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Page 1: I. Program Overview and Update

**Q1** Department(s) Reviewed:

Physics and Astronomy

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**Q2** Lead Author and Participants: Please list any person who participated in the preparation of this report.

Miriam Simpson, Scott Stambach, Glenn Thurman, Donna Olsen, David Tibbets

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**Q3** Dean/Manager:

Pam Kersey

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**Q4 Program Update:** Please summarize the changes, additions, and achievements that have occurred in your program since your last program review was submitted. To access your 2019 program review, visit the Program Review webpage.

#### Major Department Restructure

Starting in Fall 2019, the Science and Engineering department was restructured into three separate departments with separate chairs (Biology, Chemistry, and Engineering and Physical Science). Physics and Astronomy are housed in Engineering and Physical Sciences, a department with five full time faculty, three of whom are in their first year of tenure. Simultaneously Duncan McGehee, our long-time engineering lead, fully retired. As physics primarily serves students that are part of our growing engineering program and the physics lead is now also the department chair, this represents a major change.

#### Dramatic Course Redesign of PHYC 130/131 (Physics for the Life Sciences)

Our new full-time instructor, Scott Stambach, is over halfway through a major overhaul of this series. Previously (and currently at most other institutions), this course that primarily serves life and health science pathways has been a pared down version of the engineering series. We have worked hard to collect, invent, adapt, and implement more active and relevant approaches to the course that still convey the same curricular topics but now in a way that better connects to the students we see in this course. The first semester, Physics 130, was offered in fall. We are currently rolling out the second semester (Physics 131).

#### Improving Course Design and Instruction

A large part-time population with a high turnover rate has long been an obstacle to student success. Scott and Miriam have been leading a Course Design Workshop in the Engineering and Physical Science department (although it is open to all). We emphasize modeling active learning methods during the workshop (rather than lecturing people about how to be active), giving participants a vast array of research-tested teaching tools before planning a course, and then we provide support and community while they implement these tools. We have broad participation from our department as well as instructors from other STEM disciplines and even Grossmont! So far feedback from participants has been highly positive and we have 10 faculty in regular attendance with an additional 5-6 intermittent. We are looking forward to starting round 2 for next semester and seeing if there is any impact on classes led by these better-supported instructors.

#### Ongoing Lab Technician Crisis

As a result of years of sustained growth we have dramatically increased the workload of the single lab technician shared with Physics, Engineering, Astronomy, and Earth Sciences. The current technician is continuously working large amounts of overtime, faculty have been pitching in significantly, and technicians from other disciplines have been helping, and yet still we are reaching limit in terms of courses we can offer, equipment maintenance, and innovation. In addition, this puts at risk the health and safety of our students, faculty, staff, and a large quantity of expensive technical equipment.

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## Page 2: II. Assessment and Student Achievement

**Q5 1.** Do you have a course Student Learning Outcome (SLO) assessment plan on file with the Student Learning Outcome and Assessment Committee (SLOAC)? If you have not already done so, you can submit your program's assessment plan to SLO Coordinator, Tania Jabour, at [tania.jabour@gcccd.edu](mailto:tania.jabour@gcccd.edu). **Yes**

**Q6 OPTIONAL:** You may upload a copy of your SLO assessment plan for SLOAC here. If you have an Excel sheet, please convert to one of the supported files listed below before submission.

**SLO\_Physics\_3YearPlan.pdf (144.1KB)**

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**Q7 2.** Please provide an analysis of your Student Learning Outcomes (SLO) findings and what changes, if any, were made as a result.

For PHYC 190/200/210 we have been running new labs with improved manuals for instructors since 2015/2016 and you can see the improvement in student outcomes (REFER TO FIGURE 1). Physics 210 has been more of a challenge as it is a smaller group of students and the labs are much more technical, expensive, and difficult. We have recently been able to improve equipment and therefore modify many of the labs that were not working consistently before and as a result have seen some moderate improvements. We hope to continue this process.

For PHYC 130/131 we have run this course with a new instructor nearly every year, with no ability to standardize content as the only full-time instructor was fully occupied with our other course offerings. Having a second full time person in Physics has allowed us the time to really focus on this class. Historically this course has been run as a pared-down version of the engineering series (this how it was done here, but this approach is pretty typical across campuses nationwide) without regard for the fact that the skills and content life-science majors need from this class as well as the experience they bring into the class can diverge significantly from students in the engineering series. Having a full-time instructor take over the teaching and planning of this course has allowed us to reimagine it with the correct students in mind. Although we have only started taking preliminary data, the results are very promising (FIGURE 2).

