Teaching at IITB: some thoughts/observations

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Many things don't dawn on you on the first day of your teaching career, but sure enough, you learn with time and improve. In the following, I would like to share some thoughts, based on my own teaching experience which included UG theory courses on basic electronics, analog electronics, semiconductor devices, and a PG course on numerical techniques. I was also involved in UG lab courses on electronics; however, in the following, I will restrict to remarks related to theory courses only.

1. **Preparing for lectures**: I found this very challenging in the beginning. Given that some pointed questions may come your way in class, you have to understand things quite well, better than you understood those as a student.

   However, the next time I taught the same course, it was much easier, and I found time to dig a little deeper into the subject, making it more enjoyable.

   At some point, I started preparing slides (available here) for use in class. Looking back, I think this was no less than a personal breakthrough in my teaching career. Slides helped in several ways:

   (a) Slides made lecture preparation much easier – it was no longer necessary to worry about the chronology of topics to be covered, as the slides were already ordered.

   (b) Part of the class time was saved since I didn't have to draw circuit diagrams (available already on the slides) on the black (green) board. That meant that I had more time to explain concepts or equations, using the board if required.

   (c) Students also valued the slides as reference material. When only the board is used, they would find it difficult to understand the topic and simultaneously take down notes. With the slides made available, they could focus more on grasping the concepts being presented.

   One last point about lecture preparation: I found that, no matter how well I knew the topics to be covered in any particular lecture, it was very important to go over the material before the lecture. It did affect significantly the "flow" of topics in class.

2. **Lecture delivery**: From the students' perspective, this is one of the most important parts of a course. The background effort of the instructor is not visible to students; the actual lecture is. I figured that I was not a great orator, but I could make up by being well-prepared, systematic, and aware of students' needs. A few observations:

   (a) It is extremely important to cover topics in a logical sequence. Each new topic must be built on top of previously covered material. Any misstep would immediately reflect in confused expressions among students.

   (b) Students like to see connections of the theory being taught in class with real-world applications or even historical developments.

   (c) Visual feedback during a lecture is helpful; it tells you if you are making sense. If not, an immediate course correction is required.

(d) I found that MCQs (shown on slides) are a great way to check if students are following the lecture content. Furthermore, when students are working out the question, the instructor gets a chance to walk about in the class which helps to break the ice.

(e) Students often asked questions in class or asked for clarification of some point. Generally, I have been able to handle these, but in some cases, I had to read up or work out something and provide an explanation in the following class (or post it on moodle if the query was not of general interest).

3. **Attendance**: I used to take attendance by calling out names (the class size was small in those days), mainly to know who is who. Attendance was not compulsory, i.e., it was not linked to grades. However, I realised that linking attendance to the DX grade had its benefits, especially for students who are drifting away. I think being in class – as opposed to hostel or elsewhere – helps students to improve their performance although to what extent is not clear.

4. **Home work assignments**: Students are very keen on getting regular home work assignments or "practice problems" (JEE lingo?). I managed to compile questions – some my own, some taken from text books – and upload them regularly on moodle roughly at the rate of one assignment for one/two weeks. The assignments were only meant for learning and were not graded. I am not sure if that is the best approach.

5. **Exams**: For most students, doing well in exams is the number one priority for reasons we know well. Some nuts and bolts:

   (a) Syllabus: It is important to ensure that the syllabus is reasonably covered in the exams.

   (b) Quizzes: I asked students from different batches whether they favoured quizzes (in addition to the mid-sem and end-sem exams) and found that a large number of them (80 to 90 %) did prefer to have quizzes. Before moodle became popular, I used to conduct one quiz before and one after the mid-sem (on paper). I found moodle attractive for conducting quizzes since it allows randomised questions (e.g., same circuit with different resistance values) which means that students sitting next to each other will get different questions. The other advantage of course was that grading was automatic in moodle.

   (c) TA help: Although it is possible to take help from TAs in setting questions, I preferred to do it myself primarily because, as the instructor, I would know whether the questions were suitable in the context of what was covered in class.

   (d) Type of questions: My personal preference – and this is also the general trend at IITB – is to test understanding rather than rote learning. So, instead of "describe a half-wave rectifier," I would prefer to have students calculate something that tells me in unequivocal terms whether or not they have understood the circuit.

   (e) Mistakes in question paper: After setting the exam paper, it is crucial for the teacher to solve it entirely. In this process, mistakes – some of them show stoppers – do show up. Apart from that, the teacher gets a good feel for the difficulty level of each question, and he/she is then in a much better position to assess if a question is too hard or too easy for the average student. If this practice is not followed, students have to grapple with questions with mistakes. They may end up spending more time on a question the instructor thought was trivial. Highly unfair and easily avoidable.

(f) Grading: In my view, the instructor is best equipped to grade exams since she knows, in the context of the material covered in class, how to categorise a mistake made by students. For example, some numerical mistakes – like forgetting to carry a factor of 2 to the next step – may be assigned a tiny penalty, as compared to something more horrifying – such as 1.03×10^6 V across a transistor.

For large classes, TAs are often given the task of grading answer papers. The TA(s) who are assigned the job may not be experienced and therefore need detailed instructions. I found the following practices useful.

  - If there are multiple TAs involved, each TA should grade the same question for ALL papers. This ensures that TA-to-TA variation does not affect students adversely.
  - Detailed solution with a "microscopic" grading scheme should be provided to the TAs.
  - The instructor should arrange for some office or lab space for the TAs during the grading activity.
  - Any additional instructions should be shared with the TAs before they start grading. For example, I like a resolution of 1/2 mark. When I did not explicitly convey this to the TAs, an inexperienced TA used a resolution of 1/4 mark, making things a little difficult.

6. **Grade assignment**: For deciding the grade boundaries for large classes, I found this on-line facility very useful.

7. **Course evaluation**: Feedback given by students is a good indicator of the instructor's effectiveness in delivering a course. Apart from the numbers, I found the "comments" section of evaluation very useful. Comments were all kinds: heart-felt praise, constructive criticism, entertaining remarks, and indifferent commentary. One of my prized possessions: "The instructor sounded like background hum."

   After suitable filtering, I found these constructive suggestions (and acted upon them):

   - More practice problems should be provided.
   - Exams were too easy.
   - Some practical context should be given.
   - The instructor could put notes online so that he does not waste too much time drawing graphs, etc.
   - It is not possible to both understand and take notes in his class at the same time.
   - Notes for important topics should be given.

I hope these thoughts would be useful for people just starting off. In Marathi, there is a saying which translates approximately as: Two persons are walking in single file. If the person in front trips over some object, the one behind becomes a bit wiser (and is not likely to trip over the same object).

So, wish you happy tripping over some other objects!