Executive Summary

The Committee on Reconstituting On-Campus Instruction (CRCI) was established by Provost David Tirrell in late April 2020, with the following charge:

“The committee will assess our physical facilities for on-campus instruction, determine the capacity of our facilities under alternative models of physical distancing, continue to evaluate and enhance our capabilities for online instruction, identify potential models for mixed in-person and online instruction, and consider the ancillary functions needed to support our on-campus educational enterprise.”

In developing recommendations for fall 2020 instruction, the CRCI (Membership Roster, Appendix A) conducted a detailed analysis of available teaching spaces on campus, teaching models that could be employed for the fall term, and available technologies that can enhance in-person and remote teaching models. The Committee also consulted with two faculty focus groups, undergraduate and graduate student representatives, as well as key staff members in the Infectious Diseases Task Group, Student Affairs, Facilities, and Student Wellness Services. The Committee administered two surveys during the spring 2020 term to assess the effectiveness of remote teaching throughout the term, as well as a survey to gather feedback from instructors and TAs on the Learning Management System (LMS). The Committee reviewed health and educational guidance from Los Angeles County, the City of Pasadena, and the State of California Department of Education, as well as recommendations from organizations that support higher education and examples from other universities.

Recommendations for fall 2020 instruction

1. Continue remote instruction in all cases for which educational effectiveness is not severely compromised. Allow in-person instruction for courses that require in-person work or specialized equipment and/or facilities. Plans for in-person instruction must be approved as outlined later in these recommendations.

2. Prioritize students for return to campus-based instruction as follows:
   a. Experimental graduate students,
   b. Undergraduate students who need to take critical lab courses,
   c. Students with graduation needs that cannot be met remotely, and
   d. Undergraduate students with home situations or living in time zones that are unsuitable for extended learning, or who have travel restrictions requiring residence on campus.

3. Set the following conditions for returning to in-person instruction:
   a. Make all return to in-person instruction voluntary for both students and instructors.
   b. Take protective steps to ensure student compliance with social distancing and PPE guidelines. Students unwilling to commit to these guidelines should not be permitted to return to campus in the fall.
c. Ensure that individual classes and class components are taught either remotely or in person (not with the expectation that some students are in person at the same time as others are remote).

d. Ensure that measures are in place for students and faculty to communicate their concerns and educational challenges due to COVID-19 disruptions.

e. Students and instructors who return to in-person instruction must agree to participate in health and contact monitoring practices established by the Institute.

f. Instruction plans for in-person teaching must be reviewed and approved by the cognizant Division Chair as meeting the guidelines listed below. The Caltech Safety Office (and/or standing committee, if appointed) should assist the Division office in this review. The Registrar must be kept informed of any changes in teaching models for specific courses. The guidelines are:

i. Educational effectiveness would be severely compromised if taught remotely.

ii. Incorporate remote lectures and discussions whenever possible (e.g., for portions or components of the course where in-person work is not required).

iii. Cloth face coverings must be worn by students, TAs, and faculty at all times while entering, attending, and exiting class.

iv. The air exchange properties of each candidate teaching location should be individually assessed (relative to 100% laboratory fresh/exhaust) prior to scheduling classes for a given location.

v. Minimize class sizes for in-person instruction to maintain 10 ft. social distancing.

vi. Laboratory work groups that cannot maintain 10 ft. social distancing should not exceed five students, plus TA and instructor.

vii. Laboratory work groups that cannot maintain 10 ft. social distancing should utilize enhanced PPE (e.g., KN95 or N95, clean lab coat, eye protection) approved by the cognizant Division Chair.

viii. Laboratory classes should follow safety protocols established for research laboratory reopening including enhanced cleaning protocols.

ix. Teaching spaces should include separate entry and exits, with flow patterns clearly marked with tape, to facilitate ingress and egress while maintaining social distancing.

x. Scheduling of classes should allow for sanitation between classes.

xi. Sanitation must be arranged with the Facilities Department.

xii. Class components outside of primary class meetings – including recitations and office hours, and collaborations – must follow the same requirements as in-person class meetings.

xiii. Hand sanitizer stands should be placed in each teaching space.

4. For continuing remote instruction:

a. Implement additional tools and training to use those tools to facilitate student collaborations.

i. Extend/expand the iPad/Apple Pencil loaner program throughout AY2020-21.

ii. Actively assist students in establishing and maintaining collaboration groups.

b. Ensure that remote courses offer comparable forms of instruction and interaction as would be offered if the course were conducted in person.

i. Instructors may issue lab kits to students for remote instruction, subject to review by General Counsel and approval by the Division Chair.
c. Ensure that instructors and TAs maintain regular office hours and make themselves available to students who need additional academic support, particularly those who reside in distant time zones or who have difficulty connecting to synchronous classes.

5. For all types of instruction:
   a. Inform instructors as early as possible to begin planning for remote teaching and share regular communication about training, support, and updates.
   b. Return to the standard grading policy starting in the fall term.
      i. Offer increased flexibility for coursework deadlines.
   c. Maintain the normal academic calendar for AY2020-21. Require instructors to use the final week of instruction after Thanksgiving for remote teaching activities only and to conduct final exams remotely.
   d. Ensure that educational resources are delivered to remote students as efficiently as to students on campus.
   e. Implement greater use of the course ombuds program for both undergraduate and graduate courses.
   f. Emphasize the need for instructors to complete mid-quarter progress reports.
   g. Improve support for remote and in-person instruction.
      i. Develop in-house instructional technology expertise.
      ii. Implement a new learning management system to be in place by the fall term.
      iii. Consider installing additional recording equipment in more classrooms.
   h. Encourage faculty to work with the Library to use texts and reference materials that are readily available in electronic format.
      i. Continue to provide extracurricular workshops through the Library.

6. Support specific to graduate students:
   a. Encourage graduate student advisors to consider student progress toward completion in developing and implementing laboratory reopening plans.
   b. Encourage graduate student advisors to promote collaborations and healthy social interactions within their research groups.

The following report describes each of these recommendations in greater detail, along with plans to address several currently unknown factors related to returning to in-person instruction under COVID-19 conditions. Additional options to increase teaching space capacity and to implement additional teaching models – while not recommended by this committee – are included throughout the report and in the appendices.

Finally, the CRCI recommends that 14 courses that were identified by the Division Chairs be allowed to be taught on campus rather than remotely. These courses and the proposed models for instruction, including both remote and in-person components, are described more fully in this report.

---

**Current Status of COVID-19**

The recommendations in this report take into consideration guidance provided by state and local governments and generally follow the stages outlined in the Caltech Recovery Planning Framework.

As of June 24, 2020, Los Angeles County reported 88,262 cumulative confirmed COVID-19 cases including 3,171 deaths. Over 978,000 individuals have been tested, with 8% positive tests. The County reports that it has met all five of the measures it self-identified as indicating readiness for staged
reopening ([http://publichealth.lacounty.gov/media/coronavirus/covid19_recovery_dashboard.htm](http://publichealth.lacounty.gov/media/coronavirus/covid19_recovery_dashboard.htm)). The County has not yet published specific guidance for reopening instructional activities at institutes of higher education.

As of June 24, 2020, the City of Pasadena reported 1,196 cumulative confirmed COVID-19 cases with 88 associated deaths ([https://www.cityofpasadena.net/covid-19/#dashboard](https://www.cityofpasadena.net/covid-19/#dashboard)). The City has not yet published specific guidance for reopening instructional activities at institutes of higher education.

Guidance from Los Angeles County, the City of Pasadena, and the State of California Department of Education for reopening public K-12 schools have been reviewed by members of this committee. Recommendations from professional and educational organizations — including the *Chronicle of Higher Education*, the American Association of University Professors, the American Council on Education, the American College Health Association, the American Enterprise Institute — were also reviewed. Helpful examples of instruction reopening plans were received from other universities.

The Caltech Recovery Planning Framework (CRPF, Appendix B) created by the Infectious Diseases Task Group describes the external virus control conditions that are being used in planning the resumption of campus activities. The framework also provides recommendations for campus conditions in each stage, including social distancing practices, government controls on campus gatherings, testing, isolation and quarantine, and case management.

At this time, the Institute does not have a means for widespread and frequent COVID-19 testing of individuals on campus. The Institute has developed a health and contact monitoring app for use by campus employees and students who return to campus. Isolation and quarantine accommodations have been made available for students. No vaccine or therapeutics are currently available to treat COVID-19. The numbers of new cases and deaths from COVID-19 remain highly variable in the local area.

## Plans to Address Currently Unknown Factors

The COVID-19 conditions that will exist at the beginning of the fall term are unknown, but there is little expectation that campus will progress beyond CRPF Stage 3 by that time. The recommendations in this report meet or exceed the recommendations for social distancing and restrictions on gatherings that are indicated in the CRPF for Stage 3.

Individual reactions to the risks posed by COVID-19 vary greatly from those who are eager to return to campus to those who for a variety of reasons are hesitant to return to in-person instruction. There are several factors that can affect the resumption of on-campus instruction and the selection of students for return to campus for the fall term and beyond, including but not limited to the following:

**Risk of prolonged exposure to COVID-19 in enclosed spaces** – Currently, no governmental or professional guidance has been provided regarding recommended social distancing or the safe limit on the total number of people congregated in enclosed spaces such as for in-person teaching. The effectiveness of cloth face coverings in close personal contact is being researched. Rapid air exchange is a critical consideration in reducing the risk of airborne exposure. While laboratory spaces on campus often benefit from 100% outside air and 100% exhaust, many other interior spaces do not. A survey of the air handling for every candidate teaching space will be an important precursor to scheduling classes
in a given location. The CRCI will stay abreast of research in these areas and will adjust future recommendations accordingly.

Faculty willingness and ability to return to on-campus instruction – The CRCI has reached out to instructors of AY2020-21 fall term courses that were identified by the Division Chairs as those that cannot be taught effectively online or would lose their educational effectiveness if taught remotely. Results of this exercise are described in greater detail later in this report.