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**Q8 3.** Does your department or discipline offer any degrees and/or certificates? **Yes**

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Page 3: II. Assessment and Student Achievement

**Q9 4.** How are you currently assessing your PLOs?

Currently we are assessing our PLOs as a mapped combination of SLOs. We have developed a new, much better set of PLOs which can be done both using this technique AND with direct assessment, but we are waiting to see if we should do this as a program or for the entire ACP.

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**Q10 5.** Are your PLOs in the catalog an accurate reflection of the department or discipline's current learning objectives? To access the College Catalog Associate Degree Programs and Certificates section, click here. **No**

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**Q11 6.** Are the PLOs mapped onto the course SLOs? If you require assistance, please contact Madison Harding in the IESE Office at [madison.harding@gcccd.edu](mailto:madison.harding@gcccd.edu) **Yes**

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Page 4: II. Assessment and Student Achievement

**Q12** Referencing the last 5 years of data, discuss the changes in course success rate since the last program review (annual or comprehensive) report.

In Physics our success rates have been consistently high, averaging 88% with a range from 81-91% (see figure 3). This trend has been relatively stable over the last decade (large fluctuations correspond to times of lower enrollment). This is significantly higher than Grossmont's success rate, which averages 76% over the last 5 years. We attribute our high rate of success to an active, student-centered teaching format, highly motivated students, and the entrance barrier presented by math for most courses.

Astronomy has success rates averaging 80% over the last five years, which is still high for a general education science class and has remained relatively consistent.

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**Q13** Considering the college's 2024 goal of increasing course success rates to 77%, discuss how your department/discipline will help meet that goal.

Considering the college's 2024 goal of increasing course success rates to 77%, discuss how your department/discipline will help meet that goal.

We are already beyond this threshold. Increasing beyond this point is difficult as data sampled from physics classes over the last three years indicates our withdrawals and non-successes are over 50% non-academic reasons such as work scheduling, family responsibilities, and unforeseeable crises.

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**Q14** Please describe any equity gaps, in which specific groups (e.g., by gender and ethnicity) have success rates lower than that of the department or discipline overall.

In Physics, Hispanic students are doing worse than their peers on average. However, the college has an average gap of 6% and we are down to a 4% average gap and trending toward the reduction of even this reduced gap. (see figure 4)

Just as concerning, however, is the skew of our student demographics. In all of Physics, but particularly in the engineering series, the representation of women, Hispanic, and African-American students are low compared to the college demographics. This indicates that although we serve the students we have well, there are many students from historically underrepresented groups that we are losing at some earlier point in the pipeline. (see figure 5)

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**Q15** What department/discipline (or institutional) factors may be contributing to these lower success rates for these groups of students?

Since as a department our equity gaps are smaller than that of the institution, we feel that we have been relatively effective in addressing many of the department/discipline factors in this success gap. Looking at student-provided data, we find that the Hispanic student population has a higher incidence of negative indicators to success such as a larger number of hours worked and lower performance in prerequisite courses like math. As a department we have been working closely with math to provide additional supplementary support to these students, but issues like extracurricular work hours are harder to change. We have been working hard to close these gaps by training our faculty (both full and part time) to be culturally responsive, to teach using techniques proven to have better equity.

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**Q16** What specific steps will the department of discipline take to address these equity gaps in the 2020/21 academic year?

Course Design Workshop – this is a homegrown monthly workshop funded by the HSI STEM grant that models research-proven pedagogical techniques and then provides support and community for instructors implementing them. We have worked hard to make the workshop just as active and supportive as we want our classrooms to be rather than just lecturing to instructors about how they should not lecture. Before a semester starts we introduce and model course design and teaching techniques and resources, and then during the semester we help trouble-shoot the custom implementations as a group. So far feedback from participants has been highly positive and we have 10 faculty in regular attendance with an additional 5-6 intermittent. We are looking forward to starting round 2 for next semester.

Communication with our Pipeline – We are continuing having regular meetings (at least once a semester and more as needed) with Math, Engineering, CADD, and Grossmont's Physics department to make sure our students are supported that we have a shared strategy for addressing challenges like equity gaps. We plan to begin collaborating with local high schools as well.

