Engineering TA Handbook

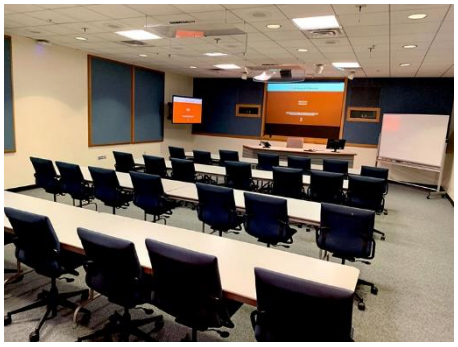
Spring 2021

Academic Affairs – Office of the Dean

The University of Texas at Austin
Cockrell School of Engineering

Preparing for Your First Class

Before the first class meeting



- Visit the classroom ahead of time to get a better feeling for the size of the room, blackboard/whiteboards, document camera, projection system, etc. If you're planning on using anything other than the blackboard, this is a good time to familiarize yourself with the interface for activating audio-visual equipment.
- If possible, observe a session led by an experienced TA in your department. It doesn't necessarily have to be the same course, but it should be the same learning environment, e.g., recitation/discussion, experimental lab, computer lab, etc.
- Prepare some notes and create a short agenda for yourself, so that you start off strong.
- Check in with your professor to see if he/she wants you to cover anything specific on the first day.

What to do at the first class meeting

- Introduce yourself and share a little bit about yourself, e.g., where you're from, what college you attended, your academic interests, and perhaps a few interesting things about yourself, e.g., hobbies, sports interests, etc. Share as much as you feel comfortable with – if you don't want to share too much personal information, tell your students about your academic/research interests.
- Go over parts of the syllabus that pertain to your role as a TA, e.g., your name, office hours, contact information, etc.
- Establish a routine so that students know what to expect at each session.

What to do throughout the semester

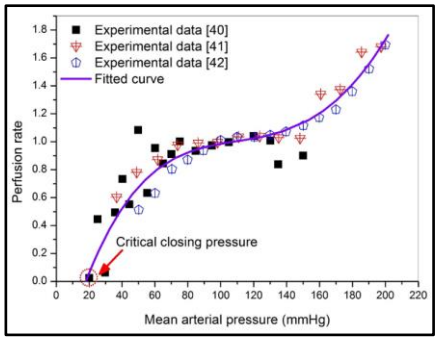
- Try to get to know students by name.
- Allow your personality to come through your teaching - be yourself.
- Ensure that students are ready to complete assignments - check in to determine what the professor has covered in class.
- Periodically check in with students as a whole group to see how they're doing in the course, e.g., "How was the exam?", "Do you feel ready for the next lab assignment?", etc.
- Keep lines of communication open between your students and faculty - students are more likely to come to you with concerns and complaints.

Effective Practices for Specific Engineering Learning Environments

Before the first class meeting

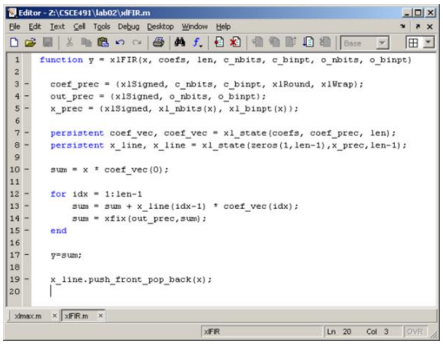
- If you find that students are not engaged or the room is very quiet during your recitation sessions, try the following to "shake things up"
  - Give the students a short problem to work on collaboratively - or get them started working on a more difficult problem - and then go over the solution together as a class.
  - Use free online polling tools, such as Poll Everywhere or Socrative, to present conceptual questions and simple problems to students, where they can answer with their smartphones.
  - Ask students to come up to the board to demonstrate either all of a part of a solution to a problem that you're working on together.