Beyond the fall term, it is not yet known which faculty for AY2020-21 winter and spring term courses will be willing to return to in-person instruction if given the opportunity to do so. The CRCI will engage in the following process to ascertain faculty willingness to teach approved on-campus courses during the remainder of the COVID pandemic. The Committee will request winter and spring term course lists from the divisions as early as July 2020, ask Division Chairs to identify courses that should be taught in-person during the winter and spring terms, work with instructors of those courses to ascertain their willingness to return to in-person teaching, and assist with the development of in-person or alternative teaching plans for those courses.

Student willingness and ability to return to on-campus housing and instruction – A survey of undergraduate and graduate students’ intentions to return to campus and to on-campus instruction will be conducted jointly by Student Affairs and the CRCI in late June. Until then, we will not know if any students will self-identify as being in a high-risk category or choose not to return to campus for other reasons.

The survey and individual consultations with students by the Deans may identify students who have unsafe home environments or home situations that are not suitable for remote learning. Remote instruction has been particularly difficult for international students who may be required to participate in synchronous classes from different time zones or have limitations on internet access to certain websites. It is currently unknown if any of these students will face difficulties traveling to Pasadena if they require an in-person course.

The CRCI recommends that these students be among those prioritized for return to campus, whether they take part in remote or in-person learning.

Student progress toward graduation – The Registrar will identify students who may require specific courses for graduation to be taken in AY2020-21 based on academic progress through the spring 2020 term. Results of this exercise are expected to be available in July, at which time we will know from the divisions if any of those courses will need to be completed in-person.

Guiding Principles for CRCI Recommendations

In making specific recommendations for return to on-campus instruction, the CRCI is guided by the following principles:

- Our primary considerations are the health and safety of the Caltech community, as well as the health of the larger Pasadena/Los Angeles county community, surrounding areas where Caltech community members may reside, and the families and communities connected to Caltech at any
distance. In general, our goal is that the risk in returning to campus should be no greater than the risk of complying with current regulations within the surrounding community.

- We wish to maintain the excellence and inclusivity of Caltech instruction and to meet the Institute’s mission which is in part to educate outstanding students to become creative members of society.
- We will adhere to all public health, regulatory and legal requirements. However, our recommendations are based on our understanding of specific risks at Caltech and may be more restrictive than these requirements.
- We will be guided by available evidence, while acknowledging the fact that there are many unknowns at this time. All our recommendations are thus continually subject to revision.
- All students have equal opportunity for a successful learning experience.

### Recommendations for Fall 2020 Instruction

In developing the following recommendations for fall term instruction, the CRCI has conducted a detailed analysis of available teaching spaces on campus, teaching models that could be employed for the fall term, and available technologies that can enhance in-person and remote teaching models. In addition, the CRCI has consulted with undergraduate and graduate student representatives and selected teaching faculty to understand their experiences with remote teaching during the spring term and the challenges of teaching remote and in-person courses during the upcoming fall term. Key staff members from the Infectious Diseases Task Group, Student Affairs, Facilities, and Student Wellness Services provided input in the development of these recommendations.

1. **Continue remote instruction in all cases for which educational effectiveness is not severely compromised. Allow in-person instruction for courses that require in-person work or specialized equipment and/or facilities.**

With the current unknown trajectory of the spread of COVID-19, the lack of campus-wide testing capacity, and the lack of vaccination or treatment options for the disease, the CRCI recommends that all courses that can be taught remotely without severely compromising educational effectiveness should be taught remotely.

The administration has the option to keep all teaching fully remote for the fall term, regardless of whether students are physically on campus. This option has the advantage of mitigating public health concerns of having students congregate in enclosed spaces for prolonged periods. Students and faculty have commended the Center for Teaching, Learning, and Outreach (CTLO); Academic Media Technologies (AMT); and Information Management Systems and Services (IMSS) for their extraordinary efforts to bring courses online for the spring term. Feedback from students solicited through the two spring term surveys and through focus groups indicated that many instructors adapted their course content to effectively teach in an online setting. However, students and faculty members agree that remote teaching cannot compare to the in-person educational experience that is the hallmark of Caltech education.

A key disadvantage to conducting all courses remotely for the fall term is the loss of educational effectiveness for courses that require hands-on experience. The Division Chairs recommended 20 such courses as necessary to be taught in-person, some of which are academically necessary for students to progress toward graduation. Included in this total are five courses (including field and seminar courses)
that were cancelled prior to registration or were recommended for cancellation by the course instructors. The remaining 15 courses were evaluated by the Registrar for importance toward graduation and the availability of alternative courses. The CRCI reached out to the instructors to determine their willingness to teach these courses in-person during the fall term. All but one of these courses has been requested to include some in-person teaching components during the fall term.

The CRCI recommends that students enrolled in these courses be allowed to return to campus to take these courses under the conditions outlined below.

2. **Prioritize students for return to campus-based instruction**

If the administration determines that a selection of students may be invited to return to campus, whether their instruction is provided in-person or using online tools and methods, the CRCI recommends that students be prioritized as follows:

a. **Experimental graduate students** – While graduate student experiments will be driven by the research laboratory reopening plans of their advisors and approved by their Division Chairs, there may exist gaps in which graduate students who need to complete experiments toward their educational goals are not in alignment with their advisors’ laboratory reopening plans. We urge graduate advisors to consider graduate student progress toward completion in developing and implementing their laboratory reopening plans.

b. **Undergraduate students who need to take critical lab courses** – As described above, 14 fall term courses that would be severely compromised if taught remotely during the fall term were recommended by the Division Chairs for in-person instruction. A similar complement of courses for the winter and spring terms will be identified by the CRCI in consultation with the Division Chairs and instructors.

c. **Students with graduation needs that cannot be met remotely** – The Registrar will identify students who will require specific courses to be completed in AY2020-21 to remain on track for graduation. Seniors will have the most specific needs identified. Non-seniors will be evaluated by historical behavior and the option-recommended schedules noted in the Catalog. This list is expected to be available in July 2020 after spring term grades are completed. The list will be compared to the list of courses that cannot be taught remotely during AY2020-21 to recommend additional students for return to campus.

d. **Undergraduate students with home situations or living in time zones that are unsuitable for extended learning, or who have travel restrictions requiring residence on campus** – Students with home situations that are unsafe or unsuitable for remote learning should be allowed to return to campus housing. These students will be identified by the Deans’ Offices and Student Wellness Services. Students living and studying in distant time zones are likely to experience greater challenges in connecting to remote courses that are taught synchronously, and engaging in collaborations and office hours with students and faculty in the U.S. Some international students may have difficulty traveling between their home country and the Institute at this time. The Deans’ Offices and International Student Programs may determine that these students should have priority in student housing regardless of their on-campus coursework.

The CRCI understands that capacity in campus housing will be determined by the administration following recommendations made by the Student Affairs Planning Group, and that selection of students
for return to campus and in-person instruction will be made by the administration in consultation with the Student Affairs Planning Group and these CRCI recommendations.

Wherever possible, the CRCI recommends that students who return to in-person instruction remain together in living/study “pods” to minimize the risk of spread of COVID-19 infection. These student pods will reside, dine, and study together under guidelines to be recommended by the Student Affairs Planning Group. If a large cohort of students (e.g., all entering first-year students) returns to campus in the fall, the CRCI recommends that their main learning experiences be delivered via online tools and methods.

3. Conditions for returning to in-person instruction

In recommending any courses to be taught in person for the fall term, the CRCI cautions that increased exposure on campus raises the risk of COVID-19 infection within the Caltech community. Any recommendations for in-person instruction must include plans to maintain social distancing, require face coverings appropriate to the venue and activity, minimize touching common surfaces, control ingress and egress from the teaching spaces, and sanitize teaching spaces between uses. Even if a class is determined to have components that need to be taught in-person, components of the class that can be delivered remotely should be delivered remotely, using online tools and methods.

a. Make all return to in-person instruction voluntary for both students and instructors. It should be noted that individual responses to returning to in-person instruction will vary widely, from those who are eager to return to in-person teaching to those who are extremely reticent to return to campus. Students and instructors may self-identify as being in a high-risk category for COVID-19, living with someone who is in a high-risk category, or remain personally unsure about the safety of the campus environment. International students may face potential immigration obstacles to returning to campus. Students may face additional hardships due to familial illness, unemployment, and/or care obligations, as well as their own mental and physical health. Some students may opt to defer returning until all classes are offered in person or until the risks associated with COVID-19 subside. Faculty and staff members who have concerns about returning to campus should refer to the Guide for Returning to the Workplace posted on the Caltech coronavirus website. Students who have concerns about returning to campus should refer to the Deans’ Offices.

b. Take proactive steps to ensure student compliance with social distancing and PPE guidelines. Anecdotal information from undergraduate student representatives calls into question the willingness of undergraduates to adhere to social distancing and safety protocols while living in campus housing. The return of students to campus will increase the risk of spread of COVID-19, so additional safety measures and student-focused education about such measures should be taken if students return to campus and participate in on-campus instruction. We emphasize the need to take multiple, significant, proactive steps to ensure compliance with social distancing and PPE guidelines for those undergraduate students who will be permitted to return to campus. Students who are not willing to commit to following Caltech social distancing and PPE guidelines should not be permitted to return to campus in the fall.

c. Ensure that individual classes and class components are taught either remotely or in person (not with the expectation that some students are in person at the same time as others are remote). Due to the disparities between the in-person and remote educational experiences, the CRCI recommends that individual classes and class components be taught either remotely or in-
person. For example, if a course includes any students who are studying remotely, then it is recommended that all components of that class should be conducted via online tools, even if some students access the online course meetings and materials while residing on campus. The CRCI examined evidence for a variety of “hybrid” models (Teaching Models, Appendix D) and found that the amount of additional course design, instructor time and effort, and technology needed to ensure that any remote students have access to as high quality an experience as those who are in person mitigate against the realistic, equitable adoption of such approaches.