Support for entering students – We are looking to open more prerequisite-free general ed science courses that allow students to explore Physics and Astronomy while fulfilling transfer requirements at a low risk to their academic progress. We also plan to pilot a first year, new student mentoring program for all entering self-identified Physics and Engineering Majors.

Supplementary academic support – We are developing a large library of supplementary physics and math videos customized for our current courses that will be free and accessible to all students via the web. We have also been working closely with tutoring to get students the help they need outside of office hours.

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**Q17** How do these steps inform the long-term department or discipline goals that you are setting in this annual program review?

Improving Courses and Instructors

Course Design Workshop -- Teacher Training and Implementation Support. Extensive training of full and part time faculty in equity-based teaching methods.

Participation in conferences that keep us fresh on the current pedagogy/tools

Emphasis on active and project-based learning

Collaboration outside the program

Math – regular meetings to discuss pipeline issues, scheduling, and the development supplementary, concurrent support.

Engineering – Regular collaboration to ensure we are supporting their program/students and finding ways to keep students motivated by giving them an idea of where they are going thought job talks, projects, clubs, internships, and field trips

Local High Schools – To create a more equitable pipeline by providing them support and informing them of where students may be going.

Student Services – Cooperation to provide support for students on non-academic issues that nevertheless affect academic performance such as mental health, housing, finances, food insecurity, etc.

Counseling – We would like to form a better partnership with the counselors to ensure we give a consistent, correct, and helpful message to students on planning, curriculum, course sequencing, and troubleshooting non-standard issues.

Ongoing coordination with Grossmont - Our students take math and physics there too, we can't pretend what they do doesn't affect us. Currently we are aligning the Physics curriculum which will make things much less confusing for students.

Support for entering students – We are looking to open more prerequisite-free general ed science courses that allow students to explore Physics and Astronomy while fulfilling transfer requirements at a low risk to their academic progress. We also plan to pilot a first year, new student mentoring program for all entering self-identified Physics and Engineering Majors.

Supplementary academic support – We are developing a large library of supplementary physics and math videos customized for our current courses that will be free and accessible to all students via the web. We have also been working closely with tutoring to get students the help they need outside of office hours.

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**Q18** In what way does your department/discipline work across instruction and student services to advance the college's student success & equity goals?

We have strongly encouraged all faculty to include the student resource guide in their syllabi, participated in Student Success Day, and we are now trying to work with counseling to communicate curriculum and advertise new or redesigned courses.

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**Q19** OPTIONAL: If you would like to attach any charts or additional documentation (aside from the program review report prepared by the IESE Office), please upload it using the button below.

**Figures for Spring 2020 Physics and Astronomy Annual Update.pdf (922.4KB)**

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Page 5: II. Assessment and Student Achievement

**Q20** Do you offer distance education (online) courses?      **No**

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Page 6: II. Assessment and Student Achievement

**Q21** Are there differences in success rates for distance education (online) versus in-person sections? **Respondent skipped this question**

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**Q22** If there are differences in success rates for distance education (online) versus in-person sections, what will the discipline or department do to address these disparities? **Respondent skipped this question**

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**Q23** What mechanisms are in place to ensure regular and effective contact within online courses across the discipline or department? **Respondent skipped this question**

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Page 7: III. Previous Goals: Update (If Applicable)

**Q24** Would you like to provide an update for your previous program review goal(s)? **Yes**

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Page 8: III. Previous Goals: Update (If Applicable) continued

**Q25** Previous Goal 1:

Lab Updates (PHYC 190/200/210)

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**Q26** Which College Strategic Goal does this department goal most directly support? **Student Validation and Engagement**

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**Q27** Please describe how this goal advances the college strategic goal identified above.

We were able to get requested lab equipment from last year's proposal and have written new labs in order to use this equipment. This year we implement the labs in class and take data!

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**Q28** Goal Status **In Progress - will carry this goal forward into next year**

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Page 9: III. Previous Goals: Update (If Applicable) continued

**Q29** Please describe the results or explain the reason for deletion/completion of the goal: **Respondent skipped this question**

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**Q30** Do you have another goal to update? **Respondent skipped this question**

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Page 10: III. Previous Goals: Update (If Applicable) continued

**Q31** Please describe action steps for the year:

1. Revise Lab Manuals
  2. Implement new labs in classes
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**Q32** How will this goal be evaluated?

