Dear ECE Graduate Student,

Listed below are suggestions from your fellow students (past and present) on the subject of PhD preliminary examination preparation. We offer these as a source of guidance (and comfort?) as you prepare to take the prelim exam.

If you have an effective way of preparing for the exam that is not included here and want to share it with future students, please send it via email to grad-help@ece.gatech.edu. We will then update this document to include your guidance.

First, here is the section about the Preliminary Examination from the New Graduate Student AdviCe document prepared by a wonderful team of successful ECE graduate students:

**Preliminary Exam**

*How to study?*

- Start at orientation! Talk to people around you and rope a few of them into forming a study group. Each of you can give a mini-lecture on whichever topic you know best and then you can do practice problems. This will make it a lot easier to pick up subjects that you've never taken before. Also, as an added bonus, you get a bunch of potential friends right out of the gate!
- You'll need to study on your own to really lock in the material -- grab some introductory textbooks from the library for the topics you want to study (or the lecture materials for the classes covered in the prelim, if they're available), and work through them in your spare time.
- The approach that worked for me was to work through problems on exams from past years. After that I would go back to the topics that were unclear and try to get lecture notes, homework and exams from the websites of professors who have taught those courses in the past.
- The key is: "The prelim doesn't just measure how much you know about ECE, but how Georgia Tech teaches ECE". Make sure you understand how Georgia Tech specifically teaches the material.
Start early- put a realistic timeline on classes and map it out on a calendar. If you only need to work through practice problems for a subject, it may only take a couple days. If you need to re-read all of your notes and work through multiple exams and the prelim questions, it may take a full week.

The way to study for the prelim is to do as many old exams as you can. There is a database of the prelims from the last ten years or so on the ECE website, solutions included. I suggest working the problems to completion first without referring to the solutions, and verify your answers afterwards.

You want to start studying early, and a little bit every week. Don't wait until the week before the prelim to cram everything in. From the start of the fall semester, you'll have about 2 months to prepare for the prelim. If you do just one practice problem a day, you'll be more than prepared come exam day. Another great strategy is to study with friends with both similar and dissimilar interests.

During the last couple days before the prelim, I suggest not studying too hard, if not studying at all. You need to make sure you are relaxed and well rested in these last couple days.

Base your study schedule on your own personal background in topics -- you don't need to study every topic, just enough of them to be fairly confident you'll pass the prelim. If you have a few topics that you were more comfortable with in undergrad, I would suggest studying those first because you should be able to study that quickly and build your confidence. Time passes very quickly in fall semester with all the things you need to get done so you want to get prepared for as many questions as possible as fast as possible.

Definitely take studying for the prelim seriously but don't let the test intimidate you. Even if you don't feel 100% prepared in the fall, I would suggest that you plan on trying the prelim in your first semester. If you do pass it, then it won't be hanging over your head in the spring, and if you don't, then you know what to expect next time and can better focus your studying in the spring. I personally didn’t think I would pass going into the prelim my first semester but I ended up passing and it was a huge relief!

While I was studying it seemed like the Fall exams tend to be a little harder than the Spring exams, so don't worry if you don't pass the first time. And remember, the prelim is just a limited testing instrument and passing or failing is not a solid predictor of success in graduate school.

It can be very helpful if you TA for an undergraduate class associated with a question on the prelim. When you TA, you are familiar with how the material is taught in that class and you help the students prepare for exams which is basically the same thing as studying for the prelim.

If you've been out of school for a few years or if you're from a different undergraduate major don't be too worried. This will likely mean you need to spend some more time studying than if you were a recent ECE undergraduate but it is still possible to pass in your first semester. In most cases, a different undergraduate major will have some overlap with a few ECE topics.

What to study?

Pick 10 problems from areas you master and focus on those topics. You only have to solve 8 problems, but it's better to have some backups. Some years, they have tricky problems in an area that you through were confident in and you need to find another question to answer.

Generally there are a few standard question types for each category, so read through the old prelims and figure out what to look for to maximize your effectiveness. For instance, the semiconductor problems tend to break down into three categories: p-n junctions, mosfets, and light absorption.
There are a few freebie questions. Your best bets for easy points are usually the basic digital logic (combinatorial logic) and circuits (RLC stuff) questions.