d. **Ensure that measures are in place for students and faculty to communicate their concerns and educational challenges due to COVID-19 disruptions.** Students should not feel pressured to return to campus if a desired course is provided in person. Faculty should not be penalized if they prefer not to teach a course in person prior to the lifting of all restrictions on in-person instruction. Reasonable accommodations must be made for students with documented disabilities, such as an underlying health issue that puts them at risk for in-person instruction. Affirmative statements should be made that students and faculty in these situations will not face discrimination, retaliation, or be disadvantaged by their decisions not to return to campus while COVID-19 conditions exist. Likewise, students and faculty should be able to adjust their status if and when their health, circumstances, or willingness to engage in on-campus instruction changes. The Deans’ Offices, faculty advisors, and course instructors are available to counsel students who face educational challenges. In addition, depending on the topic, Student Wellness Services, the Caltech Center for Inclusion and Diversity, and the CTLO are common outlets for student concerns. The Deans’ Offices should be informed about any student with educational concerns so they can follow up to assess the student’s situation and provide needed assistance.

e. **Students and instructors who return to in-person instruction must agree to participate in health and contact monitoring practices established by the Institute.** The IDTG Testing team has developed a health and contact monitoring app for use by staff and faculty who are returning to campus for research, research support, and essential services. Similar processes should be implemented for student return to campus and managed by Student Affairs.

f. **Instruction plans for in-person teaching must be reviewed and approved by the cognizant Division Chair as meeting the guidelines below.** The Caltech Safety Office (and/or standing committee, if appointed) should assist the Division office in this review. The Registrar must be kept informed of any changes in teaching models for specific courses. The guidelines are:

i. **Educational effectiveness would be severely compromised if taught remotely.** To maintain the unique benefits of a Caltech education, courses approved by the Division Chairs are recommended to be taught fully or partially in-person. These courses tend to be hands-on laboratory courses in which students receive instruction in handling and developing state-of-the-art research equipment and analyzing experimental results using such equipment.

ii. **Incorporate remote lectures and discussions whenever possible.** For portions or components of courses where in-person work is not required, remote instruction should be utilized to further minimize contacts among students, TAs, and instructors.

iii. **Cloth face coverings must be worn by students, TAs, and faculty at all times while entering, attending, and exiting class.**

iv. **The air exchange properties of each candidate teaching location should be individually assessed** (relative to 100% laboratory fresh/exhaust) prior to scheduling classes for a given location. Air exchange testing being developed by Caltech faculty members should be explored before committing a specific location for in-person classes or labs.
v. Minimize class sizes for in-person instruction to maintain 10 ft. social distancing.
Before arriving at this recommendation, the CRCI examined data and simulations to determine capacity and feasibility for a variety of forms of in-person teaching. Caltech Facilities has conducted a thorough survey of 106 potential teaching spaces across campus, including traditional lecture halls with fixed seating, classrooms with moveable furniture, conference and seminar rooms, as well as dining halls, Athenaeum and gymnasium spaces.

Using this data and 2018-19 fall enrollments, Prof. Ali Hajimiri prepared a study (Classroom Space Assignment, Appendix E) that estimates that all but 25 of the largest courses (excluding research, PE and PVA classes) could theoretically be accommodated using all available spaces and maintaining 10 ft. social distancing. The County of Los Angeles is likely to prohibit gatherings of greater than 50 individuals, including in educational settings, so approximately half of the large courses would need to be pared down into separate instructional groups, creating additional demands on teaching space. A more detailed study is needed to determine if taking into account air exchange considerations would result in a further reduction in the number of appropriate teaching locations relative to the number of rooms available based on square footage.

Non-traditional use of campus space can be explored to accommodate additional courses to be taught in person. For classes with fixed seating, seats could be color coded to alternate seating assignments between classes to minimize touching common surfaces. In addition to the availability of existing campus buildings for in-person instruction, the Institute can install outdoor tents with solid floors and equipped with electronic equipment and whiteboards for lectures. The tents would have permeable sidewalls to allow for air flow, so would not be protected from weather or external noise. The cost for a 40’ x 40’ tent could range from $5,000-$10,000 per term, depending on the amount of furnishings and equipment to be installed in the tent.

Although several teaching spaces may accommodate larger classes, we must take into consideration the diminished quality of in-person instruction with social distancing and the wearing of face coverings. Virtual simulations of student seating in a fixed-seat auditorium (e.g., Hameetman Auditorium) and open floor plan (e.g., Bechtel Dining Hall) with 10 ft. social distancing illustrate the difficulties that instructors may face in connecting with students who are located an extended distance away from them and wearing face coverings (Virtual Simulations, Appendix F). Both the instructor and students wearing face coverings would need to use voice amplification systems. Experiments using voice amplification systems among students in the same room have been marred by feedback and lack of clarity. In addition, students seated at the back of these rooms may have difficulty viewing board work at the front of the class.

vi. Laboratory work groups that cannot maintain 10 ft. social distancing should not exceed five students, plus TA and instructor. This recommendation is consistent with instructors’ preliminary plans to deliver laboratory courses in-person.

vii. Laboratory work groups that cannot maintain 10 ft. social distancing should utilize enhanced PPE (e.g., KN95 or N95, clean lab coat, eye protection) approved by the cognizant Division Chair. It is likely that students, TAs, and instructors may have to
maintain closer distancing than is recommended for research laboratories. Using enhanced PPE in these circumstances is highly recommended.

viii. **Laboratory classes should follow safety protocols established for research laboratory reopening including enhanced cleaning protocols.**

ix. **Teaching spaces should include separate entry and exits, with flow patterns clearly marked with tape.** Signage and clear markings in teaching spaces will help facilitate ingress and egress while maintaining social distancing.

x. **Scheduling of classes should allow for sanitation between classes.** Teaching spaces must be sanitized between uses.

xi. **Sanitation must be arranged with the Facilities Department.** Self-cleaning of teaching spaces by students without sanitation by Facilities is not recommended. The availability of Facilities staff to maintain a sanitation schedule may affect the availability of teaching spaces.

xii. **Class components outside of primary class meetings – including recitations, office hours, and collaborations – must follow the same requirements as in-person class meetings.** All in-person contacts associated with campus instruction should follow the same guidelines as the primary class meetings. In addition, materials such as chalk, erasers, projector dongles, whiteboard markers, demonstration or activity materials, etc. should not be shared between individuals. If such materials are needed for the class, each person should retain their own set and bring them to class as needed.

xiii. **Hand sanitizer stands should be placed in each teaching space.**

4. **Recommendations for continuing remote instruction**

With the anticipated limitations in student housing to bring students back to campus, and the CRCI’s recommendation for a small subset of courses to be taught in person, it is important that Caltech deliver and improve upon its remote instruction capability. The following recommendations are made independent of the Institute’s decision to conduct any in-person instruction.

a. **Implement additional tools and training to use those tools to facilitate student collaborations.**

The CRCI recommends that additional tools to facilitate collaborations and training in the use of those tools will be important to implement for the coming academic year. A common theme expressed by undergraduate and graduate students, as well as faculty, is the difficulty in collaborating with one another through Zoom and other remote tools. Some students who had not established collaborative groups prior to the campus shutdown experienced difficulty finding and maintaining new collaborative groups while learning remotely. Collaboration will be particularly important for the incoming freshman class, who need to connect with fellow students, including upper class students, to help navigate the rigors of a Caltech education. Sophomores who had not made connections within their majors prior to the shutdown will experience similar challenges. At the course level, under normal circumstances, students might try a number of recitation sections, office hours, and collaboration groups before finding those that work well for them; in each setting on campus, students can informally connect, exchange contact information, and explore their ability to work well together. This organic way of finding a collaborative group is no longer available in the remote learning environment where students are assigned to recitation groups. Due to FERPA restrictions, students are not provided with a list of fellow students who are enrolled in the same course without express permission from all students enrolled in the course.
i. **Extend/expand the iPad/Apple Pencil loaner program throughout AY2020-21.** The iPad/Apple Pencil loaner program that was established in May in response to the spring term student survey was widely appreciated by students who received these devices. This technology paired with online applications facilitates collaboration in real time via shared digital whiteboard technology, making collaboration on and discussion of technical, visual, and other material easier. We strongly recommend that the iPad/Apple Pencil loaner program be extended for AY2020-21, expanded to include platforms that are compatible with student-owned computing equipment, and that students and faculty receive training in the use of these tools.

ii. **Actively assist students in establishing and maintaining collaboration groups.** Students should receive additional support to facilitate introductions and establish collaboration groups within their courses, majors, and class standings. This could be accomplished through non-academic social interactions that are conducted remotely and organized by academic support groups, such as the Office for Residential Experience, the Caltech Center for Inclusion and Diversity, the Deans’ Offices, course instructors, and TAs. With the common areas in student housing expected to be closed, smaller classroom spaces could be used for in-person student peer collaborations with appropriate social distancing and safety protocols. This will allow students to use whiteboards and chalkboards individually. Strict guidelines for the use and sanitation of these spaces must be implemented.

b. **Ensure that remote courses offer comparable forms of instruction and interaction as would be offered if the course were done in person.** With the potential return of students to campus, it will be important to deliver educational resources to remote students as effectively as if those courses were delivered in person. The quality of a Caltech education should not be significantly diminished by being delivered remotely.

i. **Instructors may issue lab kits to students for remote instruction, subject to review by General Counsel and approval by the Division Chair.** Lab kits were used for several lab courses during the spring term. Review by General Counsel and approval by the Division Chair are necessary to assess the safety of the materials, tools, and processes to be performed remotely. General Counsel may recommend that liability waivers be signed by students receiving lab kits at home.

c. **Ensure that instructors and TAs maintain regular office hours and make themselves available to students who need additional academic support, particularly those who reside in distant time zones or who have difficulty connecting to synchronous classes.** Office hours held by faculty and TAs were cited by students as an important means of support for students. Collaboration between students, as well as high-interaction exchanges between students and TAs/instructors such as during office hours (which share many characteristics of peer-to-peer collaboration), proved to be especially challenging remotely.

