommendation C: Stable funding for ET Advisor**

- Procurement of stable ET advisor funding has been accomplished via Perkins funding and compliance with the annual completion of Technical Skills Assessments (TSAs) by the CMET SAC.

### **Recommendation D: Assistance with curriculum development**

- The last five years, CMET program curriculum development has been in a state of continuous improvement. Changes to CMET curriculum in the last five years includes the reduction of the number of 'long courses', the revision of CMET Engineering Technology Orientation into Portland Design: Brews, Bridges and Bikes as well as Technical Engineering Physics into Global Energy Physics. CMET experienced faculty turnover in the last five years. Two full-time faculty retired between 2013 and 2018. One new full-time faculty joined the department in 2014.

### **Recommendation E: More hands on activities**

- With new curriculum development has come a variety of additional hands on activities and laboratory exercises. Incorporation of new equipment into CMET courses has increased student engagement in the classroom.
- Recommendation F: Inclusion of soft skills
- Student opportunity for learning soft skills has been incorporated throughout the program. Nearly every CMET course includes group exercises and/or a project. Advisor Linda Browning is a tremendous asset with monthly visits to CMET 111 Portland Design: Brews, Bridges and Bikes.
- CMET 255, the professional skills course, includes job search and soft skills. CMET 255 increased from 1 credit to 2 credits. This change increased contact time and allowed for such activities as mock interviews with members of the Industry Advisory Committee.
- In addition, COMM 215 Small Group Communication: Process and Theory was added as a course substitution for COMM 111 Speech Communications. The addition of COMM 215 aligns with coursework for MET transfer students to Oregon Tech. Working within small groups to solve problems is an industry norm.

### **Recommendation G: More break-out class for MET and CET**

- A variety of program changes to CET and MET are currently in process. In addition to revision of shared courses such as CMET 122 Global Energy Physics and CMET 111 Portland Design: Brews, Bridges and Bikes, diversification of courses specific to CET and MET is in progress.
- The CET program has added two Global Information System courses: GEO 265 and GEO 266 as GIS software use is common in industry. Thermodynamics (CMET 212 and CMET 222) was removed from the civil technology program. CET program changes take effect with the Winter 2020 student cohort.

- Revisions to the MET program are taking more time than CET program revisions. MET courses more aligned with CET curriculum will be replaced by a new Heat Transfer course and a revised Thermodynamics course. The current goal is to implement MET program revisions by Winter 2021.
- Currently, CET and MET students enroll in the same CAD classes. We are working towards separating CET and MET students into different CAD classes. CET students will take AutoCAD classes and MET students will take SolidWorks classes.
- A shared capstone course is also in development. Although all CMET students would take the same course, the projects would be CET or MET program specific. The class would be taught late in the program allowing students to apply skills learned throughout their coursework. The capstone course is currently being created and will likely be implemented in both programs starting Winter 2021.

### **Recommendation H: New equipment**

- A variety of new equipment has been purchased. Force tables with weights and pulleys, calipers, new surveying equipment, a small-scale tensile tester, and an aquaponics system in AM 103 just to name a few. Much of this equipment is shared across multiple CMET courses and Engineering Transfer. A detailed discussion of equipment is in Section 6.

## **2. Outcomes and Assessment:**

**Reflect on learning outcomes and assessment, teaching methodologies, and content in order to improve the quality of teaching, learning and student success.**

### **A. Course-Level Outcomes:**

**The college has an expectation that course outcomes, as listed in the CCOG, are both assessable and assessed, with the intent that SACs will collaborate to develop a shared vision for course-level learning outcomes.**

- i. What is the SAC process for review of course outcomes in your CCOGs to ensure that they are assessable?

There is no SAC process for review of course outcomes in the CMET Course Content and Outcomes Guide (CCOG)s.

- ii. Identify and give examples of changes made in instruction, to improve students' attainment of course outcomes or outcomes of requisite course sequences (such as are found in in MTH, WR, ESOL, BI, etc.), that were made based on the results of assessment of student learning.

One change we made based on assessments was the revisions to the chemistry course. For many years, we have had problems with the students having inadequate chemistry knowledge when they enter CMET133 Materials Technology and CMET211 Environmental Quality. We have now worked with the chemistry faculty and SAC to modify the curriculum of CH101.

Another example of changes made in instruction to improve students' attainment of course outcomes was the inclusion of group lab reports in CMET133. This change corresponds to the CMET133 course outcomes "Follow standard operating lab procedures and communicate lab results", "Work safely in small teams during lab activities" and "Create consistent and well-documented lab write-ups."

New CCOGs have been created for CMET 110 Statics, CMET 111 Portland Design: Brews, Bridge and Bikes, CMET 121 Strength of Materials, CMET 122 Global Energy Physics and CMET 255 CMET Professional Skills since the last Program Review. CMET 255 was changed to increase the support for students to focus on soft skills and job search.

## **B. Addressing College Core Outcomes**

The CMET Core Outcomes Mapping Matrix was updated in 2018 and is available in Appendix A. The CMET SAC keeps a local copy of the CMET Core Outcomes Mapping Matrix and reviews the matrix once per year.

## **C. Assessment of Core Outcomes (LDC) or Degree and Certificate (CTE) Outcomes.**

- i. Reflecting on the last five years of assessment, provide a brief summary of one or two of your best assessment projects highlighting efforts made to improve students' attainment of the Core Outcomes (LDC-DE disciplines) or Degree and Certificate Outcomes (CTE programs).

In 2014-2015, CMET received the award (CMET's third Learning Assessment Exemplary Report award) for Exemplary Reports for Efforts in Assessing Sustainability which is a Degree and Certificate outcome of CMET - Practice sustainable engineering methodologies. This was accomplished by assessing a CMET 211 Environmental Quality lab report. To ensure consistent scoring (inter-rater reliability), the consensus method of assessing was used where the SAC came to an agreement on scores. A rubric was used in this process.

In 2015-2016, CMET assessed another outcome regarding visual communication - Utilize the knowledge of visualization skills, computer aided drawing programs and the ability to create and interpret engineering drawings, to design civil engineering projects within proper industry acceptable standards and conventions.

In 2016-2017, CMET re-assessed this assessment with the addition of providing the students with additional guidelines (see Appendix B) on how to create a visual presentation. The continuity of having

a 2-year assessment was beneficial in the analysis of what improvements had been made from the prior year.

- ii. Do you have evidence that the changes made were effective by having reassessed the same outcome? If so, please describe briefly.

The SAC has assessed the Communication outcome twice in the past 5 years. Most of the assessment changes made were from this assessment process. Each time the SAC assesses communication, the SAC is able to clarify and become more focused on improvement. One of the faculty has designed a rubric to aid students in the appropriate construction of a PowerPoint presentation.

- iii. Evaluate your SAC's assessment cycle processes. What have you learned to improve your assessment practices and strategies?

The CMET SAC has formed a routine in the past 4 years of completing the assessment in the last week of Spring quarter using the consensus method of assessing. Often times, the assessment has been a direct assessment of the CMET 223 Project Management which has been approached as a Capstone project of the CMET program. The SAC has attended the presentations of the CMET graduates-to-be which creates a communal feel to the end of the program for students, staff and faculty. After attendance of the presentations, the SAC then participates in assessing the outcome using the consensus method. This provides a venue for discussion and communication amongst the SAC.

- iv. Are there any Core Outcomes that are particularly challenging for your (LDC-DE) SAC to assess, or difficult to align and assess within your (CTE) program?

No.

- v. CTE only: Briefly describe the evidence you have, determined by direct assessment, that students are meeting your Degree and/or Certificate outcomes.

Since the last CMET Program Review, CMET has submitted Technical Skills Assessment to the State of Oregon for the past 5 years (2014-2018). The CMET Program has designed sample problems in 5 classes (4 in MET and 4 in CET; see Appendix E) to assess whether students are meeting Degree and/or Certificate outcomes. These 5 sample problems have been approved by the CMET Industry Advisory Committee as appropriate questions which a CMET graduate should be able to solve and were given to CMET students in a testing situation. Annually, these 5 sample problems are graded separately in their respective courses and the results are reported to the CMET SAC Chair. The SAC Chair summarizes the results and reports the results. The CMET SAC has determined that a passing score should be 70% or above. Of the 144 CMET graduates (2014-2018) that scoring has been reported upon, 116 CMET graduates have met the criteria that is considered by the SAC to be meeting Degree and/or Certificate outcomes.

### 3. Other Instructional Issues

(Note: for questions A-C, specific information can be found at:

<https://www.pcc.edu/ir/factsheet/Factbook/201617/swrafte201617.html>)

#### A. Enrollments

**Please review the data for course enrollments in your subject area. Are enrollments similar to college FTE trends in general, or are they increasing or decreasing at a faster rate? What (if any) factors within control of your SAC may be influencing enrollments in your courses? What (if any) factors within control of the college may be influencing enrollments in your courses?**

The chart below shows the enrollment trends over the last 5 years. Enrollment has declined. A part of this decline is attributed to a program change that occurred in 2014-2015. At that time the CMET program shifted from two cohorts starting per year (Fall term and Winter term) to only one. The impact of this change is the second start was used to bolster the group starting in the Fall. In order to try to mitigate this change the department choose to go with an official start in Winter term with a “soft start” in Fall.