Experimental Laboratory



- While your students are working on experimental procedures, make sure that you continually circulate through the lab to avail yourself for student questions as you walk by. Do not sit in the front of the lab and simply wait for students to come to you.
- Make sure that you are allocating your time to different lab groups equitably. Keep yourself in check if you're spending too much time helping one group.
- If you have a group that is experiencing a lot of difficulties, ask a group that is further along in the lab activity to help them. This practice is called "peer instruction" and has been proven to work very well. Also, it will save you time, especially if you're busy helping a lot of people during the lab session.
- Ask students to sketch what the experimental data they're about to collect should look like.
- Present students with "bad data" and "good data" and ask them to identify which is which.
- Put together a "before you leave the lab" checklist for students. Sometimes lab groups think that they're finished and rush out of the lab as soon as they have collected all of their data. Students should have a good idea of what they are supposed to do for the lab report before leaving the lab. This can help minimize office hours visits by students who have questions that should have been asked before they left the lab.

Computer Laboratory

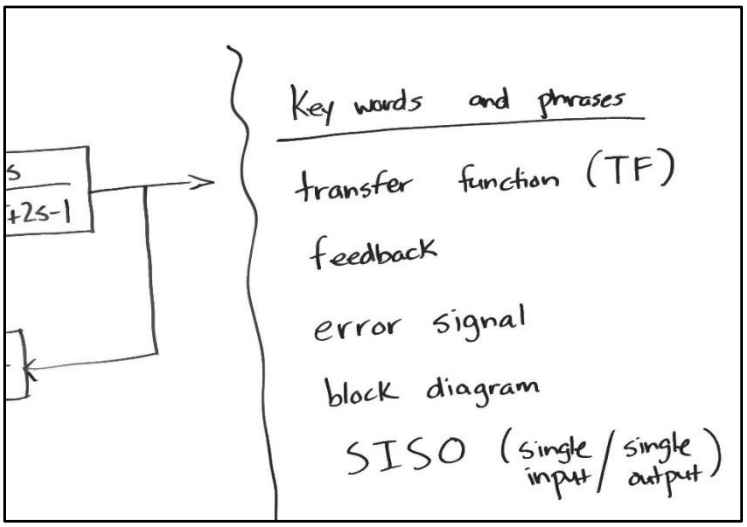


- If your students are working independently, make sure that you continually circulate through the lab to avail yourself for student questions as you walk by. Do not sit in the front of the lab and simply wait for students to come to you.
- Provide incomplete code and ask students what is missing.
- Provide code with errors and ask students to correct them.
- If you have a one or more students who are having a lot of difficulties, ask a more advanced student to help them. This practice is called "peer instruction"; it has been proven to work very well with struggling students. It will also get your more advanced students more engaged and will increase their own learning.

Overcoming Language Difficulties – Advice for International TAs

Things to write on the board to complement your speaking

- the objective or topic of session
- annotations that consist of one word or phrase that indicates critical steps in a solution
- a list of keywords or terms that are important, as illustrated here



Ask for help

- Be open with students: tell them that you are still getting accustomed to teaching in English and ask them to point out if you spell a word incorrectly or if you're pronouncing something incorrectly. Ask them to privately point this out to you after class so that it's less disruptive.
- You will find that most students will be helpful, since they have a vested interest in your ability to communicate properly.
- Students will appreciate that you are making an effort to improve your English and communicate with them more effectively. It will increase their respect for you, since you are showing that you are concerned about their learning.
- This is nothing to be embarrassed about: if you show effort and students give you feedback, your English will improve and you will be less nervous about it as the semester progresses.