5. **Recommendations for all types of instruction**

The following recommendations are pertinent to all methods of instruction that will be conducted in AY2020-21.

a. **Inform instructors as early as possible to begin planning for remote teaching and share regular communication about training, support, and updates.** The transition to remote teaching during the spring term was completed with little advance notice and preparation. While the majority of
students and faculty expressed satisfaction with their spring online learning and teaching experiences, additional planning for the fall term will result in more effective remote instruction experiences. There is a possibility that a resurgence of COVID-19 during the term may require another sudden pivot to remote teaching, so all instructors are encouraged to plan accordingly.

b. **Return to the standard grading policy starting in the fall term.** The CRCI recommends return to the normal grading policy in the fall. The pass/fail grading option that was offered to all students during the spring term went a long way toward alleviating the anxiety associated with moving all courses to an online format in a very short period of time. Forty-eight percent of undergraduate student course enrollments during the AY2019-20 spring term elected pass/fail grading, compared with 10 percent during the AY2018-19 spring term. Thirty-seven percent of graduate student course enrollments elected pass/fail grading in the most recent spring term, compared with 13 percent during the prior spring term. These figures represent student elections for pass/fail grading above those courses that were offered pass/fail.

Some faculty members who participated in the focus group meetings reported that several students who elected pass/fail grading during the spring term would have received high grades had they been graded normally. Other faculty members reported that the quality of work submitted by some students who elected pass/fail grading was less thorough and the students remained less engaged in their coursework. The undergraduate student representatives agreed that with the COVID-19 situation expected to continue through the next academic year it would not be reasonable to continue pass/fail grading for the entire academic year. Graduate students expressed concern that any petitions for pass/fail grading or requests for other accommodations be managed by the Graduate Dean’s Office rather than by faculty advisors.

For the AY2020-21 fall term, the CRCI recommends a return to the standard grading policy to preserve the integrity of a Caltech degree and to encourage students to fully engage with their coursework. The Deans will work with students who have special circumstances to provide educational accommodations, including the possibility of electing pass/fail grading or reduced course loads, as they have normally done in the past.

i. **Offer increased flexibility for coursework deadlines.** In conjunction with the return to our normal grading policy, we recommend an increase in deadline flexibility across all Caltech courses to give students grace periods that many of them will need to deal with family, health, and academic matters.

c. **Maintain the normal academic calendar for AY2020-21.** Require instructors to use the final week of instruction after Thanksgiving for remote teaching activities only and to conduct final exams remotely. The CRCI recommends that the Institute maintain the normal academic calendar for AY2020-21. Some peer institutions have announced decisions to begin their fall term one week early to enable students to return home for the Thanksgiving break without the need to return to campus. Caltech’s fall term typically begins later than many of our peer institutions, so one week of instruction, a study period, and final exams normally take place during the two weeks following the Thanksgiving break. Advancing the start of the fall term by one to two weeks could be accommodated but will interfere with the proposed implementation of the new learning management system which has been approved by the administration for implementation by the fall term. The CRCI recommends that the Institute inform instructors that they should use the final week of instruction, after Thanksgiving, for remote teaching activities, such as lab analysis and report writing, and to conduct final exams remotely. This would allow
students to leave at Thanksgiving and remain away for the rest of the term with minimal disruption to instruction.

d. **Ensure that educational resources are delivered to remote students as efficiently as to students on campus.** Many instructors were very successful in engaging students during synchronous online class meetings during the spring term. Students found the availability of recordings to be helpful. Pre-recorded lectures were used in a flipped class manner, in which students engaged with video material prior to synchronous discussion, problem solving, and Q&A. Recordings of synchronous classes were made available to students for later reference, allowing them to pause, notate, and reflect on the material before moving forward, or view the class in cases where time zones or internet connectivity prevented synchronous participation.

e. **Implement greater use of the course ombuds program for both undergraduate and graduate courses.** Students studying remotely may be more reticent to request help than they would if learning in person. The ombuds program that has been established by the ASCIT Academic and Research Committee has been helpful in providing students with peer support within their classes. Larger undergraduate courses may benefit from assigning multiple course ombudspersons that can be available at various times and through a variety of communication methods. Graduate courses may also benefit from having students serve as course ombudspersons. In addition, as instructors design their online courses, they are encouraged to consider new ways to utilize TA support, particularly for large classes. Fewer recitation sections may be scheduled, which will free up TAs for small group or one-on-one support via office hours and online collaboration.

f. **Emphasize the need for instructors to complete mid-quarter progress reports.** With a significant number of students learning remotely, it will be important to provide them with timely feedback about their coursework progress. Compliance with the mid-quarter progress reports requirement during the spring term proved to be challenging and should be emphasized while any remote teaching continues.

g. **Improve support for remote and in-person instruction.** To improve upon remote instruction for the fall term, CTLO and AMT will provide additional instructor and TA training in the use of instructional technologies. They plan to publish a schedule of opportunities during summer 2020 for more in-depth discussions about remote teaching methods. This will provide additional opportunities to hear from Caltech faculty and TAs about their experiences during the spring term. CTLO and AMT will continue to update the [teach.caltech.edu](http://teach.caltech.edu) website with additional information and materials. IMSS will add complementary information and materials to the [learn.caltech.edu](http://learn.caltech.edu) website for students. Because instructors appreciated regular communication about training, support, and updates, the practice of sharing a routine email communication with all current instructors and professorial faculty should be continued, beginning in summer 2020 for fall teaching. With further advance planning, we anticipate that communications will not need to be as frequent as they were in spring 2020.

i. **Develop in-house instructional technology expertise.** The CRCI recommends that Caltech develop additional in-house instructional technology expertise. The educational consulting firm, ATTECS, was instrumental in helping the CTLO staff to bring core classes online for the spring term. We can continue our engagement with ATTECS to assist faculty with designing online courses for the fall term, but a permanent instructional technologist would be more fully integrated into Caltech and would be able to evaluate instructional applications, test them with other applications, and create training in their use.
ii. **Implement a new learning management system to be in place by the fall term.**
Students and instructors reported several benefits to converting classes online during the spring term. The requirement for instructors to include basic course information in Caltech’s learning management system, Moodle, led to more consistent delivery of course expectations and opportunities for interaction and engagement within the class. However, remote teaching during the spring term revealed several challenges with using Moodle, including its lack of integration with other campus information systems and apps commonly used in remote teaching. The administration has approved a proposal to replace Moodle with a learning management system that will integrate many of the tools and applications that are preferred by Caltech faculty for remote instruction, such as Piazza, Gradescope, Zoom, and Google Drive, as well as connect to the Caltech Student Information System, Exeter, to manage enrollment and auditors. The spring term survey of instructors gathered feedback on the learning management system, and several faculty members participated in demonstrations of potential LMS systems under consideration. The goal is to implement the new LMS by the start of the fall term. Regardless of the amount of remote instruction in fall, the requirement for a basic presence of every course in the LMS should be continued.

iii. **Consider installing additional recording equipment in more classrooms.** Academic Media Technologies (AMT) has developed several technology options to support hybrid and remote instruction. These technologies can be used in combination or expanded to improve the learning experience for students. It is important that instructors are trained in how to use these technologies to achieve the best outcomes.

Three rooms on campus (Feynman Lecture Hall, 105 Annenberg, and Hameetman Auditorium) are currently outfitted with Echo360 lecture capture recording equipment, cameras, and microphones that can be used to record and live stream lectures and projected visual elements. The cost to outfit additional rooms with similar capabilities is approximately $50,000 per installation. Continued and expanded use of this technology will also require hardware upgrades and increased license costs.

Live streaming and recording can also be accomplished in any campus location with flat screens, whiteboards, blackboard, or projector. Rooms can be outfitted with cameras and mics, for fully remote operation. Alternatively, an AV technician can set up and operate equipment for maximum flexibility. Eleven spaces on campus are equipped with AV booths that provide distancing between the instructor and the AV technician. Another eleven locations on campus are large enough to provide space between the instructor and the AV technician. The cost to equip additional rooms with this type of technology is approximately $15,000 per installation.

Equipment to facilitate pre-recording of lectures in a classroom (e.g., using the whiteboard or computer and projection) without live streaming can also be implemented for an approximate cost of $10,000 per installation. The CRCI assumes that faculty could continue to access campus spaces without students present to use these technologies as was allowed during the initial Safer at Home orders in March 2020.

h. **Encourage faculty to work with the Library to use texts and reference materials that are readily available in electronic format.** Students cited the resources provided by the Caltech Libraries as particularly helpful during the spring term of remote learning. University Librarian
Kara Whatley noted that Caltech instructors tend to use older texts for instruction, which are easier for students to access while physically on campus but more difficult to deploy remotely. Instructors should be encouraged to update their texts and reference materials to those that are readily available in electronic format. The Library staff are available to assist instructors in the identification and procurement of such learning materials.

i. **Continue to provide extracurricular workshops through the Library.** Students also touted the extracurricular workshops that were provided by the Library during the spring term. Additional workshops and training in the use of online collaborative tools, LaTeX authoring, computer programming, and data carpentry are encouraged for the coming academic year.

6. **Support specific to graduate students**

The graduate student representatives raised several concerns that are specific to this group. While much of the graduate student experience at Caltech relies on their work within research groups, their academic progress can be improved through the following recommendations:

a. **Encourage graduate student advisors to consider student progress toward completion in developing and implementing laboratory reopening plans.** Graduate students expressed concern about their ability to complete experiments required for degree completion. As described in the prioritization of students for return to campus, there may exist gaps between students who need to complete experiments in the laboratory and their advisors’ plans to resume research in their laboratories. We urge graduate advisors to consider graduate student progress toward completion in developing and implementing their laboratory reopening plans.

b. **Encourage graduate student advisors to promote collaborations and healthy social interactions within their research groups.** The strength of graduate student collaborations within their research groups depends greatly on the structure and example set by their faculty advisors. Graduate students living in off-campus housing may develop feelings of isolation if not engaged in campus research and other activities. We urge faculty advisors to facilitate collaborations among their graduate students, and to make themselves available to the students for consultation on a regular basis. We suggest that opportunities for social interactions for graduate students be arranged by research advisors, option representatives, the Graduate Office, and other support offices on campus.

**Hy-flex and hybrid teaching models**

It will be difficult to maintain equity for students learning remotely versus those learning in person. One method to even out the learning experience will be to rotate the students between remote and in-person learning on a regular basis, though this is possible only if all students have access to the on-campus experience. Equity issues for students who choose not to return to in-person learning will remain.