CMET enrollments are down. This can be attributed to a variety of reasons. A few reasons might be that CMET is relatively not known. When students think of Engineering they often think of ENGR. We’ve also have heard comments from students, the community and other PCC employees that they didn’t know PCC had an engineering program. Support with marketing and helping us brand our program would help, we believe, to increase our enrollment.

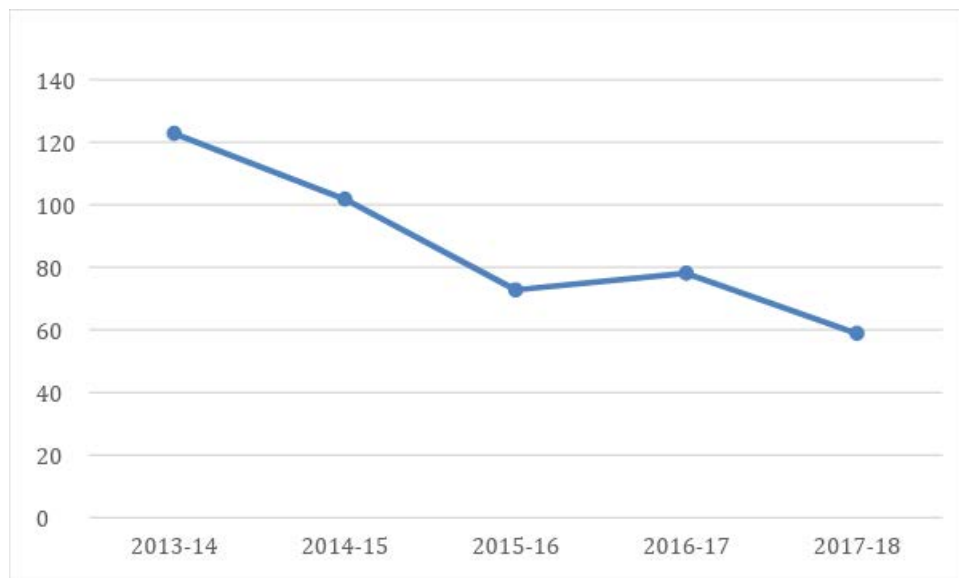


Figure 1: CMET FTE since last program review

## B. Grades

**Please review the grades awarded for the courses in your program. What patterns or trends do you see? Are there any courses with consistently lower pass rates than others? Why do you think this is the case, and how is your SAC addressing this?**

One noticeable trend in grades awarded for CMET courses between 2013 and 2018 is that the number of D / F / NP and W/Other grades awarded in 2013 either stayed decreased or stayed constant compared to the number of D / F / NP and W/Other grades awarded in 2018. See Institutional Effectiveness data for CMET grades.

## C. Online Courses versus On-Campus

**Which of your courses are offered online and what is the proportion of on-campus and online? For courses offered both via DL and on campus, are there differences in student success? If yes, describe the differences and how your SAC is addressing them.**

None

## D. Curricular changes as a result of educational initiatives

**Has the SAC made any curricular changes as a result of exploring/adopting educational initiatives (e.g., Community-Based Learning, Internationalization of the Curriculum, Inquiry-Based Learning, etc.)? If so, please describe.**

In the Spring of 2017, CMET 122 Engineering Technology Physics was converted to CMET 122 Global Energy Physics. In this course, fundamentals of Physics (Conservation of Energy, Bernoulli's equation, physical properties of states of matter) are explored with a larger focus upon the energy supply and demand of individual countries, currently and into the future. This approach contextualizes the information in an applied manner and also serves to internationalize the curriculum. An oral and written presentation are required for the Global Energy Project in which students research and present what innovative ways different countries are producing and supplying energy. International students have often chosen their home country which has produced an avenue for them to speak of their home country and for the rest of the CMET cohort to learn more about that country and those students as individuals.

In 2018, CMET students sold raffle tickets at a Portland Trailblazers game to raise money for the Community Cycling Center for extra credit in CMET 111: Portland Design: Brews, Bridges and Bikes.

In Winter quarter of 2019, CMET 110 Statics is experimenting with a flipped classroom. Students are required to watch a 'Pre-Class Video' every week (posted on D2L) of a relevant example problem being done in Microsoft OneNote before lecture. The intent is that students will have familiarity with the type of material that will be covered for the week and are also required to have a question ready about the material addressed in the video. These videos are created with a Microsoft Surface Tablet that was purchased with funds from the NSF RETA grant.

## **E. Dual Credit**

**Are there any courses in the program that are offered as Dual Credit at area high schools? If so, describe how the SAC develops and maintains relationships with the HS faculty in support of quality instruction.**

CMET 111 Portland Design: Brews, Bridges and Bikes (3 credits) is a dual credit course at Roosevelt High School. Randy Scott, the Engineering Instructor at RHS, and Greg Gerstner met twice in 2017-18 to discuss the creation of this course at RHS. This course is running for the first time at RHS in 2018-19. Randy and Greg have shared syllabi and design project information for their respective courses. Greg will visit the class at RHS during 2018-19 and assess the class using the proper Dual-Credit Assessment process.

## **F. SAC Course Evaluations**

**Please describe the use of Course Evaluations by your SAC. Have you created SAC-specific questions? Do you have a mechanism for sharing results of the SAC-specific questions among the members of your SAC? Has the information you have received been of use at the course/program/discipline level?**

The SAC has not developed SAC-specific questions for Course Evaluations.

# **4. Needs of Students and the Community**

## **A. Student Demographics**

**Have there been any changes in the demographics of the student populations you serve? If there have been changes, how have they impacted curriculum, instruction, or professional development, and, if so, in what way?**

CMET student gender and ethnicity seem to follow the national trend of the engineering field, which is mostly male and white.

In 2017-18, 66% of our students identified as white. This is a reduction compared to 2013-2014, when the number was 75%. It also appears that the percentage of African Americans and Hispanics have both grown (see table below). However, the number of students has decreased since 2014.

Engineering is a predominantly male-dominated profession. CMET gender demographics are 10 to 15% female, which is consistent with the national average of college students (link to NSF report). Similarly, the gender demographics of the engineering and engineering technology faculty at PCC demonstrate similar ratios: There are two full-time female instructors out of five full time instructors. We don't currently have any female part-time instructors either.

The number of students enrolled in the CMET department has steadily decreased each year since the last program review. One of the biggest reasons is that our program, which operates as a cohort, went from a Fall and a Winter start to just a Winter start. The faculty would like to explore offering a second start in the same style or through non-traditional modalities and course timing. By offering a second start we could increase enrollment and serve more students.

Prior to 2016, one CMET cohort started Fall quarter and another cohort started Winter quarter. Fall-start students took classes Fall, Winter and Spring terms with summer off to work or catch up. Winter-start students took 6 straight terms without any break. Both student groups would combine for the final 3 terms (second year classes) and complete together. This format helps boost enrollment for the second year classes, which is where Civil and Mechanical students split and take different courses. In the last 3 years we've been operating with one cohort start. The change has impacted our program in that we have run low enrollment Civil Engineering Technology specific courses. For example, in 2017-2018 academic year CMET 228 - Construction Materials (a Civil Engineering Technology course) had only 3 students in it. Our Civil Engineering Technicians are getting jobs, and there are more jobs available than we can fill. The Civil Engineering Technology degree program has room for more students to meet the current employment demand.

Table 2: CMET Demographics Data

Race/Ethnicity	2013-14		2014-15		2015-16		2016-17		2017-18	
	Count	% of Total	Count	% of Total	Count	% of Total	Count	% of Total	Count	% of Total
Asian	4	3.0%	8	6.9%	8	8.5%	7	8.5%	3	4.4%
Black	5	3.7%	4	3.4%	4	4.3%	4	4.9%	4	5.9%
Hispanic	13	9.6%	11	9.5%	10	10.6%	10	12.2%	9	13.2%
Multi	3	2.2%	2	1.7%	2	2.1%	2	2.4%	2	2.9%
Native	0	0.0%	2	1.7%	3	3.2%	1	1.2%	0	0.0%
Pacific	1	0.7%	1	0.9%	0	0.0%	1	1.2%	1	1.5%
Unreported	7	5.2%	8	6.9%	7	7.4%	3	3.7%	4	5.9%
White	102	75.6%	80	69.0%	60	63.8%	54	65.9%	45	66.2%
Grand Total	135	100.0%	116	100%	94	100.0%	82	100.0%	68	100.0%

Gender	2013-14		2014-15		2015-16		2016-17		2017-18	
	Count	% of Total	Count	% of Total	Count	% of Total	Count	% of Total	Count	% of Total
Female	22	16.3%	17	14.7%	16	17.0%	10	12.2%	5	7.4%
Male	110	81.5%	98	84.5%	77	81.9%	70	85.4%	60	88.2%
Unreported	3	2.2%	1	0.9%	1	1.1%	2	2.4%	3	4.4%
Grand Total	135	100.0%	116	100.0%	94	100.0%	82	100.0%	68	100.0%

Age Group	2013-14		2014-15		2015-16		2016-17		2017-18	
	Count	% of Total	Count	% of Total	Count	% of Total	Count	% of Total	Count	% of Total
Under 20	10	7.4%	9	7.8%	3	3.2%	4	4.9%	4	5.9%
20-24	21	15.6%	28	24.1%	18	19.1%	15	18.3%	13	19.1%
25-49	96	71.1%	73	62.9%	70	74.5%	63	76.8%	49	72.1%
50+	8	5.9%	6	5.2%	3	3.2%	0	0.0%	2	2.9%
Total	135	100%	116	100%	94	100%	82	100%	68	100%

Another way we'd like to improve our program, and possibly increase enrollment, is through offering more hybrid courses. Currently students are on campus 5 days a week for most of the day. If we reduce the time required on campus, this could allow for more flexibility that wasn't there before. If more courses were offered in a hybrid format there's the potential to offer a Friday / Saturday program similar to Friday Academy. This is an option that the CMET faculty may explore.

