Engineering at Alberta

Moving to remote Education

Engineering suggested considerations, process and resources

Prepared for the Faculty of Engineering, June 2020

Executive summary

This document was developed to provide engineering instructors guidelines and a process to shift their courses to remote delivery. These are well established best practices to ensure student success, teaching quality, meeting accreditation requirements as well as ensure the best use of an instructor's time.

The content is listed below. As quick guide, the document begins with general considerations, then provides a quick overview of how to plan different model of courses (lecture, lab, design), followed by more detailed information about different types of delivery, assessment considerations and so on.

Do note that these are suggestions that we believe will allow you to deliver excellent courses. Each instructor can do as they see fit, but we believe that this will provide the best experience to students and yourself.

Contents

Considerations when developing remote course delivery

In offering your classes remotely it is important to consider the student experience of all attending; the experience must be of the same quality for all and the quality of our course delivery must meet our usual exceptional standards. Things to consider:

- We have a duty to accommodate; in a time of remote delivery, the usual expectations have increased to ensure that all students, not only those registered with accessibility resources, are provided the opportunity to participate and learn.
- International or out of province students in different time zones, rural students, or students with intermittent or poor internet access may not be able to attend any or all synchronous delivery times.
- As accredited programs, contact hours are critical and must be maintained; courses cannot be only asynchronous. Lecture, lab, and seminar times, and instructor and TA office hours must be maintained.
- Teach only the core course learning outcomes and teach them well; if you are not sure what those are, speak to your associate chair.
- Text books must be eBooks or, preferably, provide course packages to ensure all have access to all course material that may be assessed.
- Synchronous delivery of content should be recorded to ensure all students can see it if they cannot attend.
- Consider the Faculty's Software use and access, internet access, other approved equipment requirements.
- Consider how students can best learn and be assessed (teaching online course).
- For pedagogical reasons, shift how you assess students and minimize cheating opportunities.
- Minimize stress and anxiety, remember these are difficult and stressful times (article).
- Consider what needs to be done if a student is ill and needs the material OR if you get sick and need to be replaced mid-course, the program needs you to prepare back up info/resources.

- You must have an eClass page, you must have an engineering syllabus, you must still collect graduate attributes when required, and you must complete your post course assessment.
- Participate in the coordinated effort to develop, where appropriate, common material for similar courses. Creating content and resources that is shared and used by others is scholarship, a type of publication.
- CTL will provide a number of seminars to help develop materials; attending some of them may help you preparing your course.

Planning your course

Before beginning to develop resources for a great remotely delivered course, whatever type of course it is, it is important to plan.

- What are the core learning outcomes? (the must versus the wants, you need the musts)
- What are the needed components and material for each (lectures, labs, seminars, tutorials)?
- What graduate attributes do I need to develop if not only knowledge base? Am I teaching a course where I need to collect them?
- What is the important content/experiments?
- What will I, versus what will the TA do?
- What is done during the lecture time and other course time?
- What resources do I need to explain a concept that I have/do not have?
- How do I usually assess students and how does that change during remote delivery?
- How can I provide the best student experience?
- How do I use my eClass page?

The following are examples of how to plan for you course. The steps here are not exhaustive and do not include the "how to"; that is found in the next sections.

PLANNING A LECTURE COURSE

While developing a lecture base course, first identify the core learning outcomes and graduate attributes using the engineering syllabus system.

Second, breakdown each of the learning outcomes in smaller modules of content and skills/exercises that need to be presented/developed to build to the learning outcome. Each module or learning outcome can be a section in eClass with various resources for students to grasp the concepts. Resources examples:

- Aim of the learning outcome, why important in the context of the course and curriculum, instructor expectations, how you plan to deliver the material, (the 5 Ws and H)
- short video lectures focusing on the theory and a simple example or a set of progressively more complex examples.
- Lecture notes packages (books may be very difficult to obtain) or online readings
- If possible, it would be important to tie the concept to an engineering application or a lab experiment students do in another course (even tying in/including the lab course video related to the concept on your eClass to build a bridge between the different courses)
- developing/identifying an existing simulation that allows students to "play" with the variables (Samer Adeeb has great examples of this).
- Include in eClass a Q&A forum, avoid using email for questions, it is not a good use of your time.