The Hy-flex teaching model provides every element of a course simultaneously in both online and in-person modes. This model gives flexibility to students to decide whether to return to campus and allows greater control of physical distancing in teaching spaces. Additional technical support must be provided for this type of instruction to operate and monitor the remote recording equipment, and to deliver course materials to an online audience in a manner that is equitable to the in-person experience.
The Hy-flex method of teaching is extremely demanding for the instructor who must simultaneously engage with both a live class and with remote students. Course materials and activities must be prepared in two ways for delivery in person and online, and interaction among students in person and online is not easily facilitated with this model. For the reasons described above, the CRCI does not recommend using a Hy-flex model.

Additional information about the Hy-flex and other forms of hybrid teaching are shown in Appendix D.

**Next Steps**

It will be important for fall term instructors to begin planning for remote teaching as early as possible, whether their courses will continue to be taught remotely or in-person. With the possibility of a second wave of COVID-19 infections, the campus may be required to pivot all classes online quickly as happened prior to the spring term. The CRCI strongly recommends that an announcement about planning for remote instruction be made by the administration as soon as possible. This announcement may also incorporate recommendations for fall term instruction that are approved by the administration and should not be delayed by the approval process.

The CRCI will continue with the following activities throughout the summer leading up to the start of the fall term:

- Assess student intentions and ability to return to campus for the fall term (July)
- Assess student progress and graduation needs (expected in July)
- Implement a new learning management system targeted for fall 2020
- Identify courses that should not be taught remotely for winter and spring terms and work with instructors to develop in-person or remote teaching plans for those courses
- Refine recommendations for in-person and remote teaching methods
- Investigate additional tools to facilitate collaboration for academic and research purposes
- Develop instructor and TA training in the use of instructional technologies
- Develop recommendations for in-person and remote teaching under Stage 2 conditions
- Monitor governmental and professional guidance for in-person instruction
APPENDIX A – Committee on Reconstituting On-Campus Instruction Roster

The Committee on Reconstituting On-Campus Instruction (CRCI) includes all members of the former Academic Workgroup within the Infectious Diseases Task Group (IDTG), which was tasked with transitioning Caltech instruction to fully remote teaching for the Spring 2020 term in response to the COVID-19 Safer at Home restrictions imposed by state and local governments. Five faculty members were added to the CRCI at its inception to shift the group’s focus to envisioning potential scenarios for campus instruction beginning with the fall 2020 term and beyond. The membership of the CRCI listed below represents the Center for Teaching, Learning, and Outreach (CTLO); Information Management Systems and Services (IMSS); Academic Media Technologies (AMT); the Undergraduate and Graduate Deans’ Offices; the Office of the Registrar; the Caltech Libraries; Athletics, Physical Education, and Recreation; the Divisions of Biology and Biological Engineering, Engineering and Applied Science, and the Humanities and Social Sciences; and the Provost’s and Vice Provosts’ Offices.

CRCI Members:
Jin Chang, Chief Information Officer
Regina Colombo, Senior Assistant Administrator, Office of the Provost
Marionne Epalle, Division Operations Officer, Division of Engineering and Applied Science
Ali Hajimiri, Bren Professor of Electrical Engineering and Medical Engineering
Cassandra Horii, Director, Center for Teaching, Learning, and Outreach
Ron Kong, Associate Chief Information Officer
Kim Mawhinney, Associate Registrar
Leslie Maxfield, Director, Academic Media Technologies and Communications
Kate McAnulty, Associate Dean for Graduate Studies
Betsy Mitchell, Director of Athletics, Physical Education and Recreation
Lesley Nye, Associate Dean of Undergraduate Students
Niles Pierce, Professor of Applied and Computational Mathematics and Bioengineering
Christy Salinas, Registrar
Stacey Scoville (chair), Administrator, Office of the Provost
Jennifer Weaver, Associate Director of University Teaching
Cindy Weinstein, Eli and Edythe Broad Professor of English; Vice Provost; Chief Diversity Officer
Kristin Weyman, Associate Dean for Undergraduate Students
Kara Whatley, University Librarian
## APPENDIX B – Caltech Recovery Planning Framework

### Caltech Virus Control Stages

<table>
<thead>
<tr>
<th>Level of Virus Control</th>
<th>Stage 1: Universal Control</th>
<th>Stage 2: Widespread Control</th>
<th>Stage 3: Limited Control</th>
<th>Stage 4: Slow the Spread</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Distancing Practices</td>
<td>Cover face when coughing or sneezing; be mindful of proximity to others in public; Wash hands frequently and do not touch face</td>
<td>Use face coverings; stay home when ill; maintain physical distance with others in public; Wash hands frequently and do not touch face</td>
<td>Use face coverings; maintain 6-foot physical distance with others in public; Wash hands frequently and do not touch face</td>
<td>Use face coverings; maintain 4-foot physical distance with others; stagger personnel schedules; Wash hands frequently and do not touch face</td>
</tr>
<tr>
<td>Gov’t Controls</td>
<td>Guidance from PHD; no international travel restrictions</td>
<td>Partial restrictions on gatherings activities, international travel</td>
<td>Restrictions on gatherings, activities, travel</td>
<td>Safer at Home Order</td>
</tr>
<tr>
<td>Testing</td>
<td>Universal point of care testing and serology</td>
<td>Widespread testing available for those with COVID-19 symptoms; Serology testing available</td>
<td>Sufficient testing capacity to quickly test those with COVID-19 symptoms</td>
<td>Limited and/or unreliable access to local testing</td>
</tr>
<tr>
<td>Case Management</td>
<td>Isolation and Quarantine discontinued</td>
<td>Isolation &amp; Quarantine for few remaining cases; Active monitoring of cases &amp; close contacts</td>
<td>Isolation and Quarantine; Active monitoring of cases and close contacts (contact tracing)</td>
<td>Isolation and Quarantine; Contract tracing needs exceed resource capacity</td>
</tr>
<tr>
<td>Therapeutics and Hospital Capacity</td>
<td>Therapeutics readily available; Hospitals have sufficient equipment &amp; supplies in reserve</td>
<td>Therapeutics may be available; Local hospitals able to treat without crisis standard of care</td>
<td>No therapeutics available; Local hospitals able to treat without crisis standard of care</td>
<td>No therapeutics available; Local hospital capacity strained</td>
</tr>
<tr>
<td>Case Growth</td>
<td>Limited/no new cases</td>
<td>Ongoing sustained reduction in cases; Herd immunity thresholds established</td>
<td>Sustained 14-day reduction in cases</td>
<td>Widespread community transmission</td>
</tr>
<tr>
<td>Vaccine</td>
<td>Mass vaccination efforts; New vaccines developed quickly</td>
<td>Vaccine available for prioritized groups</td>
<td>No vaccine</td>
<td>No vaccine</td>
</tr>
</tbody>
</table>
APPENDIX C – Fall Course Offerings Recommended for In-Person Instruction

Recommendations regarding specific courses are confidential and have been removed prior to distribution of this report.
### APPENDIX D – Spreadsheet of Teaching Models for Caltech 2020-21