## **B. Facilitating success for students with disabilities**

**What strategies are used within the program/discipline to facilitate success for students with disabilities? If known, to what extent are your students utilizing the resources offered by Disability Services? What does the SAC see as particularly challenging in serving these students?**

CMET students make use of the testing center at Sylvania. Students who require testing accommodations can take their tests in the testing center and for the length they need. Sometimes scheduling these tests can be challenging, as it may require students to make arrangements outside of class time.

Other strategies faculty use to support students with disabilities is to make lecture content available online for students to access as needed. One of the CMET instructors uses LiveScribe pens that are available through Disability Services.

The CMET students are sometimes students who are retraining for a new career. Sometimes these students are retraining due to an injury. Having adjustable tables and chairs with arms is very helpful for these students to feel comfortable in the classroom.

A few of the CMET instructors have created videos for their classes. These videos could be closed captioned to further increase our ability to better serve students.

## **C. Facilitating success for online students**

**What strategies are used within the program/discipline to facilitate success for online students? What does the SAC see as particularly challenging in serving online students?**

While CMET department doesn't currently offer online courses, many of the faculty use D2L to communicate with their students. Courses that have significant material on D2L are primed for a hybrid course offering.

## **D. Implementation of Feedback for curriculum/instructional changes**

**Has feedback from students, community groups, transfer institutions, business, industry or government been used to make curriculum or instructional changes (if this has not been addressed elsewhere in this document)? If so, describe.**

Since the last program review there have been changes to the CMET program. Under the program we offer 2 degree paths and 4 total AAS degrees. The two paths are Civil Engineering Technology (CET) and Mechanical Engineering Technology (MET). We have changed the CET program (new program advising guide attached) and have plans to change the MET program. Some of the changes were outlined in section 1B.

One change we've made is to shift when students take the drafting courses. This was primarily based on feedback and work we did with our Industry Advisory Committee. The Industry Advisory Committee requested a deeper understanding of the Computer Aided Drafting (CAD) software. Some Industry Advisory Board Members also were interested in hiring students through internships. To support both requests we moved the courses early in the program. Faculty can help the students maintain and/or deepen their use of the software through assignments that include CAD requirements.

## **5. Faculty: reflect on the composition, qualifications, and development of the faculty**

### **A. Faculty strategic intentions for diversity, equity, and inclusion**

**Provide information on how the faculty instructional practices reflect the strategic intentions for diversity, equity and inclusion in PCC's Strategic Plan, [Theme 5](#). What has the SAC done to further your faculty's inter-cultural competence and creation of a shared understanding about diversity, equity, and inclusion?**

- One CMET faculty participated in the Social Justice for Faculty Workshop in spring 2016.
- CMET participated in the Diversity Internship program in 2014-15. Through this participation, we successfully trained and hired the intern as an adjunct. This intern worked for 4 terms before being hired for a non-teaching role at PCC on another campus.
- Two CMET faculty and the Dean participated in and NSF funded Women Tech Educators Online Training Fellowship in 2014-15. The fellowship was run by National Institute for Women in Trades, Technology and Science (IWITTS). This fellowships was free for participants.
- PCC joined the newly created Oregon Council for Engineering and Related Technical Education (OCERTE) with the goal of aligning engineering curriculum for students who transfer credits to different academic institution.

- NSF S-STEM grant. This grant money is used to support diversity in CMET and other technology programs (Electronic Engineering Technology and Machine Manufacturing). The grant money provides scholarship money to students and money for training faculty.
- One CMET faculty is currently a part of the Teaching Teams at the Sylvania campus.
- CMET faculty have presented at Las Hermanas - Design your future conference in 2017 and 2018

## B. Instructor Qualifications

**Report any changes the SAC has made to instructor qualifications since the last review and the reason for the changes. Current Instructor Qualifications are available at:**

<http://www.pcc.edu/resources/academic/instructor-qualifications/index.html>

The CMET SAC reviews the instructor qualifications annually. There have been no changes to the instructor qualifications since the last program review.

## C. Faculty Professional Development

**How have professional development activities of the faculty contributed to the strength of the program/discipline? If such activities have resulted in instructional or curricular changes, please describe.**

- In January 2016, one faculty members attended a Flipped Classroom Conference at Harvey Mudd College. Most of the attendees were in Engineering or other STEM related field. Following the conference, the faculty experimented with flipping portions of their CMET course. This mode of teaching supported the students by giving them time to learn content while at home and then practice the content in the classroom with the support of the instructor.
- Faculty involvement with NSF through grant reviews strengthens the connection between CMET Department faculty, the NSF and PCC.
- Faculty presented at the HI-TEC 2017 conference, Salt Lake City
- Teach teams through Sylvania campus: One of the faculty is currently participating in the Sylvania campus Teaching Teams.
- In Spring 2018 the department chair, Tara Nelson attended the Diversity, Equity & Inclusion faculty department Chair / Division Dean Summit.
- In May 2016 one of the faculty attended a 2 day training organized by the Diversity, Equity and Inclusion office. At the workshop there were three units:
  - Culturally Relevant Curriculum
  - Multicultural Organizational Development and the Hidden Curriculum in your Classroom
  - Pedagogical Approach in the classroom for culturally relevant teaching
  - Critical Race Theory and Critically Responsive Teaching
- One of the CMET developed a Humanitarian Engineering camp as a part of an interdisciplinary team. This 3.5 day camp ran in the summer of 2017 and was designed for female middle school students (19 students attended, not all of which were female). The camp hired high school students from underrepresented groups to be camp “counselors”.

## 6. Facilities, Instructional, and Student Support

### A. Describe how classroom space, classroom technology, laboratory space, and equipment impact student success.

ALL CMET classroom space, classroom technology, laboratory space and equipment is shared space, used by both CMET and the engineering transfer (ENGR) program. CMET uses classrooms in the SS building and rooms AM 105, AM 112 and AM 125. The SS classrooms are indistinguishable from most on campus and impacts on student success are likely indistinguishable as well. The classrooms AM105, AM112 and AM125 are less desirable and, while only anecdotal data can be presented, are not spaces that positively impact student success. AM classrooms and computer labs lack natural, ambient light, that research has shown to have positive impacts on student success. The minimal light that enters the westward looking, lower-level AM classrooms and computer lab spaces comes from a 25 inch x 15 inch window in the entrance door to the classroom. Additionally there have been air quality issues in AM 112. Since the remodel AM 112 has been reported numerous times to PCC Facilities for problems with automotive exhaust problems (carbon monoxide) infiltrating the room during class time. AM 112 and AM 125 also have very low ceilings presenting a claustrophobic feeling to students and faculty alike. We, as faculty, would be appreciative of improved ambient lighting and higher air quality.

The shared CMET and ENGR laboratory space in the AM building consists of:

- AM 101, the MakerLab. CMET 111, CMET 121, CMET 133, CMET 223, CMET 235, and CMET faculty office hours use this space. The PCC MakerLab is integral in a number of CMET classes. The classes which depend upon the PCC MakerSpace include CMET 111 Portland Design: Brews, Bridges and Bikes, CMET 133 Materials Technology, ENGR262 Manufacturing Processes, and CMET 235 Machine Design. Three of the CMET133 labs take place in the MakerLab. The MakerLab tools also fabricate lab samples for CMET133. ENGR262 utilizes the MakerLab for six of the ten labs in the course. Students in ENGR262 build four week project using the fabrication tools in the MakerLab. The MakerLab is integral to CMET235, which utilizes the MakerLab for all of the labs in the course. Maintenance and security are the responsibility of Laboratory Technician Amy Petit. Makerspace is a very popular space. User head count continues to increase:
  - 180 PCC students and staff used the MakerLab, Winter 2018.
  - 243 PCC students and staff used the MakerLab, Spring 2018.
  - 426 PCC students and staff used the MakerLab, Fall 2018
- AM 102 houses the tensile test equipment used by CMET and Engineering Transfer. Maintenance, security and cleaning are the responsibility of Laboratory Technician Richard Dawes
- AM 103 and 103(a-e) is a multi-purpose space with multiple (a-e) attached rooms. AM 103 is an eleven (11) seat computer lab with additional tables for studying. Second-year CMET students are given key card entry to this space. This main room connects the other rooms by access doors. The other rooms in AM 103 (a-e) are:

- Laboratory Technician office and storage area for survey equipment, tools, batteries and supplies. Security and cleaning are the responsibility of Laboratory Technician Richard Dawes.
- Storage room for tools, saws, mechanical-electrical supplies, welding equipment and technician tools to build teaching aids. Security and cleaning are the responsibility of Laboratory Technician Richard Dawes.
- Geotechnical laboratory. Maintenance, security and cleaning are the responsibility of Laboratory Technician Richard Dawes.
- All-user restroom
- Wet lab/Chemical Storage and Materials Science lab space. Maintenance, security, safety and cleaning are the responsibility of Laboratory Technician Richard Dawes.
- AM 105, a Lecture/Laboratory space with elevated tables for student work. AM 105 has typical lecture resources.
- AM 106, a Twenty-four (24) seat computer laboratory maintained by PCC IT department. This room has tight quarters for a computer laboratory and offers limited space for students. Space between students is uncomfortable for working. Access to students can be limiting for the instructor as the rows are narrow. Ambient light in room is limited to a 25 x 17 inch window in access door. Printer paper filled as needed by Laboratory Technician, Richard Dawes.
- AM 107, a Twenty-four (24) seat computer lab maintained by PCC IT department. This room has tight quarters for a computer laboratory and offers limited space for students. Space between students is uncomfortable for working. Access to students can be limiting for the instructor as the rows are narrow. Ambient light in room is limited to a 25 x 17 inch window in access door. Printer paper filled as needed by Laboratory Technician, Richard Dawes.