Speak with students informally before or after class

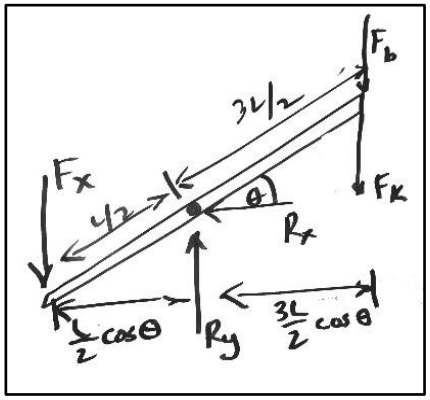
- Take a minute or two before and after class to get to know students better. You can make a comment about the weather, sports, local news, student organizations (IEEE, AIAA, ASME, etc.), something interesting that you've noticed about Texas or American culture, etc. Showing an interest in students will earn you their appreciation and respect.
- If you'd rather not get too personal, ask students how the lecture is going, what the professor covered in lecture, how difficult/easy they are finding the homework, what they thought of the last exam, etc.

Effective "Board Work" to Increase Clarity and Student Understanding

Ensure that diagrams are sufficiently large – take advantage of available board space

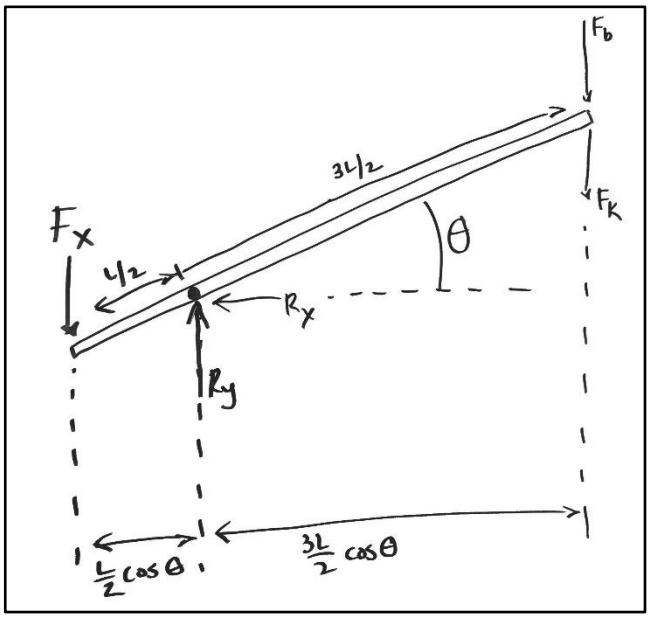
Unacceptable

- diagram is too small – may be difficult to see from the back of the classroom
- diagram is too crowded – student will more easily be confused by such a diagram



Better

- diagram uses more space on the board
- diagram is larger and can be more easily viewed and interpreted by all students
- diagram spreads out dimensions by dropping and extending dashed lines



Tip: If you have a very complicated diagram that you need to use in class, scan or photocopy it and then distribute to students - either electronically or on paper. This will save you time in class and it will also help students better understand the information that you are trying to convey.

Strive to include learning objectives, annotations, and sentence fragments

Unacceptable

- no labels or annotations

$$m\ddot{x} + b\dot{x} + kx = F(t)$$
$$x_1 = x$$
$$x_2 = \dot{x}$$
$$m\dot{x}_2 + bx_2 + kx_1 = F(t)$$
$$\dot{x}_1 = x_2$$

Better

- annotation illustrates a critical step
- annotation shows the end result

$$m\ddot{x} + b\dot{x} + kx = F(t)$$
$$x_1 = x, \quad x_2 = \dot{x} \quad \leftarrow \text{change of variables define } x_1, x_2$$
$$m\dot{x}_2 + bx_2 + kx_1 = F(t), \quad \dot{x}_1 = x_2 \quad \} \text{ two simultaneous diff eqns}$$

Outstanding

- learning objective stated
- helpful annotations
- use of arrows to illustrate logic or procedural steps

Converting a second order DE to a system of first order DEs

$m\ddot{x} + b\dot{x} + kx = F(t)$ → 2nd order DE

let: $x_1 = x$, $\dot{x}_1 = \dot{x}$; $x_2 = \dot{x}$, $\dot{x}_2 = \ddot{x}$ } → therefore, $\dot{x}_1 = x_2$ (DE #1)

Plug above expressions into 2nd order DE

$m\dot{x}_2 + bx_2 + kx_1 = F(t)$ (DE #2) → these form a system of two simultaneous 1st order DEs.