<table>
<thead>
<tr>
<th>Model #</th>
<th>CRPP Stage</th>
<th>Teaching Model</th>
<th>Description</th>
<th>Guidelines for Implementation</th>
<th>Overall Advantages or Benefits</th>
<th>Overall Disadvantages or Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
<td>Stage 3 or 2</td>
<td>Baseline Institutional Requirements for Some Remote Instruction Regardless of Specific Model</td>
<td>As a return to normal is very unlikely in the fall, there will definitively be some instruction that occurs remotely. This line highlights the baseline considerations that will be needed for all instruction, regardless of the exact model followed.</td>
<td>Implement tools, approaches and solutions from the Spring 2020 surveys and offering training to make Fall and beyond more successful. Institution-wide efforts will be needed to implement collaboration tools and structures for UGs. Thoughtful transparent communication for decision making.</td>
<td>Improve upon lessons learned from remote instruction. Offering some remote classes will be more accessible to students with disabilities and health concerns.</td>
<td>Collaboration is an important component of a Caltech education - we will need to put institute-wide efforts at all levels (administration, faculty, students) into facilitating collaboration structures and building community amongst students.</td>
</tr>
<tr>
<td>Model 2</td>
<td>Stage 3 (limited control)</td>
<td>Fully Remote; Minimal UG Occupancy On Campus</td>
<td>In this model, all courses are taught remotely, akin to the Spring Quarter of 2020, regardless of whether students are on-campus.</td>
<td>Implement tools, approaches and solutions from the Spring 2020 surveys and offering training to make Fall and beyond more successful. Institution-wide efforts will be needed to implement collaboration tools and structures for UGs. Thoughtful transparent communication for why a very limited number of students are on-campus while others are not.</td>
<td>This is a known option from Spring 2020 that we can improve upon; other options have new unknowns. Public health concerns mitigated. More accessible to students with learning and other disabilities that prevent them from being able to attend class regularly - i.e. ability to record, rewatch, reward, helpful for students with disabilities.</td>
<td>We will need to get Freshman class (and new instructors) up to speed with tools. Some classes may not be available online (including some labs, others). Collaboration will be an issue for many cohorts of students. A small number of students will likely need to be back on campus even if in remote classes.</td>
</tr>
<tr>
<td>Model 3</td>
<td>Stage 3 or 2 (limited or wide-spread control)</td>
<td>Grads Remote or In -Person Classes, Undergrads (UGs) Remote</td>
<td>This model allows certain cohorts back on campus based on status as grad or UG. In this model, faculty can choose for grad courses to be all remote or in person (the latter also dependent on size). UG courses are all offered remotely (regardless of whether undergrads are in dorms or not). UG/Grad mix courses are offered remotely with the possibility of grads organizing supplementary journal clubs / discussion groups.</td>
<td>Implement tools, approaches and solutions from the Spring 2020 survey to instructors, TAs, and students and offering training to make Fall and beyond more successful. Institution-wide efforts will be needed to implement collaboration tools and structures for UGs. Thoughtful transparent communication for why some students are on-campus while others are not.</td>
<td>Keeps Grades on track with their program. Allows grad to TA from their offices (more resources). More accessible to students with learning and other disabilities that prevent them from being able to attend class regularly - i.e. ability to record, rewatch, reward, helpful for students with disabilities.</td>
<td>Impression of unfairness that Grads given priority over UGs - can be creative and turn that into a UG advantage like new mentoring/learning with Grads in course.</td>
</tr>
<tr>
<td>Model 4</td>
<td>Stage 3 or 2 (limited or wide-spread control)</td>
<td>Grad In-Person or Remote Classes, Undergrad Labs In Person, All Others Remote</td>
<td>This model allows certain cohorts in the 'classroom' based on research needs - students taking labs and conducting research projects. In this model, labs and office hours for small lab classes can be taught in person, but all other courses are remote (even if students are in dorm rooms).</td>
<td>Implement tools, approaches and solutions from the Spring 2020 survey to instructors, TAs, and students and offering training to make Fall and beyond more successful. Institution-wide efforts will be needed to implement collaboration tools and structures for UGs. Thoughtful transparent communication for why some students are on-campus while others are not (or some classes are remote while others are not).</td>
<td>This choice is based on an action and not on UG/Grad status which can be seen as more equal to students overall, allows students to complete labs and other courses difficult to complete online. More accessible to students with learning and other disabilities that prevent them from being able to attend class regularly - i.e. ability to record, rewatch, reward, helpful for students with disabilities.</td>
<td>Students on campus because they have labs may be seen to have an advantage over their peers in non-lab classes that aren't on campus, as they can still collaborate in small groups. Substantial changes would still be needed for lab classes - expanded and staggered scheduling to maintain distance, communication with masks, limits on in-person collaboration labwork and projects.</td>
</tr>
<tr>
<td>Model 5</td>
<td>Stage 2 (wide-spread control)</td>
<td>Grads + Select Cohort (e.g. Freshmen, Sophomores, Seniors) On Campus</td>
<td>This model allows certain cohorts in 'classroom' based on year - freshmen, seniors and/or seniors. In this model, small classes / recitations / office hours for these cohorts can be taught in person, but all other courses are remote (even if students are in dorm rooms).</td>
<td>Implement tools, approaches and solutions from the Spring 2020 survey to instructors, TAs, and students and offering training to make Fall and beyond more successful. Institution-wide efforts will be needed to implement collaboration tools and structures for UGs. Thoughtful transparent communication for why some students are on-campus while others are not (or some classes are remote while others are not).</td>
<td>Allows Freshmen to acclimate to campus; allows students to complete senior thesis.</td>
<td>Students on campus because they have labs may be seen to have an advantage over their peers in non-lab classes that aren't on campus, as they can still collaborate in small groups. Substantial changes would still be needed for lab classes - expanded and staggered scheduling to maintain distance, communication with masks, limits on in-person collaboration labwork and projects.</td>
</tr>
<tr>
<td>Model 6</td>
<td>Stage 2 (wide-spread control)</td>
<td>Hy-Flex</td>
<td>Courses are taught both face-to-face and online by the same instructor at the same time.</td>
<td>Implement tools, approaches and solutions from the Spring 2020 survey to instructors, TAs, and students and offering training to make Fall and beyond more successful. Institution-wide efforts will be needed to implement collaboration tools and structures for UGs. Thoughtful transparent communication for why some students are on-campus while others are not (or some classes are remote while others are not).</td>
<td>Gives great flexibility to students; allows greater control of physical distancing; students can choose whether to return to campus.</td>
<td>Offering both in-person and high-quality online options for potentially almost all classes requires more instructional planning/design than may be reasonable to expect (online can't be a secondary/poorer version - has to be just as good). There may not be physical space for all students who wish to return to campus.</td>
</tr>
<tr>
<td>Model 7</td>
<td>Stage 1</td>
<td>Back to Normal</td>
<td>Back to normal but be prepared to transition abruptly to remote teaching.</td>
<td>Should only be considered with widespread testing available and upon consultation with instructors.</td>
<td>Back to normal but with a possibility of completing the quarter remotely.</td>
<td>High likelihood of moving back to stage 2/3.</td>
</tr>
</tbody>
</table>
Recommendations for Reconstituting On-Campus Instruction for the Fall 2020 Term

(Continued from previous page)

<table>
<thead>
<tr>
<th>Model #</th>
<th>Structure for Lectures</th>
<th>Structure for Seminars</th>
<th>Structure for Recitations (Recs)</th>
<th>Structure for Office Hours (OH's)</th>
<th>Structure for Labs</th>
<th>Collaboration Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
<td>If in person, no groupwork or close-contact active learning within lectures/seminars/recitations/office hours (can use digital tools or do individual work), must abide physical distancing guidelines; small classes must be held in large rooms. If online, lectures must be recorded or pre-recorded with all interactions (lectures, seminars, recitations and office hours) having a strong emphasis on student engagement.</td>
<td>Labs must be cancelled, offered in-person or translated to an online environment - the latter two will take much extra effort and resources.</td>
<td>Collaboration is an important component of a Caltech education - we will need to put institute-wide efforts at all levels (administration, faculty, students) into facilitating collaboration structures and building community amongst students.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 2</td>
<td>As per Spring 2020 - using tools such as Zoom, Moodle (or new LMS), Google Drive, etc.</td>
<td>Where possible, UG labs are online or are cancelled for Fall (and perhaps rescheduled to other quarters).</td>
<td>Collaboration is difficult online and ARC/ASCIT/Deans/CTLO will need to create task force to devise some solutions for students without study groups. This will be especially important for freshmen. Guidance can be offered to faculty on providing some initial structure for collaboration as part of classes.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 3</td>
<td>UG lectures online; small Grad courses in person if faculty chooses.</td>
<td>UG labs would follow guidelines for research labs. Labs may have to expand scheduled hours and have students and faculty/TAs in shifts.</td>
<td>Collaboration is difficult online and ARC/ASCIT/Deans/CTLO will need to create task force to devise some solutions for students without study groups. This will be especially important for freshmen. Guidance can be offered to faculty on providing some initial structure for collaboration as part of classes.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 4</td>
<td>UG lectures online; small Grad courses in person if faculty chooses.</td>
<td>UG labs would follow guidelines for research labs. Labs may have to expand scheduled hours and have students and faculty/TAs in shifts.</td>
<td>Collaboration is difficult online and ARC/ASCIT/Deans/CTLO will need to create task force to devise some solutions for students without study groups. This will be especially important for freshmen. Guidance can be offered to faculty on providing some initial structure for collaboration as part of classes.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 5</td>
<td>No groupwork or close-contact active learning within lectures (can use digital tools or do individual work); lectures must abide physical distancing guidelines; large lectures may have to be online due to limited spaces and limits on size of group gatherings or be taught multiple times in sections; small classes must be held in large rooms.</td>
<td>Grad and UG office hours online or in-person following physical distancing guidelines.</td>
<td>Collaboration is difficult online and ARC/ASCIT/Deans/CTLO will need to create task force to devise some solutions for students without study groups. This will be especially important for freshmen. Guidance can be offered to faculty on providing some initial structure for collaboration as part of classes.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 6</td>
<td>All lectures must have online option. No groupwork or close-contact active learning within lectures (can use digital tools or do individual work); lectures must abide physical distancing guidelines; large lectures may have to be online due to limited spaces and limits on size of group gatherings or be taught multiple times in sections; small classes must be held in large rooms.</td>
<td>UG lab hours would follow guidelines for research labs. Labs may have to expand scheduled hours and have students and faculty/TAs in shifts.</td>
<td>Collaboration is difficult online and ARC/ASCIT/Deans/CTLO will need to create task force to devise some solutions for students without study groups. This will be especially important for freshmen. Guidance can be offered to faculty on providing some initial structure for collaboration as part of classes.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 7</td>
<td>Follow physical distancing guidelines; large lectures will have to be moved outdoors or taught in sections.</td>
<td>UG labs would follow guidelines for research labs.</td>
<td>Collaboration is difficult online and ARC/ASCIT/Deans/CTLO will need to create task force to devise some solutions for students without study groups. This will be especially important for freshmen. Guidance can be offered to faculty on providing some initial structure for collaboration as part of classes.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Concern: if many/most classes have both on-campus and remote students, how are collaborations managed so students are not siloed by location?

Collaboration is an important component of a Caltech education - we will need to put institute-wide efforts at all levels (administration, faculty, students) into facilitating collaboration structures and building community amongst students.