The shared laboratory spaces, and equipment, in the AM building have a critical impact on student success in the CMET program because Engineering Technician training is by definition a hands-on, laboratory heavy experience. All the second year CMET courses depend on the laboratory experience to achieve student success. Safe, clean space with working equipment is critical to the impact of these spaces on student success. Laboratory Technician for the shared spaces of CMET and ENGR is Richard Dawes.

The Laboratory Technician for the shared CMET and ENGR laboratory space is invaluable because the needs of the laboratories are so extensive and diverse. The Laboratory Technician is responsible for:

- Equipment preparation, calibration, cleaning and repairs. The Laboratory Technician for one lab may have to preheat high temperature ovens, calibrate the oven's thermal controller, and troubleshoot temperature deviations. While the oven is preheating, the Laboratory Technician installs sanding paper rolls into the polishing machines, repairs or replaces drive belts, mixes and fills dispensers with polishing liquids and prepares space for etchant acids to be safely and properly used.
- Maintain all battery equipment. Remove batteries before decommissioning equipment, track, store, and properly dispose of batteries. Cycle charge reusable batteries.
- Cleaning laboratory floors, tables and walls; including sweeping, dusting and mopping laboratory spaces not maintained by Facility Services.

- Weekly and monthly inspections of safety equipment, and acting as Safety Committee Floor Monitor.
- Chemical storage and waste storage, documentation and disposal of regulated products.
- Purchasing of chemical and other consumables including those that require Safety Data Sheets (SDS) documentation and Hazardous Material communication as required by OSHA.
- Being the contact between equipment vendors and the department for parts, repairs, calibrations, and equipment and software updates.
- The credit card, online accounts, statement processing and maintaining two (2) different expenditures spreadsheets; one of the district and one for the division dean.

There would be not be impact from laboratory spaces and equipment to discuss without the Laboratory Technician, Richard Dawes. To properly support the CMET and ENGR programs he has to be a jack of all trades able to adapt to the situation, stay calm under short time lines, and continually demonstrate a willingness to do what is needed to assure that the laboratory space and equipment continue to have an impact on students.

It is estimated that there are over 5000 different pieces of parts and equipment needed to run the diversity of labs for CMET. Some examples of different equipment used include:

- CMET 133 - lab equipment in AM103 is an integral part of the course. It provides hands-on learning opportunities for students. Lab equipment and staff support for materials science sample preparation and testing. This includes furnaces, polishing equipment, microscopy equipment, and testing equipment.
- CMET 214 - New equipment purchased in fall 2017 replaced 20 year old machines. The technology in the new equipment makes use much easier. As a result, students are asking “how” does one pursue a surveying degree?
- ALL CMET equipment is shared with the ENGR (LDC) programs
- AM103 - added an aquaponics system that is used in both CMET and ENGR lab courses.
- Lab space and equipment is shared between ENGR and CMET. Equipment shared with ENGR 101 include calipers and metrology equipment in used in CMET 235 and force tables and pulleys in CMET 226.
- iClickers are used in CMET 133 to obtain instantaneous assessment. The iClickers are shared with ENGR courses such as ENGR 231.

**B. Describe how students are using the library or other outside-the-classroom information resources (e.g., computer labs, tutoring, Student Learning Center). If courses are offered online, do students have online access to the same resources?**

In addition to its use as a classroom space, the MakerLab acts as a prototyping and 3-D printing center open for educational and outreach purposes. Students have the opportunity to work on their own design projects as well as extra time for class projects.

Second year students are granted access to AM 103 and AM 105 for computer lab use. The computers in AM103 include the software taught in CMET classes, such as CAD software, standard Microsoft Office products and tool specific software such as microscopy and surveying software.

**C. Does the SAC have any insights on how students are using Student Resource Centers Such as Academic Advising, Counseling, Student Leadership, and Student Resource Centers (e.g., the Veterans, Women’s, Multicultural, and Queer Centers)? What opportunities do you see to promote student success by collaborating with these services?**

The CMET Program has had many students who have used the Veteran’s Resource Center. Often times, Veterans have learned skills in their military careers that translate well to Civil and Mechanical Engineering Technology.

Another great resource for students is the PCC Jobs and Internships office. Our current Jobs Specialist is Nicole Perez. Nicole shares jobs data with the faculty several times a week. She attends our advisory meetings and has been helpful in communicating job opportunities. We’ve had the practice of sharing these jobs with all students in CMET. Students early in the program can see what’s “out there” before they’re ready to apply and students nearing the end of the program can tailor their resumes to specific jobs.

The CMET program, like other programs at PCC, asks a lot from students which causes stress. PCC’s counselling department serves as a resource for students who need support or need to build stress coping skills.

7. Career and Technical Education (CTE) Programs only: To ensure that the curriculum keeps pace with changing employer needs and continues to successfully prepare students to enter a career field...

**A. Evaluate the impact of your program’s advisory committee on curriculum and instructional content methods, and/or outcomes.**

On average our advisory committee has 10 industry members who attend. We meet once in November and once in May. This board provides the input when requested. We are continually looking for ways to improve the input provided and how to make this committee more engaged in our program.

Minutes from the last three advisory committee meetings are available in the appendix.

**B. Describe current and projected demand and enrollment patterns for your program. Include discussion of any impact this will have.**

Enrollment in CMET is not as high as we would like it to be. We currently have 23 new CMET students (first-year started Winter 2019) and roughly 22 second year. We would like to see higher enrollments. We have the capacity to start and teach 30 to 35 students each year. However, since the last program review we have reduced this program to one start each year. This has negatively impacted our program as it leaves a smaller window for students to enroll in the courses we teach.

We are hoping that with the changes we’re making in the program along with more hybrid courses offerings that we will see an increase in enrollment.

We are also working on some Marketing with an outside vendor and are hoping that will also generate some enrollment.

**C. How are students selected and/or prepared (e.g., prerequisites) for program entry?**

Prerequisites to enter the CMET Program are MTH65 and WR121. The complete CMET Advising guide is available in Appendix F.

**D. Review job placement data for students over the last five years, including salary information where available. Forecast future employment opportunities for students, including national or state forecasts if appropriate.**

CMET Faculty and Staff need institutional support from the college to compile, store and analyse job placement and salary data of graduating students. The current mechanism to collect job placement and salary data is totally contingent upon the CMET Advisor. Currently, CMET relies on the open communication from students to college this data. If a student does not voluntarily provide personal contact information at the end of their last quarter, job placement and salary data is not recorded. Once students graduate, CMET depends on the graduates to keep this contact current and respond to requests. This means CMET job data is anecdotal in nature. Linda Browning has maintained a Google Document with data regarding CMET graduates since 2012. According to this document, CMET graduates have found employment at Intel, Solar City, ESCO, Environmental Management Systems (EMS), High Speed Interconnects, City of Portland Department of Transportation, Voltavodare, Power Engineers, Washington County Engineering, Columbia West Engineers, RedBuilt LLC, City of McMinnville Engineering, Lam Research, Pacific Diabetes Technologies, Black and Veatch, AKS Engineering, WB Wells, NW Geotech, Contech Engineered Solutions, Maxim, TE Connectivity and Biotronik. This is not an exhaustive list of employers. Anecdotally, these jobs tend to pay in the \$45000 to \$50000 per year range to start.

**E. Present data on the number of students completing degree(s) and/or certificate(s) in your program.**

**Analyze any barriers to degree or certificate completion that your students face, and identify common reasons why students may leave before completion. If the program is available 100% online, please include relevant completion data and analysis.**

The degree and certificate trends for CMET are reported below. The CMET program is comprised of 4 degrees and two certificates. Most of the students earn either the CET - Civil Engineering Technology or the MET - Mechanical Engineering Technology. The number of degrees has steadily declined in line with the enrollment for the program.

Not all of the students who start the program earn a degree or certificate. A few anecdotal reasons include the following:

- Life events prohibit students from continuing.
- Students learn more about the program and choose other areas of study.
- Students don't have the time commitment to be in school full-time.
- Students start in CMET and transfer to ENGR transfer mid flow. This usually accounts for up to three students a year. While decreases our completion rate, the faculty are supportive of the students who choose this route.