Assessment of lab SLOs for relevant courses.

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**Q33** Do you have another goal to update? **Yes**

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Page 11: III. Previous Goals: Update (If Applicable) continued

**Q34** Previous Goal 2:

Redesign PHYC 130/131 Lecture and Labs

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**Q35** Which College Strategic Goal does this department goal most directly support? **Student Validation and Engagement**

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**Q36** Please describe how this goal advances the college strategic goal identified above.

Our new full-time instructor, Scott Stambach, is over halfway through a major overhaul of this series. Previously (and currently at most other institutions), this course that primarily serves life and health science pathways has been a pared down version of the engineering series. We have worked hard to collect, invent, adapt, and implement more active and relevant approaches to the course that still convey the same curricular topics but now in a way that better connects to the students we see in this course. The first semester, Physics 130, was offered in fall with noticeable improvements (see SLO data in figure 2). We are currently rolling out the second semester (Physics 131).

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**Q37** Goal Status **In Progress-will carry this goal forward into next year**

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Page 12: III. Previous Goals: Update (If Applicable) continued

**Q38** Please describe the results or explain the reason for deletion/completion of the goal: **Respondent skipped this question**

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**Q39** Do you have another goal to update? **Respondent skipped this question**

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Page 13: III. Previous Goals: Update (If Applicable) continued



**Q40** Please describe action steps for the year:

1. Implement PHYC 131 redesign
2. Refine the new PHYC 130/131 and offer for a second time this year
3. Advertise these courses to the county
4. Gather data to present at conferences

**Q41** How will this goal be evaluated?

Preliminary survey data shows students have a 10-20% more positive reaction to the new version of this course, SLO data shows that students are performing just as well if not better than they did in the old version of the course (see figure 2), and enrollment was high enough to open an extra section this semester. We will continue to monitor these metrics as we implement and hone the second semester of this redesign.

**Q42** Do you have another goal to update? **Yes**

Page 14: III. Previous Goals: Update (If Applicable) continued

**Q43** Previous Goal 3:

Revive Physics 110 with online option

**Q44** Which College Strategic Goal does this department goal most directly support? **Guided Student Pathways**

**Q45** Please describe how this goal advances the college strategic goal identified above.

Grossmont runs several sections of this course and we still have it on the books. This is a great course for students to explore the field at low risk to their educational goals (they don't have to take a year or more of math before deciding whether they like it or not). This also would be an excellent choice as a general education requirement for students in art, graphic design, and music pathways, and we plan to work with instructors in those areas to make sure the content is relevant to their areas. In addition, creating the option for a hybrid or online course would be helpful in accommodating students with scheduling or transportation issues but have to take a time-intensive lab course.

**Q46** Goal Status **Not Started**

Page 15: III. Previous Goals: Update (If Applicable) continued

**Q47** Please describe the results or explain the reason for deletion/completion of the goal: **Respondent skipped this question**

**Q48** Do you have another goal to update? **Respondent skipped this question**

Page 16: III. Previous Goals: Update (If Applicable) continued

**Q49** Please describe action steps for the year:

1. Update Curriculum including an online option.
  2. Design Course
  3. Run Course in Fall
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**Q50** How will this goal be evaluated?

We will look at enrollment and success data initially, and survey students about whether this course is helping them meet their goals.

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**Q51** Do you have another goal to update? **No**

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Page 17: III. Previous Goals: Update (If Applicable) continued

**Q52** Previous Goal 4: **Respondent skipped this question**

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**Q53** Which College Strategic Goal does this department goal most directly support? **Respondent skipped this question**

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**Q54** Please describe how this goal advances the college strategic goal identified above. **Respondent skipped this question**

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**Q55** Goal Status **Respondent skipped this question**

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Page 18: III. Previous Goals: Update (If Applicable) continued

**Q56** Please describe the results or explain the reason for deletion/completion of the goal: **Respondent skipped this question**

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**Q57** Do you have another goal to update? **Respondent skipped this question**

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Page 19: III. Previous Goals: Update (If Applicable) continued

**Q58** Please describe action steps for the year: **Respondent skipped this question**

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**Q59** How will this goal be evaluated? **Respondent skipped this question**