We will need to put institute-wide efforts at all levels (administration, faculty, students) into facilitating collaboration structures and building community amongst students. Concern: if many/most classes have both on-campus and remote students, how are collaborations managed so students are not siloed by location?
<table>
<thead>
<tr>
<th>Model #</th>
<th>Equity, Accessibility and Inclusion Considerations</th>
<th>Considerations for students who cannot return to campus</th>
<th>Grading Considerations</th>
<th>Faculty and TA Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
<td>Stress, mental health, bandwidth, rural areas, students with concerning home situations (may be mitigated by allowing these students on campus?); inequitable access for students who have pre-existing medical conditions.</td>
<td>Where possible, all classes should have an online component accessible to all students (with the exception of some labs). Many classes are likely to have at least one student or faculty member who cannot return to campus and this may determine whether these courses will be offered as remote / online only.</td>
<td>Pass/Fail should be an option for UGs as it accommodates those in difficult situations (especially if not back on campus). There may be consequences for quality of learning and future applications (grad/med school, etc.).</td>
<td>All in-person instructors will wear PPE and engage in physical distancing; this will have a notable impact on instruction quality, effort, and necessary resources.</td>
</tr>
<tr>
<td>Model 2</td>
<td>Stress, mental health, bandwidth, rural areas, students with concerning home situations (may be mitigated by allowing these students on campus?).</td>
<td>Not applicable as almost all students will be away from campus.</td>
<td>Pass/Fail should be an option for UGs as it accommodates those in difficult situations (especially if not back on campus). There may be consequences for quality of learning and future applications (grad/med school, etc.).</td>
<td>Faculty and TAs continue to work from home / office.</td>
</tr>
<tr>
<td>Model 3</td>
<td>Stress, mental health, bandwidth, rural areas, students with concerning home situations (may be mitigated by allowing these students on campus?); inequitable access for students who have pre-existing medical conditions.</td>
<td>Grad class instructors should survey their students to find out their intentions for return to campus - small classes which have at least one student who will be remote should intend to have an online class (unless prohibitive because a lab).</td>
<td>Pass/Fail should be an option for UGs as it accommodates those in difficult situations (especially if not back on campus). There may be consequences for quality of learning and future applications (grad/med school, etc.).</td>
<td>Faculty teaching in-person with masks and physical distancing; faculty can choose to offer Grad class remotely; TAs can offer everything remotely.</td>
</tr>
<tr>
<td>Model 4</td>
<td>Stress, mental health, bandwidth, rural areas, students with concerning home situations (may be mitigated by allowing these students on campus?); inequitable access for students who have pre-existing medical conditions.</td>
<td>Grad class instructors should survey their students to find out their intentions for return to campus - small classes which have at least one student who will be remote should intend to have an online class (unless prohibitive because a lab). UG labs offered as an in-person lab can only be taken in-person and students must commit to this before registering (i.e., if they choose to not come back to campus or leave campus, they have to drop the class).</td>
<td>Pass/Fail should be an option for UGs as it accommodates those in difficult situations (especially if not back on campus). There may be consequences for quality of learning and future applications (grad/med school, etc.).</td>
<td>Faculty teaching in-person with masks and physical distancing; faculty can choose to offer lab classes remotely; extra work to balance in-person and online class simultaneously; extra hours in lab to accommodate physical distancing; challenges in demonstrating and working with students on lab equipment and procedures with distancing.</td>
</tr>
<tr>
<td>Model 5</td>
<td>Stress, mental health, bandwidth, rural areas, students with concerning home situations (may be mitigated by allowing these students on campus?); inequitable access for students who have pre-existing medical conditions.</td>
<td>Grad and small UG class instructors should survey their students to find out their intentions for return to campus - small classes which have at least one student who will be remote should intend to have an online class (unless prohibitive because a lab). UG labs offered as an in-person lab can only be taken in-person and students must commit to this before registering (i.e., if they choose to not come back to campus or leave campus, they have to drop the class).</td>
<td>Pass/Fail should be an option for UGs as it accommodates those in difficult situations (especially if not back on campus). There may be consequences for quality of learning and future applications (grad/med school, etc.).</td>
<td>Faculty teaching in-person with masks and physical distancing; faculty can cancel or offer lab classes remotely; extra work to balance in-person and online class simultaneously.</td>
</tr>
<tr>
<td>Model 6</td>
<td>Non-returning students must have an equal quality alternative experience for any in-person offerings; the principle of Hy-Flex is essentially duplicating each class experience in two versions, fully online and fully remote, so remote is not considered an accommodation or secondary experience.</td>
<td>Offering both in-person and high-quality online options for potentially almost all classes requires more instructional planning/design than may be reasonable to expect (online can't be a secondary/poorer version - has to be just as good).</td>
<td>Pass/Fail should be an option for UGs as it accommodates those in difficult situations (especially if not back on campus). There may be consequences for quality of learning and future applications (grad/med school, etc.).</td>
<td>Teaching in-person with masks and physical distancing; need in-class TA support; considerable time, effort needed to plan classes that work for students who are both on campus and remote, with equivalent learning experiences. In practice, this may devolve to just one model - either it's basically fully online, or fully in person and remote students are excluded.</td>
</tr>
<tr>
<td>Model 7</td>
<td>Accommodations will need to be made for students who choose not to return to campus but remain enrolled - recording lectures, virtual office hours, etc. Will have inequitable access for students who have pre-existing medical conditions.</td>
<td>Grad and small UG class instructors should survey their students to find out their intentions for return to campus - small classes which have at least one student who will be remote should intend to have an online class (unless prohibitive because a lab). UG labs offered as an in-person lab can only be taken in-person and students must commit to this before registering (i.e., if they choose to not come back to campus or leave campus, they have to drop the class). Some classes (e.g., large core classes and labs with in-person recitations) may choose to have designated online recitation session(s) for students not on campus.</td>
<td>As per usual.</td>
<td>Faculty weary of outbreaks, virus, childcare for K-12 children, safety.</td>
</tr>
</tbody>
</table>
### Recommendations for Reconstituting On-Campus Instruction for the Fall 2020 Term

#### (Teaching Models, continued from previous page)

<table>
<thead>
<tr>
<th>Model #</th>
<th>Public Health Implications</th>
<th>Needed Support from the CTLO</th>
<th>Needed Support from Student Affairs</th>
<th>Needed Support from IMSS and AMT</th>
<th>Needed Support from the Library</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
<td>Requires masks, 6 foot distancing minimum and sanitization / cleaning between classes, time distancing between classes, individual equipment (whiteboard markers, chalk).</td>
<td>Instructional videos / office hours / workshops / short courses / resources for online course design support for all teaching faculty and TAs. Need to begin earlier than typical fall course planning to meet needs.</td>
<td>Helping students to form collaboration groups and meet each other entirely virtually (UGs); perhaps facilitating use of smaller classroom spaces for student collaboration or office hours with clear guidelines.</td>
<td>Instructional videos, office hours, one-on-one troubleshooting; purchase and manage equipment for instructors; purchase/install equipment for whiteboard/PPT instruction (Echo360, automated camera); manage automated solution; network assessment for recording locations; IMSS Help Desk support to troubleshoot Zoom/G Suite.</td>
<td>Continued equipment lending program; digital course reserves (via Box/PDFs with passwords or new LMS-integrated system); additional lead-time and outreach for Adopt-a-Text; library stacks closed with curbside pick up and possible book loans via USPS; library workshops via Zoom.</td>
</tr>
<tr>
<td>Model 2</td>
<td>Students follow public health guidelines where they reside.</td>
<td>Instructional videos / office hours / workshops / short courses / resources for online course design support for all teaching faculty and TAs. Need to begin earlier than typical fall course planning to meet needs.</td>
<td>Helping students to form collaboration groups and meet each other entirely virtually (UGs).</td>
<td>Instructional videos, office hours, one-on-one troubleshooting; purchase and manage equipment for instructors; purchase/install equipment for whiteboard/PPT instruction (Echo360, automated camera); manage automated solution; network assessment for recording locations; IMSS Help Desk support to troubleshoot Zoom/G Suite.</td>
<td>Continued equipment lending program; digital course reserves (via Box/PDFs with passwords or new LMS-integrated system); additional lead-time and outreach for Adopt-a-Text; library stacks closed with curbside pick up and possible book loans via USPS; library workshops via Zoom.</td>
</tr>
<tr>
<td>Model 3</td>
<td>Requires masks, 6 foot distancing minimum and sanitization / cleaning between classes, time distancing between classes, individual equipment (whiteboard markers, chalk).</td>
<td>Instructional videos / office hours / workshops / short courses / resources for online course design support for all teaching faculty and TAs. Need to begin earlier than typical fall course planning to meet needs.</td>
<td>Helping students to form collaboration groups and meet each other entirely virtually (UGs); perhaps facilitating use of smaller classroom spaces for student collaboration or office hours with clear guidelines.</td>
<td>Instructional videos, office hours, one-on-one troubleshooting; purchase and manage equipment for instructors; purchase/install equipment for whiteboard/PPT instruction (Echo360, automated camera); manage automated solution; network assessment for recording locations; IMSS Help Desk support to troubleshoot Zoom/G Suite.</td>
<td>Continued equipment lending program; digital course reserves (via Box/PDFs with passwords or new LMS-integrated system); additional lead-time and outreach for Adopt-a-Text; library stacks closed with curbside pick up and possible book loans via USPS; library workshops via Zoom.</td>
</tr>
<tr>
<td>Model 4</td>
<td>Requires masks, 6 foot distancing minimum and sanitization / cleaning between classes, time distancing between classes, individual equipment (whiteboard markers, chalk).</td>
<td>Instructional videos / office hours / workshops / short courses / resources for online course design support for all teaching faculty and TAs. Need to begin earlier than typical fall course planning to meet needs.</td>
<td>Helping students to form collaboration groups and meet each other entirely virtually (UGs); perhaps facilitating use of smaller classroom spaces for student collaboration or office hours with clear guidelines.</td>
<td>Instructional videos, office hours, one-on-one troubleshooting; purchase and manage equipment for instructors; purchase/install equipment for whiteboard/PPT instruction (Echo360, automated camera); manage automated solution; network assessment for recording locations; IMSS Help Desk support to troubleshoot Zoom/G Suite.</td>
<td>Continued equipment lending program; digital course reserves (via Box/PDFs with passwords or new LMS-integrated system); additional lead-time and outreach for Adopt-a-Text; library stacks closed with curbside pick up and possible book loans via USPS; library workshops via Zoom.</td>
</tr>
<tr>
<td>Model 5</td>
<td>Requires masks, 6 foot distancing minimum and sanitization / cleaning between classes, time distancing between classes, individual equipment (whiteboard markers, chalk).</td>
<td>Instructional videos / office hours / workshops / short courses / resources for online course design support for all teaching faculty and TAs. Need to begin earlier than typical fall course planning to meet needs.</td>
<td>Helping students to form collaboration groups and meet each other entirely virtually (UGs); perhaps facilitating use of smaller classroom spaces for student collaboration or office hours with clear guidelines.</td>
<td>Instructional videos, office hours, one-on-one troubleshooting; purchase and manage equipment for instructors; purchase/install equipment for whiteboard/PPT instruction (Echo360, automated camera); manage automated solution; network assessment for recording locations; IMSS Help Desk support to troubleshoot Zoom/G Suite.</td>
<td>Continued equipment lending program; digital course reserves (via Box/PDFs with passwords or new LMS-integrated system); additional lead-time and outreach for Adopt-a-Text; library stacks closed with curbside pick up and possible book loans via USPS; library workshops via Zoom.</td>
</tr>
<tr>
<td>Model 6</td>
<td>Requires masks, 6 foot distancing minimum and sanitization / cleaning between classes, time distancing between classes, individual equipment (whiteboard markers, chalk).</td>
<td>Instructional videos / office hours / workshops / short courses / resources for online course design support for all teaching faculty and TAs. Need to begin earlier than typical fall course planning to meet needs.</td>
<td>Helping students to form collaboration groups and meet each other entirely virtually (UGs); perhaps facilitating use of smaller classroom spaces for student collaboration or office hours with clear guidelines.</td>
<td>Instructional videos, office hours, one-on-one troubleshooting; purchase and manage equipment for instructors; purchase/install equipment for whiteboard/PPT instruction (Echo360, automated camera); manage automated solution; network assessment for recording locations; IMSS Help Desk support to troubleshoot Zoom/G Suite.</td>
<td>Continued equipment lending program; digital course reserves (via Box/PDFs with passwords or new LMS-integrated system); additional lead-time and outreach for Adopt-a-Text; library stacks closed with curbside pick up and possible book loans via USPS; library workshops via Zoom.</td>
</tr>
<tr>
<td>Model 7</td>
<td>High potential for outbreak again</td>
<td>As per usual.</td>
<td>As per usual.</td>
<td>As per usual.</td>
<td>As per usual.</td>
</tr>
</tbody>
</table>
(Teaching Models, continued from previous page)