The department feels that one of the barriers to completing is the time commitment. The program currently is taught during the day and all of the courses are face-to-face. Additionally the program tends to be susceptible to the economy. In good economic times, the programs sees a drop in enrollment and a boost in poor economic. As mentioned previously in this document the CMET faculty are committed to reviewing the student time demands and expect to produce more on-line learning options as well as reduced contact time as is appropriate for our students.

*Table 1: 5 Year Trends of Degrees & Certificates Awarded*

Program	Description	Degree	2013-14	2014-15	2015-16	2016-17	2017-18
CET	Civil Engineering Technology	AAS	12	12	10	4	8
		ACERT2	2	3	0	0	0
CGR	CET: Green Tech & Sustainability	AAS	0	1	3	1	1
MET	Mechanical Engineering Technology	AAS	19	18	9	15	13
		ACERT2	3	2	1	1	0
MGR	MET: Green Tech & Sustainability	AAS	0	1	2	0	0
<b>Grand Total</b>			<b>36</b>	<b>37</b>	<b>25</b>	<b>21</b>	<b>22</b>

**F. Is the program Perkins-eligible? If so, answer the questions below.**

- i. With which secondary school(s) does the program have aligned Programs of Study? Do PCC faculty meet with these HS program faculty on a regular basis?

The CMET Program has aligned programs of study with Roosevelt High School in using CMET 111 Portland Design: Brews, Bridges and Bikes as a dual-credit course. Greg Gerstner meets with Randy Scott at least once per year and shares emails a couple times per year.

- ii. Please describe the Technical Skill Assessments (TSAs) that are reported annually. Include information about the nature of the assessment, content covered, alignment of degree and certificate outcomes, when the assessment is taken by students, the number of completers, and the percentage of students meeting the identified benchmark(s) for the last 5 years.

Since the last CMET Program Review, CMET has submitted Technical Skills Assessment to the State of Oregon for the past 5 years (2014-2018). The CMET Program has designed sample problems in 5 classes

(4 in MET and 4 in CET; see Appendix E) to assess whether students are meeting Degree and/or Certificate outcomes. These 5 sample problems have been approved by the CMET Industry Advisory Committee as appropriate questions which a CMET graduate should be able to solve and were given to CMET students in a testing situation. Annually, these 5 sample problems are graded separately in their respective courses and the results are reported to the CMET SAC Chair. The SAC Chair summarizes the results and reports the results. The CMET SAC has determined that a passing score should be 70% or above. Of the 144 CMET graduates (2014-2018) that scoring has been reported upon, 116 CMET graduates have met the criteria that is considered by the SAC to be meeting Degree and/or Certificate outcomes.

iii. What does the SAC consider to be the most impactful use of Perkins funding for your program?

The CMET SAC has an extremely valuable member of the team in Linda Browning, Program Advisor for Engineering Technology. Linda promotes Engineering Technology through Advising Sessions, advises students throughout their PCC academic careers and works closely with students to prepare them for their next step after graduation. This position is supported by Perkins funding.

**G. Describe opportunities that exist or are in development for graduates of this program to continue their education in this career area or profession.**

MET Students have the opportunity to continue their education at Oregon Tech. 2-year MET students can articulate into Oregon Tech's 4-year BSMET program at the Wilsonville campus. Some CET students have continued their education at Portland State. There are a small number of students who elect this option. CMET coded classes transfer directly to Oregon Tech's BSMET program, but CMET coded classes not transfer directly into Portland State's 4-year Civil Engineering Program.

## 8. Recommendations

**A. What is the SAC planning to do to improve teaching and learning, student success, and degree or certificate completion, for on-campus and online students as appropriate?**

- Reduce Contact Hours for students in first and second year courses.
- Create Open Educational Resources - Textbook costs in Engineering are high. It is common for Engineering textbooks to be between \$200 to \$300. Many publishers update their textbooks every 2 or 3 years, making used books obsolete. Sadly, many of the changes are a new color scheme and shuffling of the homework problems numbers. There is a limited amount of quality OER content in

Engineering. The CMET SAC agrees reducing the textbook costs for our students are important. CMET 122 Global Energy Physics uses an OER textbook.

- Create more student schedule flexibility: Offer more classes in a hybrid model - CMET courses are currently only offered at the Sylvania Campus. We are hoping that more hybrid courses would offer a way to bring in students from a wider geographic area in Portland, by requiring student to be on campus only a few days a week rather than five days a week. In addition, a hybrid course model may be a good way to maintain the connection with students that occurs in face-to-face classes, while providing more flexibility for students.
- Increase student diversity - According to five years of data available from Institutional Effectiveness, CMET students are nearly 60% white each year. The SAC wants to increase the number of diverse students. The SAC would also like to see more women enrolled in Engineering courses. According to Institutional Effectiveness data, in 2015-16 17% of our students were female, whereas in 2017-18 7.5% are female. A female-to-male student ratio more inline with the college is preferred. In order to increase student diversity, the CMET SAC needs to devote time and resources to intentionally recruit and enroll a diverse student population.
- CMET 133 Materials Technology is currently offered during the same quarter as CH 101 Inorganic Chemistry Principles. The CMET SAC plans on revising the course schedule so that students complete CH101 before they take CMET133.
- Update the MET program with changes that are currently in progress.
- Incorporate Humanitarian Engineering focused curriculum into CMET 221 Environmental Systems.

## **B. What support do you need from administration in order to carry out your planned improvements?**

- CMET has an opportunity to increase the diversity of the incoming student population. CMET needs support from the PCC Marketing Office to help make this happen.
- Adding the engineering image to computer lab spaces for students to access department specific software is important. The department would like to have CAD specific software be installed on the computer resource computers.
- Faculty have a number of years acquiring grants from the National Science Foundation. To support the CMET change we request Administration support for applying to the National Science Foundation's (NSF) Advanced Technology Education grant program. To apply for the grant requires an administrative-level sponsor/Champion. Second is a small amount of release time for a faculty

member. Faculty have experience managing a national Center for NSF and can provide knowledge, experience and leadership to a proposal. There is a need for one (1) lab's worth of release time during spring quarter 2019 to work with the administrative sponsor and the Grant's Office to prepare the grant. The proposed writing of this grant is timely as it can be written as a collaborative effort. The three legs of the development triangle would be the internal PCC support of the proposal, the CMET change, and the recent PCC Career, Technical Education (CTE) bond. The focus of the grant will be on CMET's challenge to change the ratios of gender and race within engineering technology.

- Decrease the amount of time and practical barriers for Part-time faculty to receive four essential abilities before the start of classes: Keys, Key Card Access, Copy Code, PCC Computer Login Access.
- Financial support to visit some successful Civil and Mechanical Engineering Technology programs in the region and US. A contingent of the CMET faculty would travel to two (2) to three (3) programs that demonstrate exceptional rates of placing students at graduation. One example locally could be Clackamas Community Colleges Water and Environmental Technology (WET) Program. Regionally, North Seattle Community College has had great success in NSF grant funding and incorporating results into their programs. Nationally, looking at large, western institutions with engineering technology programs would be our guidelines.
- Continued support from the PCC Degrees and Certificates Committee and the PCC Curriculum Committee to evaluate and approve CMET's degree, certificate, and course revisions. In particular, support for the creation of a CMET Capstone class, and MET and CET degree changes.
- CMET has developed more curriculum and course project revolving around CAD (Computer Aided Drafting). A CAD lab with 32 seats and drafting space, printer, and instructor podium is needed. Currently, CAD is only installed in AM106, AM107 (24 seats each) and AM103 (10 computers). Two of these rooms, AM106 and AM107 are scheduled very tightly with CMET and ENGR classes. They are rarely, if at all, available for student project or homework use. AM103 has some computers and CAD software, but not enough computers for a class worth of students to use and there is no instructional capability where the computers are located in AM103.
- An opportunity for CMET faculty to go on sabbatical to develop open education resources and/or hybrid courses. A sabbatical for one eligible CMET faculty before the next program review is ideal.
- Room, technology and food support for a 2-year CTE version of OCERTE (Oregon Engineering Transfer bi-yearly meeting) to host the first meeting on the PCC campus. Community College CTE faculty all across Oregon will be invited to the meeting. A room, technology, parking and food support is needed when PCC hosts the state-wide OCERTE meeting.
- Support from the PCC Foundation, PCC Board of Trustees, and PCC President's office to assist with invitations to new CMET Professional Advisory Board members.
- Support from the PCC administration to include part-time faculty in the Program Review Process. Compensation for Part-time faculty to participate in Program Review meetings and work on the Program Review Report and Presentation (similar to how Part-time Faculty are compensated for SAC meetings).
- Administration support for the creation and adoption of OER textbooks in CMET courses.
- Support from administration to modify some current face-to-face courses into hybrid courses.

## 9. Assurances

Please put X's next to all three boxes to verify that...

faculty and FDCs at all of the campuses offering courses in this discipline/program have received a late-stage draft of the Program Review document.

all of the division deans offering courses in this discipline/program have been sent the late-stage draft.

the SAC administrative liaison has reviewed and had the opportunity to provide feedback on the final report.