Note: You do not always have to write a lot of notes on the board – strike a balance between communicating information to students and engaging them in productive struggle.

Guidelines for Effective Office Hours

Getting students to come to office hours

- Actively encourage students to come to office hours
  - Remind students to come to your office hours and/or ask your professor to remind them that you're there to help them during office hours.
  - E-mail your students to invite them to office hours.
  - Suggest that students are allowed to visit you with another classmate.
  - Offer office hours on a "by appointment" basis in addition to scheduled office hours, if possible.
- Be strategic when scheduling office hours
  - Check in with students about scheduling.
  - When are homework or labs due?
  - Are your office hours conflicting with another class for which a majority of your students are registered?
  - Schedule some extra office hours before an exam, if possible. Student will remember your efforts.
- Be flexible, within reason
  - You cannot please everybody.
  - Remember that you have your own work to do.

Keep students coming back to office hours

- Make their visit a positive learning experience
  - Be welcoming and supportive.
- Adapt to the student's learning style…
  - "Would it help to write a bulleted list of steps for a problem solution?"
  - "Would you rather talk through the solution with me?"
  - "Would it be helpful to draw a flowchart for the solution procedure?"
- Ask questions to…
  - determine what the student knows and doesn't know.
  - guide the student to understanding instead of giving away answers – allow a degree of productive struggle.
- Before the student leaves, assess their situation and reinforce their initiative
  - "Are you now confident to continue your work on the problem?"
  - "Do you feel less confused than before you came in to see me?"
  - "Feel free to come back if you have more questions."
  - "I'm glad that you stopped by – it shows me that you take your academic work seriously."

Guidelines for Grading

Grading can become very time consuming if you don't have a good strategy for handling it. Developing an effective rubric can help tremendously.

Using a Rubric in Your Grading

- Creating a rubric, or grading guide, requires an upfront time investment, but it has many benefits…
  - Makes grading easier and faster
  - Makes grading more consistent, especially if you have multiple sections
  - Helps students better understand academic expectations
  - Inspires better student performance
  - Reduces grading disputes
  - Protects against accusations of favoritism, inconsistency, etc.

* See the next page for a sample problem and its corresponding grading rubric

Using a "Minimal Marking" Approach

- Used most often in courses where there a substantial amount of writing is involved, e.g., Social Sciences, Liberal Arts, etc.
- Can be easily adapted for grading engineering work.
  - missing step in solution
  - math error
  - incorrect equation
  - incorrect assumption
  - unit conversion error
  - etc…

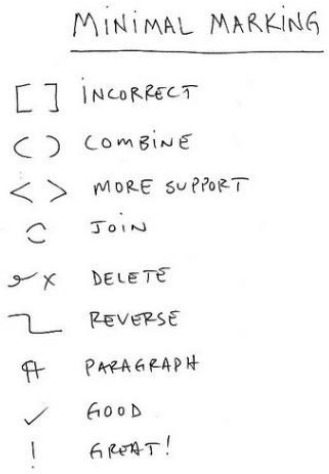


image from www.theillustratedprofessor.com/minimal-marking/

- Benefits
  - Saves you a lot of time on grading
  - Compels students to further investigate their mistakes and thus learn from them.

Example Rubric

Problem Statement

The rate at which a baby bird gains weight is proportional to the difference between its adult weight and its current weight. At time $t = 0$, when the bird is first weighed, its weight is 20 grams. If $B(t)$ is the weight of the bird, in grams, at time t days after it is first weighed, then

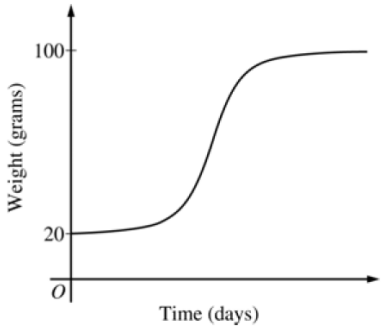
$$\frac{dB}{dt} = \frac{1}{5}(100 - B).$$

Let $y = B(t)$ be the solution to the differential equation above with initial condition $B(0) = 20$.