<table>
<thead>
<tr>
<th>Model #</th>
<th>Baseline Necessary Equipment</th>
<th>Maps to Student Affairs Model #</th>
<th>References and examples of other schools enacting this model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 2</td>
<td>Faculty and TAs - iPads and stylus; Students - iPads and stylus; Webcams, microphones; Lecture Capture (Echo360) or automated camera/mic equipment for whiteboard/PPT instruction.</td>
<td>Option 1 - Online Only</td>
<td>CSU system <a href="https://www.insidehighered.com/blogs/learning-innovation/fall-scenario-11-students-residence-learning-virtually">https://www.insidehighered.com/blogs/learning-innovation/fall-scenario-11-students-residence-learning-virtually</a> [<a href="https://www.chronicle.com/article/The-Case-Against-Reopening/248785?cid=wcontentgrid_hp_6">https://www.chronicle.com/article/The-Case-Against-Reopening/248785?cid=wcontentgrid_hp_6</a>]</td>
</tr>
<tr>
<td>Model 3</td>
<td>Faculty and TAs - iPads and stylus; Students - iPads and stylus; Webcams, microphones; Lecture Capture (Echo360) or automated camera/mic equipment for whiteboard/PPT instruction.</td>
<td>Option 2 - Subset of Students</td>
<td><a href="https://www.insidehighered.com/digital-learning/blogs/learning-innovation/fall-scenario-5-graduate-students-only">https://www.insidehighered.com/digital-learning/blogs/learning-innovation/fall-scenario-5-graduate-students-only</a></td>
</tr>
<tr>
<td>Model 4</td>
<td>Faculty and TAs - iPads and stylus; Students - iPads and stylus; Webcams, microphones; Lecture Capture (Echo360) or automated camera/mic equipment for whiteboard/PPT instruction.</td>
<td>Option 2 - Subset of Students</td>
<td><a href="https://www.insidehighered.com/digital-learning/blogs/learning-innovation/fall-scenario-5-graduate-students-only">https://www.insidehighered.com/digital-learning/blogs/learning-innovation/fall-scenario-5-graduate-students-only</a></td>
</tr>
<tr>
<td>Model 5</td>
<td>Faculty and TAs - iPads and stylus; Students - iPads and stylus; Webcams, microphones; Lecture Capture (Echo360) or automated camera/mic equipment for whiteboard/PPT instruction.</td>
<td>Option 2 - Subset of Students</td>
<td><a href="https://www.insidehighered.com/blogs/learning-innovation/fall-scenario-4-first-year-intensive">https://www.insidehighered.com/blogs/learning-innovation/fall-scenario-4-first-year-intensive</a> <a href="https://broadcastemail.ubc.ca/2020/05/11/covid-19-ubcs-approach-for-the-fall-term/">https://broadcastemail.ubc.ca/2020/05/11/covid-19-ubcs-approach-for-the-fall-term/</a></td>
</tr>
<tr>
<td>Model 7</td>
<td>N/A</td>
<td>Option 3 - Full Occupancy</td>
<td>Purdue <a href="https://www.insidehighered.com/blogs/learning-innovation/fall-scenario-3-back-normal">https://www.insidehighered.com/blogs/learning-innovation/fall-scenario-3-back-normal</a></td>
</tr>
</tbody>
</table>

Note: Virus Control stages are as follows: 3=limited control (no treatment or vaccine; sustained 14-day reduction in cases); 2=widespread control (some treatments; limited vaccine; sustained reduction in cases); 1=universal control (treatment + vaccine; limited/no new cases)

References and Resources:
APPENDIX E – Preliminary Study of Classroom Space Assignment under Social Distancing

A preliminary study of possible classroom space assignment under social distancing was prepared by Prof. Ali Hajimiri in May 2020 and updated in June 2020 based on the updated enrollment data from the Registrar and Facilities data on the room capacities. Based on 100 sq. ft. per student (average of 10 ft. spacing) and fall 2018-19 enrollments, the following 25 courses could not be accommodated.

<table>
<thead>
<tr>
<th>COURSE NUMBER</th>
<th>COURSE TITLE</th>
<th>INSTRUCTOR</th>
<th>ENROLLED</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS/CNS/EE 156A</td>
<td>Learning Systems</td>
<td>Abu-Mostafa</td>
<td>245</td>
</tr>
<tr>
<td>CS 001</td>
<td>Introduction to Computer Programming</td>
<td>Vanier</td>
<td>202</td>
</tr>
<tr>
<td>PS 012</td>
<td>Introduction to Political Science</td>
<td>Ordeshook</td>
<td>160</td>
</tr>
<tr>
<td>ACM/IDS 104</td>
<td>Applied Linear Algebra</td>
<td>Zuev</td>
<td>128</td>
</tr>
<tr>
<td>ACM/EE/IDS 116</td>
<td>Introduction to Probability Models</td>
<td>Zuev</td>
<td>108</td>
</tr>
<tr>
<td>Ma/CS 006A</td>
<td>Introduction to Discrete Mathematics</td>
<td>Katz</td>
<td>103</td>
</tr>
<tr>
<td>PS/Ec 172</td>
<td>Game Theory</td>
<td>Tamuz</td>
<td>95</td>
</tr>
<tr>
<td>CS/IDS 121</td>
<td>Relational Databases</td>
<td>Pinkston</td>
<td>85</td>
</tr>
<tr>
<td>CS 009</td>
<td>Introduction to Computer Science Research</td>
<td>Ralph</td>
<td>78</td>
</tr>
<tr>
<td>Ph 125A</td>
<td>Quantum Mechanics</td>
<td>WiseB</td>
<td>67</td>
</tr>
<tr>
<td>ME 010</td>
<td>Thinking Like an Engineer</td>
<td>Andrade</td>
<td>58</td>
</tr>
<tr>
<td>Ph 106A</td>
<td>Topics in Classical Physics</td>
<td>Weinstein</td>
<td>54</td>
</tr>
<tr>
<td>Ph 127A</td>
<td>Statistical Physics</td>
<td>Motrunich</td>
<td>53</td>
</tr>
<tr>
<td>Ph 012A</td>
<td>Waves, Quantum Physics, and Statistical Mechanics</td>
<td>Chen</td>
<td>52</td>
</tr>
<tr>
<td>CS/EE/IDS 143</td>
<td>Communication Networks</td>
<td>Low</td>
<td>49</td>
</tr>
<tr>
<td>EE 111</td>
<td>Signal-Processing Systems and Transforms</td>
<td>Vaidyanathan</td>
<td>48</td>
</tr>
<tr>
<td>Ph 002A</td>
<td>Waves, Quantum Mechanics, and Statistical Physics</td>
<td>Porter</td>
<td>48</td>
</tr>
<tr>
<td>Ma 002</td>
<td>Differential Equations</td>
<td>Isett</td>
<td>43</td>
</tr>
<tr>
<td>Ph/CS 219A</td>
<td>Quantum Computation</td>
<td>Preskill</td>
<td>42</td>
</tr>
<tr>
<td>Ma 108A</td>
<td>Classical Analysis</td>
<td>Lazebnik</td>
<td>41</td>
</tr>
<tr>
<td>CS 011</td>
<td>Computer Language Lab</td>
<td>Vanier</td>
<td>36</td>
</tr>
<tr>
<td>BE/Bi 103</td>
<td>Data Analysis in the Biological Sciences</td>
<td>Bois</td>
<td>35</td>
</tr>
<tr>
<td>E 002</td>
<td>Frontiers in Engineering and Applied Science</td>
<td>Ravichandran</td>
<td>35</td>
</tr>
<tr>
<td>Ma 020</td>
<td>Frontiers in Mathematics</td>
<td>Graber</td>
<td>35</td>
</tr>
<tr>
<td>ME 012A</td>
<td>Mechanics</td>
<td>Mello</td>
<td>35</td>
</tr>
</tbody>
</table>

Assumed course schedule:

- 1-hour lectures on MWF and 1.5-hour lectures on TTh
- 1-hour gap between each two lectures to allow for passive/active sanitization, passive/active (using portable fans) air replacement, etc.
- TTh: classes starting at: 8am, 10:30am, 1pm, 3:30pm, 6pm (5 time slots)
- MWF: classes starting at: 8am, 10am, 12pm, 2pm, 4pm, 6pm (6 time slots)
- Under this schedule 11 classes can be assigned to each room
Classes by enrollment size, using 2018-19 enrollment data (excluding research, PVA, or PE courses). 
x-axis=number of classes; y-axis=enrollment range of students

Unassigned classes with 10 ft. separation, using all available spaces. 
x-axis=number of classes; y-axis=enrollment range of students
APPENDIX F – Virtual Simulations of Teaching Spaces with Physical Distancing

Simulation of Hameetman Auditorium with 10 ft. physical distancing and students and instructor wearing face coverings. [Link to video]

Simulation of Bechtel Dining Hall with 10 ft. physical distancing and students and instructor wearing face coverings. [Link to video]