## 10. Appendices

### Appendix A: Core Outcomes Mapping Matrix

Table 3: CMET Course Outcome Mapping Matrix, 1st year courses

		Communication	Community and Environmental Responsibility	Critical Thinking and Problem Solving	Cultural Awareness	Professional Competence	Self-Reflection
Course #	Course Name	CO1	CO2	CO3	CO4	CO5	CO6
CMET 110	Statics	3	3	4	3	3	3
CMET 111	Portland Design: Brews, Bridges, and Bikes	3	3	4	3	3	3
CMET 112	Technical Algebra / Trigonometry	2	2	4	2	3	2
CMET 121	Strength of Materials	3	3	4	2	3	3
CMET 122	Global Energy Physics	3	4	3	4	3	3
CMET 123	Technical Algebra with Analytic Geometry	2	2	4	2	3	2
CMET 131	Applied Calculus	3	2	4	2	3	2
CMET 133	Materials Technology	3	2	4	2	3	2

Table 4: CMET Course Outcome Mapping Matrix, 2nd year courses

		Communication	Community and Environmental Responsibility	Critical Thinking and Problem Solving	Cultural Awareness	Professional Competence	Self-Reflection
Course #	Course Name	CO1	CO2	CO3	CO4	CO5	CO6
CMET 211	Environmental Quality	3	4	4	2	3	2
CMET 212	Thermodynamics I	2	3	4	2	3	2
CMET 213	Fluid Mechanics	2	4	4	2	3	2
CMET 214	Surveying II (CET)	3	2	4	2	4	2
CMET 221	Environmental Systems	3	4	4	3	4	2
CMET 222	Thermodynamics II	3	3	4	2	3	2
CMET 223	Project Management	4	3	4	2	4	4
CMET 226	Dynamics (MET)	3	3	4	2	3	2
CMET 227	Applied Electricity Fundamentals	2	3	3	2	3	3
CMET 228	Construction Materials (CET)	3	3	4	2	4	2
CMET 233	CET Applied CAD (CET)	3	3	3	2	4	2
CMET 235	Machine Design (MET)	3	3	4	2	3	2
CMET 236	Structural Design	3	1	4	2	3	2
CMET 237	MET Applied CAD (MET)	3	2	4	2	4	2
CMET 241	Structural Steel Drafting	3	2	3	1	4	2
CMET 254	CMET Seminar	4	2	2	3	2	3
CMET 255	CMET Professional Skills Development 1	4	2	2	3	4	4

## Appendix B: Communication Rubric

### Rubric For Communication using Engineering Problem Format

Instructions given to the student:

Problems presented in order

Written clearly in pencil on engineering calculation paper

Headings must be underlined

Final answers must be boxed

The Given statement: problem statement from the text. It must include enough information to recreate the problem without the use of the text.

The Find statement: what you are looking for.

Solution: must show a clear/ logical evaluation process, including a free-body diagram or other figure when applicable, with a boxed final answer.

One question per page/ start a new page for each problem

Use the face of the engineering pad only

<b>Mechanics</b>		Yes	No	N/A
1	Is the assignment on engineering calculation paper?			
2	Is the writing only on the front side of the paper?			
3	Is the writing done in pencil?			
4	Are the problems completed in order?			
5	Does each problem start on a new page?			
6	Does each page include the student's name?			
7	Does each page include the class (either name or number)?			
8	Does each page include a page number?			
9	Is the page number in the x of n (or X/N) format?			
10	Are appropriate section headings used?			
11	Are the section headings underlined?			
12	Are the solutions boxed?			
13	Is there adequate white space for readability?			
14	Could you read everything on the page?			
15	Is the paper free of smudges, debris, etc. ?			
<b>Problem Statement</b>				
Given Section				
1	Is the problem number shown?			
2	Is there at least one sentence that describes the problem in words?			
3	Is the written description adequate without the use of the text?			
4	Are all given diagrams/ figures included?			
5	Are all given diagrams/ figures included without any alteration or additions?			
6	Are all given quantities clearly identified?			

Cont'd

<b>Find Section</b>				
1	Is there at least one sentence identifying what is to be found?			
2	If a variable is declared is it clear what that variable represents?			
3	Is the find statement complete?			
4	Is it clear what is to be found in the solution to the problem?			

<b>Solution</b>				
1	Is the solution clearly separated from the problem statement?			
2	Are there clear steps in the solution?			
3	Are all major steps to the solution included?			
4	Do the solution steps follow a logical progression?			
5	Are any assumptions clearly identified?			
6	Are all necessary diagrams included? (FBD, Schematic, etc.)			
7	Is the diagram complete? ( All forces, etc)			
8	Are necessary references included? (coordinate system, labels, etc.)			
9	Are appropriate units included?			

## Appendix C: CMET Advisory Meeting Minutes

### i. CMET Advisory Minutes November 2018

#### **Civil & Mechanical Engineering Technology Program Advisory Committee Minutes Spring Meeting November 8, 2018**

##### **Advisory Committee**

Brian Pashley  
Aaron Phariss  
Robert Rivera  
Van Martin  
Pasquale Dell'Aquila  
Heinz Mueller  
Randy Yoshimura  
Luke Levin

##### **PCC Staff/Students**

Linda Browning  
Tara Nelson  
Chuck Litchfield  
Adam Scheible  
Peter Kazarinoff  
Jenna Bell  
Todd Sanders  
Nicole Perez  
Karin O'Connor  
Sarah Tillery  
Nicole Perez – Job's Office  
Leia Zimmerly – NSF Recipient

##### **Call to Order:**

The meeting was called to order at 7:40 a.m.

Welcome and introductions

Minutes from May 10, 2018, were reviewed and approved

##### **Unfinished Business**

- Pasquale Dell'Aquila shared results of his survey
  - Nineteen respondents
  - Look at data: Do we want/need to recruit people from certain/other areas?
  - Pasquale can reach out to his group for volunteers
  
- Question arose about whether or not CMET program and/or Advisory Board have a mission statement. That could guide us toward getting more members. Tara Nelson will bring that information to the May 2019 meeting
  
- Tara Nelson brought up group goals
  - What are goals for this academic year? Discussion ensued regarding role of Advisory Board
  - It was agreed that Board has relationship of advising but is not a governing body. PCC is bound by certain constraints, including money, so may/may not be able to implement ideas/suggestions. Extensive discussion ensued about Board's role, that it gives advice which may include soft skills being incorporated into classes, what skills are important, what feedback could be given to students, and there were offers by members to help
  
- Luke Levin asked what has been done regarding some of our action items

- He would like to see members seeing a need or a project that would be helpful and taking the lead or doing it on their own and bringing it to group (e.g., Pasquale's survey), and delegating action items. Recommended several check-ins throughout year regarding status of projects

## Reports

### PCC

- Program review happening in February. It is an opportunity for departments to present information to administration about what/how they are doing. We may ask for members of Advisory Board to act as panelists to provide feedback during review
- Tara shared the schedule changes for Civil's degree
  - Capstone class (to be offered in term six) will be developed for 2020 – not enough time to get it done earlier based on PCC deadlines. Discussion ensued regarding what the communication could be with students about how to do capstone
- Peter Kazarinoff talked about changes that mechanical engineering technology is looking at
  - Modification of a current class which has to go through curriculum
  - Need to create other classes
- Linda Browning shared statistics for enrollment and jobs
  - 23 graduating in June and one is already working
  - Nine civil and fourteen mechanical, three of whom are women
  - 20 applications for January start, seventeen of whom have committed

### Industry/Job Trends

- IMSE slowed hiring a bit
  - Did hire two CMET students recently and 1/3 of their workforce are PCC graduates
- The City of Portland is looking for several engineers
- Members shared their needs. The majority have hired PCC students and been very pleased with their skills
- Tara Nelson raised the question of whether or not we want to add REVITT design tool to our curriculum
  - Discussion ensued regarding what it does and whether or not it is relevant for engineering or building design. Structural civil could use it but not for standard civil engineering. Could we offer option for students to use Revitt or MicroStation since it is used in work for utility industries?
  - Tara asked if those members who use Revitt or MicroStation could help us with course development? Could Linda ask those employers we work with what they use?
- Greg Gerstner spoke about the Humanitarian Engineering Camp held in summer of 2017
  - It took place over three days and nineteen female/underrepresented groups of middle school students attended. Would love to have financial or volunteer support/involvement from members
  - OSU has minor in Humanitarian Engineering
  - [Worldmeters.info](http://Worldmeters.info): Population clock

**Action items**

- Tara will provide mission statement draft for review
- Linda will ask those employers we work with whether they use Revit or MicroStation
- Guest speakers – send information to Tara if you want to speak in certain classes

Advisory board suggested a need for more soft skills. CMET added a second credit to CMET 255 - Professional Skills course, which helps students get jobs and give them guidance on professionalism on life after college.

Next meeting will take place on Thursday, May 2, 2019.

Meeting adjourned at 9:05 a.m.

ii. CMET Advisory Minutes May 2018

**Civil & Mechanical Engineering Technology  
Program Advisory Committee Minutes  
Spring Meeting**

May 10, 2018

**Members Present:**

- Chantelle Sims
- **Sarah Tillery**
- Dana Gritz
- Pasquale Dell'Aquila
- **Peter Kazarinoff**
- **Chuck Litchfield**
- Steve Greenslate
- Randy Yoshimura
- Travis Kruger
- **Jenna Bell**
- **Linda Browning**
- Andy Brewer
- Robert Rivera
- **Greg Gerstner**
- **George Knox**
- Brian Pashley
- **Karin O'Connor**
- Lucas Levin
- **Tara Nelson**
- Aaron Phariss
- Thomas Ng
- Maria Cahill
- **Todd Sanders**

**Guest:**

- Rebecca Zegers, RedBuilt

**PCC Staff are in BOLD**

The meeting was called to order at 7:40 a.m.