With these resources on eClass, class/seminar/tutorial time can be used to focus on more or broader examples, applications, answering questions, great story telling, specific skill development, and/or class team or individual activities (breakout rooms) related to each module/learning outcome.

A design course for example, will usually have team activities that are during or outside of the class time. These need to be maintained and organized. Design mentorship is critical for student success and will help create a better learning environment.

For each small module, you can develop short eClass quiz to allow students to move to the next module. These are formative, very small value assessments. These permit you to assess if the students can identify the important aspects of a concept and explain its use.

Assessing core learning outcomes and graduate attributes can be done at regular intervals. Most courses have between 5 and 12 learning outcomes and develop/assess between 1 to 30+ graduate attribute indicators.

Each learning outcome must be assessed. EClass can be used to develop a bank of open ended, open book questions that randomly change numbers/questions to assess the same learning outcome makes it more difficult to cheat. Making each learning outcome question worth less than 10% and giving limited time to complete also removes the incentive/possibility to cheat. Another option is to combine learning outcomes into one larger question and using the same strategy (short period of time to answer, different questions for every student, open ended); projects, can be a good way to assess students' ability to apply, synthesize information and evaluate the concepts.

Graduate attributes only need to be explicitly assessed if required as part of our continuous improvement process. These should be linked to learning outcomes if they are assessed, but separate measures are required for each indicator.

If the course has a final exam, ask yourself does it one or could I get an exception? If assessments are well used in the term, it may not be required to have a final exam as long as there is sufficient number of individual trusted term assessments to evaluate and differentiate students' abilities/knowledge.

PLANNING A LAB COURSE

As with a lecture course, the use of eClass is very important. Each lab should have its own eClass section with basic information (5Ws and H) and including the information below.

The first part of developing your lab course is to review the core learning outcomes and graduate attributes and identify if any are **psychomotor** (i.e. students actually need to be doing things) or if they are all cognitive. Most labs are cognitive, we and students

prefer the opportunity to actually do the "turning of the buttons", but most do not need to be.

If there **are psychomotor learning outcomes**, and they are critical to the program, it will be important to identify how to replace the experience with a simulated version of the tasks (simulation, sending samples to students, developing a set of tasks that can be accomplished at home to replicate the psychomotor skill). This will take some research and likely some development. There are likely many in other programs (here or elsewhere) in the same situation. Identifying these learning outcomes early allows you to find partners. This will likely require developing:

- the simulated environment,
- a set of instructions, detailing safety procedures and training
- an assessment scheme for the tasks

One suggestion would be to get student teams to develop a simple experiment to replicate the learning outcome of this lab (problem solving, investigation, team work, design, use of engineering tools, lifelong learning graduate attributes all in one). You could use a video to explain the challenge and use lab time to work with students working through a solution. The assessment could be a lab design proposal which includes research, details what theory they used to develop their lab proposal, equipment, methods, expected or measured results, discussion, conclusions and so on.

If the labs do **not have psychomotor** learning outcomes, the simplest approach is to create a video demo of the experiment explaining components, process, safety, effect of different variables, what phenomena are occurring, etc … and provide raw data (different sets for each student/student team). There may be similar experimental videos online, these may be tempting to use, but make sure they are what you need. Again, talking to colleagues here or at other institutions, you may find that there are labs in common and these may be folks with whom you can share ideas and resources.

One approach is to develop short quizzes as prelab assessments to start the discussion. Use lab time to further discussed the lab with student; have a Q&A forum on eClass and be prepared to answer the questions during lab time.

Students/student teams submit a lab report usually for these.

Some lab courses have **final exams**, why? Is it required, is there a learning outcome that points to a final exam? If not, request an exception.

Delivery of content

ASYNCHRONOUS DELIVERY

Asynchronous: Information or activities that students can review or participate in by themselves, at their own pace and on their own time available on eClass.

Type of content best suited for asynchronous delivery

- Focus of fundamental knowledge (theoretical development) and basic/mechanical examples
- Simulations of concepts
- Lab demonstration videos and safety information/assessments
- Resources (readings, exiting YouTube videos, follow copyright rules)
- Using eClass for discussion forums (pre-discussion for lecture time discussions) or Q&A forums

Means by which to create asynchronous content

Depending on what the content/resource you want to provide there are a number of options you can use. Keep resources short in duration and have focused content. Remember the limit of viewer attention span. Use visual elements and examples.