(a) Is the bird gaining weight faster when it weighs 40 grams or when it weighs 70 grams? Explain your reasoning.

(b) Find $\frac{d^2B}{dt^2}$ in terms of B. Use $\frac{d^2B}{dt^2}$ to explain why the graph of B cannot resemble the following graph.

(c) Use separation of variables to find $y = B(t)$, the particular solution to the differential equation with initial condition $B(0) = 20$.



Rubric

(a) $\left.\frac{dB}{dt}\right|_{B=40} = \frac{1}{5}(60) = 12$

$\left.\frac{dB}{dt}\right|_{B=70} = \frac{1}{5}(30) = 6$

Because $\left.\frac{dB}{dt}\right|_{B=40} > \left.\frac{dB}{dt}\right|_{B=70}$, the bird is gaining weight faster when it weighs 40 grams.

2 : { 1 : uses $\frac{dB}{dt}$; 1 : answer with reason }

(b) $\frac{d^2B}{dt^2} = -\frac{1}{5}\frac{dB}{dt} = -\frac{1}{5}\cdot\frac{1}{5}(100 - B) = -\frac{1}{25}(100 - B)$

Therefore, the graph of B is concave down for $20 \le B < 100$. A portion of the given graph is concave up.

2 : { 1 : $\frac{d^2B}{dt^2}$ in terms of B ; 1 : explanation }

(c) $\frac{dB}{dt} = \frac{1}{5}(100 - B)$

$\int \frac{1}{100 - B}\, dB = \int \frac{1}{5}\, dt$

$-\ln|100 - B| = \frac{1}{5}t + C$

Because $20 \le B < 100$, $|100 - B| = 100 - B$.

$-\ln(100 - 20) = \frac{1}{5}(0) + C \Rightarrow -\ln(80) = C$

$100 - B = 80e^{-t/5}$

$B(t) = 100 - 80e^{-t/5}, \quad t \ge 0$

5 : { 1 : separation of variables ; 1 : antiderivatives ; 1 : constant of integration ; 1 : uses initial condition ; 1 : solves for B }

Note: max 2/5 [1-1-0-0-0] if no constant of integration

Note: 0/5 if no separation of variables

Guidelines for Electronic Communications with Students

While electronic communications such as Canvas messaging and e-mail, can help save time and keep your students informed, you need to ensure that electronic communications with students do not take up a lot of your time – this can get out of control quickly if you are not strategic about it.

Set boundaries on electronic communications

- Avoid communications that would be better handled face-to-face. Use e-mail or Canvas messaging only for quick questions and clarifications.
- Indicate the times of day when electronic communication is acceptable.
- Ensure that people have an idea of your turnaround time for expecting a response.
- An electronic message is forever: do not put anything in an electronic message that you wouldn't want to be circulated online. Be civil and professional at all times.

Privacy and Security

- **The Family Educational Rights and Privacy Act of 1974 (FERPA)** is a federal law that protects the privacy of student education records, such as
  - enrollment information
  - course schedule information
  - assignment, quiz, exam, project, and course grades
  - student ID photo and other identifying information
- Assume that any student information is private, unless it is in the online directory.
- Use Canvas for communicating confidential information, such as assignment grades, exam grades, course grades, etc. Per university guidelines, regular e-mail is not a secure form of communication.

Social Media

- Keep the use of social media with your students in the academic and professional realm, e.g., LinkedIn, etc.
- Avoid contact with students via Facebook, Twitter, etc. unless it is related to a course or other official academic purpose.