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**Q60** Do you have another goal to update? **Respondent skipped this question**

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Page 20: III. Previous Goals: Update (If Applicable) continued

**Q61** Previous Goal 5: Respondent skipped this question

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**Q62** Which College Strategic Goal does this department goal most directly support? Respondent skipped this question

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**Q63** Please describe how this goal advances the college strategic goal identified above. Respondent skipped this question

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**Q64** Goal Status Respondent skipped this question

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Page 21: Copy of page: III. Previous Goals: Update (If Applicable) continued

**Q65** Please describe the results or explain the reason for deletion/completion of the goal: Respondent skipped this question

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Page 22: Copy of page: III. Previous Goals: Update (If Applicable) continued

**Q66** Please describe action steps for the year: Respondent skipped this question

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**Q67** How will this goal be evaluated? Respondent skipped this question

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Page 23: IV. New Goals (If Applicable)

**Q68** Would you like to propose any new goal(s)? Yes

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Page 24: IV. New Goals (If Applicable) continued

**Q69** New Goal 1:

Align Physics Courses with Grossmont, Followed by a Joint Redesign

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**Q70** Which College Strategic Goal does this department goal most directly support? Guided Student Pathways

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**Q71** Please describe how this goal advances the college strategic goal(s) identified above.

Currently the misaligned courses are at best confusing and at worst damaging to students. In theory, a series started at one college cannot be continued at the other, which is a problem for students trying to fit these large classes into tight schedules. In practice students do flow back and forth between the colleges putting them at risk of missing or duplicating certain topics, and making their transfer and articulation processes more difficult and confusing. In addition, the exchange of students indicates a need for better communication across both campuses and more uniform presentation of the class across all instructors. To fix this we plan to not only fix the curriculum but also work together with Grossmont to design a new version of these courses that will better serve both students and part-time faculty by creating a standard set of tools and practices based on research-proven methods.

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**Q72** Please indicate how this goal was informed by SLO (student learning outcome) assessment results, PLO (program learning outcome) assessment results, student achievement data, or other data:

Over the last five years we have found that, although it is strongly discouraged, 10-25% of students in this series have taken one or more courses from this series at Grossmont in any given year.

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**Q73** Action steps for this year:

1. Submit Curriculum
  2. Notify (and work with) affected programs
  3. Get articulation to UCSD and SDSU
  4. Start to design the new courses for a phased rollout in Fall 2021
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**Q74** How will this goal be evaluated?

We will monitor enrollment, student success and equity data, SLOs, and poll students.

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**Q75** Do you have another new goal? **Yes**

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Page 25: IV. New Goals (If Applicable) continued

**Q76** New Goal 2:

Course Design Workshop

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**Q77** Which College Strategic Goal does this department goal most directly support? **Guided Student Pathways**

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**Q78** Please describe how this goal advances the college strategic goal(s) identified above.

This is a homegrown monthly workshop funded by the HSI STEM grant that models research-proven pedagogical techniques and then provides support and community for instructors implementing them. We have worked hard to make the workshop just as active and supportive as we want our classrooms to be rather than just lecturing to instructors about how they should not lecture. Before a semester starts we introduce and model course design and teaching techniques and resources, and then during the semester we help trouble-shoot the custom implementations as a group. So far feedback from participants has been highly positive and we have 10 faculty in regular attendance with an additional 5-6 intermittent. We are looking forward to starting round 2 for next semester.

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**Q79** Please indicate how this goal was informed by SLO (student learning outcome) assessment results, PLO (program learning outcome) assessment results, student achievement data, or other data:

The minimum qualifications required by the state to teach community college include a fair amount of academic rigor, but no actual teaching experience or training. As a new chair evaluating our full and part time faculty for the first time, this flaw was very evident in the classroom. In the process of evaluation I spoke to many of these faculty and found they were very open to suggestions and eager to be better instructors but many of them were not sure where to begin. Since academic physics has a strong and growing subfield of applied pedagogical research, we mined that community for some ways for faculty to transform their courses and teaching.

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**Q80** Action steps for this year:

We plan to compare success and equity data of the courses of participating instructors with the averages in that course over the last five years.

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**Q81** How will this goal be evaluated?

We plan to compare success and equity data of the courses of participating instructors with the averages in that course over the last five years.

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**Q82** Do you have another new goal?