1. Zoom will allow you to record your lecture on a tablet/computer. You will need a zoom account. Instructions are here. Always best to have a split screen with content and your face to make it more personal.
2. PowerPoint allows you to create content, do voice over and create a video (mp4).
3. Simulations can be created using a number of software (e.g. Solidworks, Python, Mathematica) to demonstrate concepts; or if the exist online use them if appropriate (e.g. Bernoulli's principle).
4. eClass training is available on this self-paced online course

SYNCHRONOUS DELIVERY

Synchronous: Information provided or activities undertaken in person through zoom or other during lecture, lab, seminar times and office hours.

Important: record and post all synchronously delivered content. If students cannot attend for illness, connectivity or other issues, they are entitled to the full course content. If you do not, you cannot expect students to be assessed on the material provided. **This is our duty to accommodate.** Further information is available here, specifically about recording lectures, and what you need to be careful about or get permission for.

Type of content best suited for synchronous delivery

- Examples of theory focused on the field of application
- Design examples
- Discussion focused
- Focus on the experience of the instructor
- Used to develop skills and other graduate attributes (not knowledge base). The faculty has developed an eClass resource hub to provide tips on developing other graduate attributes.
- Engaging activities (instead of doing a lab, ask students to develop an experiment at home, alone or in teams, to test a concept)
- TA and instructor mentorship
- Design team meetings
- Break out rooms with active mentorship/touch points for team meetings, lab group activities
- Team activities, team quiz shows (Kahoot!)

Means by which to create Synchronous content

- You can create a Zoom meeting to meet your class in eClass. This will allow you to interact with students, do live lecturing/discussion. You can create breakout rooms for team meetings, TA/instructor meetings and various activities.

Lab/field courses

As with other types of courses, lab courses must be delivered remotely. There are a number of options available. It will be required to recreate the experiment and experience as possible and to be creative in doing so.

- Provide experimental manual (all lab courses should have this already)
- Create a video demonstrating the experiment focusing on the key features, variables and skills that students would have gained.
- Create simulations that allow students to interact with a virtual version of the experiment and experience the effects of manipulating the variables.
- Use the videos created by the Dean's Office for each program about safety in your lab course and ensure that students have viewed and been assessed on safety aspects; this is a critical part of developing a safety culture and meeting CEAB requirements.
- Provide raw data for students to work on the experiments and submit lab reports.
- In consultation with your program leads, discuss the possibility of providing students with samples/equipment to allow them to perform experiments at home.
- Consider reversing the experiment: have student teams do research and develop an experiment/simulation to demonstrate the learning outcomes of the lab courses and report on it.

Assessments

Reliability of the internet and a student's synchronous participation in activities does not lend itself to high value, remote, proctored final examinations. It creates many challenges for both students and instructors when considering required accommodations from Accessibility Resources. There will be no supported proctored examinations. Instructors must devise new assessment methods.

There is no perfect way to assess students remotely. We can only minimize risk and opportunity to cheat.

Long and high mark assessments/exams create an environment that encourages academic dishonesty. Students most often cheat because they feel overwhelmed and online assessments make it even more tempting to cheat. There are a number of sites that will provide students answers to assessment questions. If you suspect any academic dishonesty it is your responsibility to the university and your duty

to the profession to take action. There is no small, excusable level of cheating. Decision on cases of possible dishonesty is the purview of the Dean's Office.

When shifting your assessments consider:

- That all assessments must be completed or submitted in eClass.
- That the first question on any assessment is a signed acknowledgement that academic dishonesty is not permitted and that they will not violate the student code of behaviour (this is often enough to make students think twice about cheating.
- Assessments should avoid being simply numerical answers that are easy targets for academic dishonesty; answers that require reflection, short answers, focusing on process or questions that focus on the application of knowledge in an open ended problem will be much more individualized.
- Team assessments, where appropriate, can be used to minimize the number of papers that need grading. Required that each student's contribution is clearly indicated.
- Multiple choice assessments can be generated in eClass
- Reviewing CTL information.

Exams:

- That final exams are not mandatory. You can get an exception, talk to your Associate Chair, fill out the request form, and contact addengg@ualberta.ca.
- Using a final project (application of knowledge) due the last day of classes, instead.
- Final exams must be between 30-70% of the grade; however, consider that:
  - If less than 40%, students are not eligible for a re-exam
  - A midterm grade differed to the final should not exceed 70% limit; if it does, you must inform the Dean's Office (contact addengg@ualberta.ca).