**Introductions**

Chantelle Sims announced that this is her last meeting as president

Minutes from November 17, 2017, were reviewed and adopted with changes

**Unfinished Business:**

**Draft of Five-Year Plan – Tara Nelson**

- Reviewed contents including demographics, wish list, program goal set up that we can work on as a group. Discussion on draft centered around what people are noticing about demographics, wishlists. Suggestion was made that Instructional Technology be involved in projects with our program and provide cross-over training
- How does CMET advance development in the economy?
  - Luke Levin said that we are providing a program that quickly moves students from low to higher-end jobs
  - Sarah Tillery shared that market has to increase enrollment by attracting more women. When the economy is better we always see downturn in enrollment in CTE programs but it feels higher for CMET because we are a small program, so the percentage of enrollment decline looks bigger. The headcounts are higher in engineering transfer and/or EET so changes in their demographics are not as impactful.

What are we doing to increase women's enrollment in engineering? We attend trade fairs for women go into high schools for trying to increase contact with young women. CMET does not tend to get young people straight out of high school and women are often the ones raising children so it is more reasonable that we get older adults who are looking for retraining

- Tara brought up the NSF S-STEM scholarship and how it helps with recruitment by training tutors and funding presentations to classes. She added that, although forms ask participants to state their race and gender, people do not always identify as a specific gender or race and their responses are all we have to go on
- Wish List
  - Pasquale Dell 'Aquila encouraged looking at the processes and actions on the wish list, not just things. Greg Gerstner shared that he is going to have a class next summer that spends seven weeks at PCC and two weeks in Japan. Can we offer more of this kind of thing? We also need to prioritize items on wish list
- Members divided into groups of three, one PCC person per group. Discuss what committee members want from this committee.

### Reports:

- Tara talked about changes in programs, such as Mechanical Technology, being on hold because they have to go through curriculum review process. Have approval for Civil Tech (the Thermodynamics will be replaced with GIS courses). Are we going to start with fall 2018 students or wait? That is yet to be determined. Students can take two years of transfer credits but then take the last year of CMET to get certificate

### PCC

- We have seventeen MET graduates for summer term and one Civil student graduating in December
- Second Year Enrollment: 22 students
- Chantelle asked Linda about doing exit interviews and said that the SAC will discuss this
- Companies that may be looking for employees: Intel, Contech, Black and Veatch, Maxim, Columbia Steel, TE Connectivity, Portland Dept. of Transportation, Western Federal Lands Highway Division, Warn Industries, Lam Research
- 13 CTE, 11 EE, majority working
- George Knox shared that wages have not really come up for tech graduates; they get paid somewhere in the \$40k range vs. engineers who can get \$60k+ upon graduation.
- Per George, we have hosted three or four recruitment events, and have had some open houses and job fairs

### Employers

- Tesla hired three and have one opening
- Washington County has turnover, so constant postings, but it is a slow process at the city
- Microsystems Engineering continuing to hire, and will need up to ten people by end of year. They have about 100 employees in manufacturing, about a third are PCC graduates, and they have several PCC interns. Although current turnouts have been small, they are planning open houses in fall and spring.

### **Discussion of CMET Program – Tara Nelson**

- Currently, it is an 18-month program. We are exploring a fall, winter, spring schedule with summers off. One disadvantage is the impact this would have on students who get financial aid; if they do not take enough credits and lose their aid, we may lose them. Two start dates give people an option of starting with something else, changing his/her mind and then being able to start the CMET track
- We could offer electives in summer that would lighten load for other terms. We can also offer full time summer internships, and work study can be used if students work with governmental agencies. Would Board members be willing/able to have students as interns that start in summer?
- Greg Gerstner have his students a survey and, of the nineteen who responded, six said yes to winter start, six said no, and six said it would not matter

### **Membership**

Pasquale Dell' Aquila handed out a survey to get a sense of who attends meetings. He will collect surveys and bring results back to the fall meeting.

### **Board Chair**

Luke Levin was elected to serve as Board's new chair.

**Next meeting is November 8, from 7:30 – 9:00 a.m., in the CC Building Oak Room.**

### **Future Meetings:**

- Next meeting
  - Membership update from Pasquale
  - Discussion of adding REVIT classes to CMET curriculum

iii. CMET Advisory Minutes November 2017

**Civil & Mechanical Engineering Technology  
Program Advisory Committee Minutes  
Fall Meeting  
November 15, 2017**

**Members Present:**

- Chantelle Sims\*
- Sarah Tillery
- Dana Gritz\*
- Pasquale Dell'Aquila\*
- Adam Schibele\*
- Ayn Generes\*
- Peter Kazarinoff
- Chuck Litchfield\*
- Travis Kruger\*
- Jenna Bell
- Linda Browning
- Andy Brewer\*
- Robert Rivera \*
- Greg Gerstner
- Karin O'Connor
- Lucas Levin
- Tara Nelson

**Members Absent:**

- Heath Fewell\*
- Jeremy Riddels
- Kylie Thompson\*
- Richard Dawes
- Minh Luu\*
- Steve Greenslate\*
- Kevin Foster
- Wangping Sun
- Heinz Mueller\*
- George Knox
- Todd Sanders

**Guest:**

- Allie Flanary

**Meeting Objectives or Agenda:**

- Call to Order
- Introductions
- Unfinished Business
- Reports & Updates
- New Business
- Future Meetings

**Call to Order:**

The meeting was called to order. Minutes from May 17, 2017, were reviewed and approved with the correction of the spelling of Chantelle Sim's and Pasquale Dell' Aquila's names.

Chantelle reminded the attendees that she will be the committee chair for one more year so other people may want to consider running.

**Introductions:**

Special guest in attendance was Allie Flanary, PCC Faculty Librarian.

**Unfinished Business:**

A vote will be taken at the end of today's meeting regarding the time of day for the spring meeting.

## Reports:

### PCC

- First Year Enrollment for Winter Term: 18; 3 civil and 15 mechanical
- Second Year Enrollment: 24; 2 civil and 22 mechanical
- Graduates - (31)
- Jobs – Intel (3), Contech (1), Black and Veatch (2), Maxim (1), Columbia Steel (1), TE Connectivity (1), Portland Dept. of Transportation (1), Western Federal Lands Highway Division (1), Warn Industries (1), Lam Research (1) Only listed CMET folks
- A discussion ensued regarding what employers expect of new employees, what types of on-the-job training are available, and what components of our programs relate to and support problem-solving, which is a critical ability for any employee to have. One way to provide us with more information about problem-solving skills is to state which of our program components relate to/support problem-solving ability.

### Demographics Review from 5-Year Plan

- Completion rates were not captured
- Anecdotal evidence was shared by Peter Kazarinof that no women were in one of his classes
- Sarah Tillery would like more data regarding when and where we lose people. It is currently hard to obtain that information because PCC does not have a systematic process for gathering the data. The college has signed on to Achieving the Dream, a program which will help us collect more accurate completion information.

### Enrollment Update

- Sarah shared that enrollment in CTE programs across all PCC campuses is down and transfer program enrollment is up. There is an inverse relationship between the economy and enrollment and currently employment trends are up.
- Sarah responded to a question regarding the impact of Oregon Promise on enrollment. There are very specific requirements for the program. Students in the Portland area who meet the requirements were already tracking to come to PCC so we have not seen a change. Colleges in Madras and other areas outside Portland metro have seen bumps in enrollment.
- Tara brought up the point that PCC's President Mitsui made regarding the movement of people who are housing-insecure. They are being pushed farther out from Portland so it becomes more difficult for them to get to Sylvania.
- Tara also brought up possibility of offering more options for students. For example, a class that "meets" twice a week, once in person and once online.
- Peter Kazarinof suggested having an industry-driven capstone event and used the example of students making gears for Tesla.
- Tara suggested using the Wish List from the 5-Year Plan as a beginning document for planning at our next meeting.
  - **ACTION STEP:** Contact programs around the country to gather information about graduation statistics.

### 2-Year Degree vs. Certificate

- Per Chantelle, getting a bachelor's degree does not provide assurance of employment. People with 2-year certificates, however, are highly employable.
- Lengthy discussion ensued with a number of anecdotal examples supporting the benefit of getting an associates or 2-year certificate vs. getting a 4-year degree.

### Wish List from 5-Year Plan

Tara reviewed list and raised these questions:

- How can we as a committee achieve or reach toward these goals?
- What goals can we establish?
- Can we develop work groups to meet outside of regular board meetings?

### New Business:

- After lengthy discussion, the draft of the requirements for the AAS degree in Mechanical Engineering Technology adopted as a work plan. The motion was unanimously passed.
  - The following classes were removed: Thermodynamics II, Speech Communications, Environmental Systems, Environmental Quality, and Writing 121.
- After another lengthy discussion, the draft of the requirements for the 2-year AAS degree in Civil Engineering Transfer was adopted as a work plan with the expectation of reconvening to discuss incorporating AutoCAD.
  - The following classes were removed: Thermodynamics I and II, and Speech Communications. Writing 121 will no longer be a pre-requisite to start the program but is still needed to graduate.