**Yes**

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Page 26: IV. New Goals (If Applicable) continued

**Q83** New Goal 3:

Astronomy Updates

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**Q84** Which College Strategic Goal does this department goal most directly support?

**Student Validation and Engagement**

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**Q85** Please describe how this goal advances the college strategic goal(s) identified above.

The Astronomy lab takes place in a light-polluted dirt patch with a daisy chain of extension cords in a space that will now be obstructed by a huge scoreboard. In addition, all of our expensive and delicate telescopes are currently in a shed without environmental or vibration controls. This is not a good way to get students excited about a lab that should be pretty darn magical. Most colleges (including Grossmont and Mesa) have designated space for telescopes away from bright lights and in a stable area (usually on a roof) with well-designed electrical connections and storage for their telescopes that ensures they won't be damaged by weather or a large truck rolling by.

In addition, we would really like some sort of planetarium space to run daytime labs and do outreach (and bring in revenue) from the local community. With the current interest in space travel with the recent successes of private rocketry and various Mars missions, this is an idea that has met it's time.

If we could offer more modern technology and facilities, we could spend the savings on telescope repair and the massive amount of labor required for set up and take down of equipment to focus on things like updating and expanding course offerings, field trips, student-led research (for which there are many opportunities), and online/hybrid courses so students coming to evening labs do not have to attend morning lectures.

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**Q86** Please indicate how this goal was informed by SLO (student learning outcome) assessment results, PLO (program learning outcome) assessment results, student achievement data, or other data:

Our enrollment has been dipping over the last several years thanks to competition from better-supported programs in the county.

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**Q87** Action steps for this year:

1. Attempt to get a better space
2. More lab support from additional technician
3. Investigate hybrid/online courses

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**Q88** How will this goal be evaluated?

Enrollment, student success, and money/press for the college.

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**Q89** Do you have another new goal?

**Yes**

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Page 27: IV. New Goals (If Applicable) continued

**Q90** New Goal 4:

First year Physics/Engineering Major Mentoring

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**Q91** Which College Strategic Goal does this department goal most directly support?

**Guided Student Pathways**

**Q92** Please describe how this goal advances the college strategic goal(s) identified above.

We are looking to reach out to incoming students indicating an interest in Physics or Engineering (most students in physics are engineering majors) and providing them with mentoring. Most of these students do not show up in our classes until their second or third year, and they encounter many barriers before we see them in the classroom. We hope to do this in collaboration with Engineering (obviously), Grossmont, Guided Pathways, and the UC Irvine NSF-sponsored resonance program.

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**Q93** Please indicate how this goal was informed by SLO (student learning outcome) assessment results, PLO (program learning outcome) assessment results, student achievement data, or other data:

Looking at our poor demographic representation of certain genders and ethnicities compared to college populations, we feel this would be a good first step to making sure we have cleared barriers to our program that we control.

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**Q94** Action steps for this year:

1. Acquire list of interested students from CCCApply
  2. Design a database with mailing list functionalities
  3. Get faculty to agree to mentor
  4. Explore an older peer mentor model
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**Q95** How will this goal be evaluated?

We will monitor student demographics and equity gaps in our program.

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Page 28: V. Resources Needed to Fully Achieve Goal(s)

**Q96** Is the program requesting resources this year to achieve this program goal(s)? (Faculty Resource Needs, Classified Staff Resource Needs, Technology Resource Needs, Supplies/Equipment Resource Needs, Facilities Resource Needs or Other Resource Needs) **Yes**

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Page 29: VI. Faculty Resource Needs

**Q97** Are you requesting one or more Faculty Positions to achieve this program goal(s)? **No**

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Page 31: VIII. Classified Staff Resource Needs

**Q98** Are you requesting one or more Classified Positions to achieve this goal? **Yes**

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Page 33: X. Technology Resource Needs

**Q99** Are you requesting technology resources to achieve this goal? **Yes**

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Page 35: XIV. Supplies/Equipment Resource Needs

**Q100** Are you requesting supplies and/or equipment resources to achieve this goal? **Yes**

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Page 37: XVI. Facilities Resource Needs

**Q101** Are you requesting facilities resources to achieve this goal(s)? **Yes**

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Page 39: Final Check

**Q102** Are you ready to submit your program review?If you would like to go back and review a section, select a section a click "Next." **I am ready to submit my program review**

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