Term assessments:

- Using smaller, time-limited and regular term assessments (formative) on eClass that verify mastery of core learning outcomes. Use short, short answer, open book quizzes (20

minutes) worth little (~5%) to verify basic concepts – this way, students do not have time to cheat.
- Using one or two time-limited open book tests for summative assessments (~15-20%).
- Under no circumstances, are quizzes or exams to be scheduled in the last two weeks of classes to replace a final exam.

Technology:

- As part of the faculty's required list of technology (phone or camscanner), students must have means to take images of their work; require them to upload images of their solution to eClass.
- If you do have a quiz or exam, follow the remote exam guide and use ExamLock feature.

Accessibility resources and duty to accommodate:

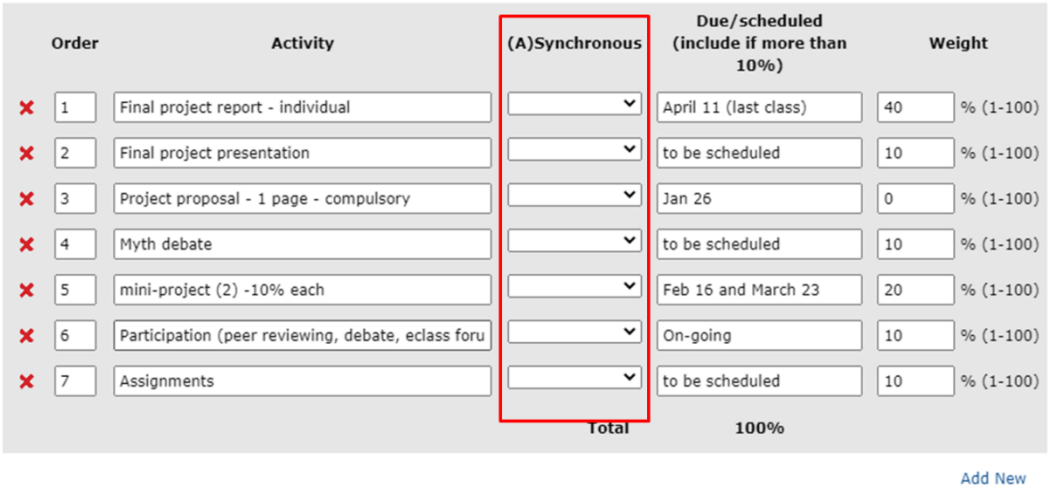
- Accommodations are still required during remote delivery and assessments. Plan your assessments accordingly. Aim to facilities the experience for you as well. You need not have exam accommodations if you do not have an exam.

Syllabus

It will be critical to inform students on your syllabus of the following:

- The times of your course are synchronous and asynchronous, and, more importantly, which of your assessments will be scheduled synchronously and asynchronously. The syllabus system has been modified to inform students of this in two sections, course Information and Marking Scheme.

Asynchronous & synchronous course content delivery
Instructors need to clearly state which components of the course content will be delivered synchronously and asynchronously.



Order	Activity	(A)Synchronous	Due/scheduled (include if more than 10%)	Weight
1	Final project report - individual		April 11 (last class)	40 % (1-100)
2	Final project presentation		to be scheduled	10 % (1-100)
3	Project proposal - 1 page - compulsory		Jan 26	0 % (1-100)
4	Myth debate		to be scheduled	10 % (1-100)
5	mini-project (2) -10% each		Feb 16 and March 23	20 % (1-100)
6	Participation (peer reviewing, debate, eclass foru		On-going	10 % (1-100)
7	Assignments		to be scheduled	10 % (1-100)
		Total	100%	

Add New

- The technology is required for your course if it exceeds the minimum requirements of your program. Please note that additional technical requirements (laptop performance and configuration, software, additional equipment) above the minimum program requirement must be approved by the chair of your department and by the Dean's office. Finally, students in your course must be informed of these technological requirements at least two weeks before the beginning of your course.

Hardware/software needed

- Tablet or computer
- Microphone and webcam
- Screen capture: Zoom. Advanced options: Camtasia, Camstudio, Screencast-O-Matic
- PowerPoint
- Video editing software (Windows and Mac OS all come with some)
- Programming software (if developing simulations)