### Future Meetings:

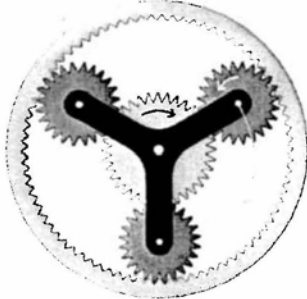
- After discussion and a poll, it was agreed that meeting times should alternate between morning and late afternoon. The next meeting will take place in the morning.
- Next meeting Thursday, May 10, 2018, from 7:30 to 9:30.
- Tara asked attendees to think about people they know and identify someone who would provide mutual benefit to themselves and us by becoming involved with the committee. It may be more effective to have individual members approach potential members/attendees and then provide contact information to Chantelle rather than just giving her the contact information. An initial conversation with a member is more likely to engender a positive response than an email or phone call from someone s/he does not know.

## Appendix D: Course Outcome Mapping Matrix

### Technical Skills Assessment Test

#1) Question from CMET 226 Dynamics (MET only)

#### Planetary Gear



Given:

$$w_{\text{ring gear}} = 0$$

$$w_{\text{spider}} = 4 \text{ rad/s clockwise as shown above}$$

$$r_{\text{spider}} = 3 \text{ in}$$

$$r_{\text{planet gear}} = 2 \text{ in}$$

Find:

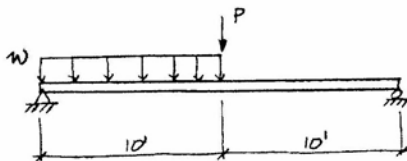
Gear Ratio between input shaft (connected to spider) and output shaft (connected to sun gear).

Express your answer in the form of \_\_\_\_ : \_\_\_\_

*Hint:*  $w_{\text{spider}}$  is not really important, but may make solving the problem easier if you don't like working with variables

#2) Question from CMET 236 Structural Design

For the beam shown below, the distributed load  $w$  is 2.5 k/ft and the load  $P$  is 12 k.



- (20) Draw the Shear and Moment diagrams for the beam.
- (5) Select the most economical W beam. The beam has lateral support at the reactions and under the distributed load, but NOT on the right half. Shear and deflection do not need to be considered.

Since the loading includes an allowance for the beam weight, you do not need to check this.

3. (5 each = 15) A single C6x10.5 is connected to a 3/8" thick gusset plate with 3/4" diameter bolts. A36 steel.

- Find the allowable load per bolt in shear,  $r_v$ , for A325-SC bolts
- Find the allowable load per bolt in shear,  $r_v$ , for A325-X bolts
- Find the allowable load per bolt in bearing,  $r_p$

#3) Question from CMET 228 Construction Materials (CET only)

A Proctor compaction test was performed, yielding the following data:

Test number	1	2	3	4	5	
$\rho_{\text{wet}}$ , kg/m <sup>3</sup> :	2055	2083	_____	2095	2077	Note: these are not $\rho_d$ 's!
water content, $w$ , %:	15.1	15.8	_____	18.4	19.4	
$\rho_{\text{dry}}$ , kg/m <sup>3</sup> :	_____	_____	_____	_____	_____	

For test 3, the mass of the Proctor mold is 4756.3 g, and the weight of the mold with wet soil is 6743.3 g. For the moisture content test, the mass of the container is 29.4 g, the mass of the container and wet soil is 65.5 g, and the mass of the container and dry soil is 60.2 g. The volume of the Proctor mold is 943.9 cm<sup>3</sup>.

a) (10) determine  $\rho_{\text{wet}}$  and  $w$  for test 3. Please fill in your results above.



b) (10) Determine  $\rho_{\text{dry}}$  for each test (show at least one calculation), and fill in your results above. Plot  $\rho_{\text{dry}}$  versus  $w$  on the standard graph paper provided (or your own if desired). Determine  $\rho_{\text{dry-max}}$  and  $w_{\text{opt}}$  from the graph. Select scales for the axes of your graph such that you can "accurately" determine  $\rho_{\text{dry-max}}$  and  $w_{\text{opt}}$ . **Show  $\rho_{\text{dry-max}}$  and  $w_{\text{opt}}$  on the graph.**

c) (5) Plot the zero air voids curve with points corresponding to water contents of 18%, 19%, and 20%.  $RD = 2.65$ . (Show your work for at least one of the ZAV calculations.)

## Appendix F: Advising Guides

### Civil Engineering Technology Degree

2-Year A.A.S. Degree

[www.pcc.edu/programs/civil-engineering](http://www.pcc.edu/programs/civil-engineering)

(Portland Community College 2019-2020 Catalog)

Total Credits Required: 97

Location: Portland Community College, Sylvania Campus ST 200

Department Chair: Tara Nelson tara.nelson1@pcc.edu 971.722.8087

Student Advisor: Linda Browning linda.browning@pcc.edu 971.722.8730

Program Prerequisites: Placement in MTH 65, WR 121

Equipment: TI-89 calculator

Note: All students must have an advising interview with a CMET advisor.

<u>First Term (CMET courses offered Winter)</u>			<u>Fourth Term (CMET courses offered Fall)</u>		
CMET 110	Statics	4	ENGR 226	Plane Surveying	4
CMET 111	Portland Design:Bikes, Bridges & Brews	3	CMET 221	Environmental Systems	3
CMET 112	Tech. Algebra / Trigonometry	4	CMET 255	Civil and Mech Professional Skills	2
ENGR 102	Engineering Graphics	3	CMET 233	Computer Aided Design	3
	General Education	4	GEO 265	Introduction to GIS	4
		<b>Total: 18</b>			<b>Total: 16</b>
<u>Second (CMET courses offered Spring)</u>			<u>Fifth Term (CMET courses offered Winter)</u>		
CMET 121	Strength of Materials	4	CMET 228	Construction Materials	3
CMET 122	Global Energy Physics	4	CMET 223	Project Management	3
CMET 123	Tech. Algebra / Analytic Geometry	4	CMET 211	Environmental Quality	4
CMET 241	Structural Steel Drafting	3	GEO 266	GIS Analysis	4
				General Education	4
		<b>Total: 15</b>			<b>Total: 18</b>
<u>Third (CMET courses offered Summer)</u>			<u>Sixth Term (CMET courses offered Spring)</u>		
CMET 131	Applied Calculus	8	CMET 214	Surveying II	3
CMET 213	Fluid Mechanics	3	CMET 236	Structural Design	3
CH 101	Inorganic Chemistry	5	COMM 215	Small Group Communication	4
				General Education	4
		<b>Total: 16</b>			<b>Total: 14</b>

#### Recommended Classes for Fall 2019

ENGR 102	Engineering Graphics	3
GEO 265	Intro to GIS	4
	Math	
	General Education / Comm 215 / WR 121	

updated: 11/7/2018

# Mechanical Engineering Technology Degree

2-Year A.A.S. Degree

<http://www.pcc.edu/programs/mechanical-engineering/>

(Portland Community College 2018-2019 Catalog)

Total Credits Required: 101

Location: Portland Community College, Sylvania Campus ST 200

Department Chair: Tara Nelson tara.nelson1@pcc.edu 971.722.8087

Student Advisor: Linda Browning linda.browning@pcc.edu 971.722.8730

Program Prerequisites: Placement in MTH 65, WR 121

Equipment: TI-89 calculator

Note: All students must have an advising interview with a CMET advisor.

## First Term (CMET courses offered Winter)

CMET 110	Statics	4
CMET 111	Portland Design: Bikes, Bridges & Brews	3
CMET 112	Tech. Algebra / Trigonometry	4
ENGR 102	Engineering Graphics	3
	General Education	3
<b>Total:</b>		<b>17</b>

## Fourth Term (CMET courses offered Fall)

CMET 226	Dynamics	3
CMET 133	Materials Technology	3
CMET 221	Environmental Systems	3
CH 101	Inorganic Chemistry Principles	5
COMM 111	Speech Communications	4
<b>Total:</b>		<b>18</b>

## Second (CMET courses offered Spring)

CMET 121	Strength of Materials	4
CMET 122	Global Energy Physics	4
CMET 123	Tech. Algebra / Analytic Geometry	4
WR 121	English Composition	4
<b>Total:</b>		<b>16</b>

## Fifth Term (CMET courses offered Winter)

ENGR 262	Manufacturing Processes	4
CMET 212	Thermodynamics I	4
CMET 211	Environmental Quality	4
CMET 241	Structural Steel Drafting	3
CMET 255	Civil and Mech Professional Skills	2
<b>Total:</b>		<b>17</b>

## Third (CMET courses offered Summer)

CMET 131	Applied Calculus	8
CMET 213	Fluid Mechanics	3
CMET 227	Applied Electricity Fundamentals	2
	General Education	4
<b>Total:</b>		<b>17</b>

## Sixth Term (CMET courses offered Spring)

CMET 235	Machine Design	3
CMET 237	MET Applied CAD	3
CMET 222	Thermodynamics II	4
CMET 223	Project Management	3
CMET 236	Structural Design	3
<b>Total:</b>		<b>16</b>

## Additional Classes for Green Technology and Sustainability Option

EET 110	Introduction to Renewable Energy	3
SOC 228	Intro. to Environmental Sociology	4
GEO 265	Intro to GIS	4

## Recommended Classes for Fall 2018

ENGR 102	Engineering Graphics	3
	Math	
	General Education	

updated: 11/7/2018