Be aware that Georgia Tech teaches part of their basic logic design class differently than pretty much everyone else, and the prelim may test you on their methods, so you WILL need to go and look at the materials from the Georgia Tech classes if you want to pick up all the points from that category. Specifically look for the stuff on Mixed Logic Design (one cheat sheet here).

Each technical area has about two questions each so you should choose four or five areas to study. Choose these areas based on your strengths and interests - which classes in undergrad did you do best at? What are your research interests coming in to grad school? The difficulty of the problems on the prelim are similar to what you may have seen in your undergraduate classes. The questions are written by ECE professors who have taught the courses before. Chances are those questions are very similar to old exam questions they have given in the past. You may be able to request old exams from these professors.

When possible, find the older class notes/texts for the class. Working through old final exams for each class you plan to test on gives you additional practice of realistic questions beyond the ones already on the prelim.

Keep in mind different universities and colleges use slightly different notations and approaches, so finding the GATech version is important as that is the approach they will be likely to give you most partial credit for.

Check out who is teaching the course that semester on buzzport - usually that will be the professor submitting the prelim question for the test. You can see if you can find old exams or class notes from that particular professor as each professor teaching things slightly differently.

Advice for test day

- Take a deep breath and try to relax. Go to sleep early the day before, because by this point the extra few hours of studying can only hurt you. Eat whatever breakfast you can, and bring some snack bars and a water bottle.
- If you don't think it will freak you out, flip through the exam booklet and plan out which questions you want to tackle, and in what order (start with the easy ones!)
- Stick it out to the bitter end, and triple-check everything - every point counts! If you kind of know how to tackle a problem but are having some issues with the math, write out your thoughts on the procedure and the expected results.
- You may not be able to confidently answer eight questions. After you’ve answered all the questions you’re confident in -- you will need to figure out which of the remaining questions you can get the most points from. This may mean you can only work through one or two parts of a question. The best question to answer at this point may be in an area you don’t expect -- really read through all the problems to figure out which you can get the most partial credit from.
- Sleep well...
- Make sure you have an approved calculator -- see http://ncees.org/exams/calculator-policy/ for a list. If you don’t already own one, make sure to buy it long before test day so there is no stress the day or two before.
- Be sure you bring a functioning calculator, multiple writing utensils, erasers, and a bottle of water.
- Do not arrive late- that being said, if you arrive at the start of registration, you will be sitting their anxious for a full hour.
Following are some bits of wisdom coming from our past students who have been through the process. Enjoy!

1.

My first approach would be to choose your focus groups:

For example:

I decided on BIO, COMPE, CONTROLS, and SIGNALS--these were non-equation based areas and good for me since I do not perform well on exams when a vast amount of memorization of equations is involved. Also these areas contained some overlap with Controls & Signals which cut down on my study time.

I would suggest studying areas that you REALLY REMALLLY REMALLLY enjoy learning about. Because you will have to be able to approach the problems in many different ways--even ways that may not have been seen in previous exams. Also you will have to work alot of these problems so it won't be so bad if you like the material. You should be able to recognize the various tricks involved in each area. Meaning if you have a question and they ask that you explain a procedure they may be asking for a particular graph although the question does not directly ask for it. When I took the exam I realized that it was key that you understand how to answer an indirect question directly.

It is a good idea to have your strongest areas with more questions for example: I was really knowledgeable about the BIO (3) CONTROLS (2) so that was 5 questions that I was pretty confident about & then COMPE(4) & SIGNALS (2). I knew that I had a 50% chance on those areas so I believe that strategy worked well for me since that gave me 3 more questions completing the eight-question requirement.

I would say have no more than 4 focus areas because when you spread yourself too wide you don't know as much as you should about the specifics.

Secondly I would gather my resources:

Collect all the prelim exams on the ECE website.

If you have the chance contact the professors who taught classes in your focus areas the previous semester (say you take the fall exam--look at the prof's who taught the course in the summer or spring). Inform them that you are studying for the prelim and would like old final exams, tests, homeworks, lecture notes, anything that will help you better grasp the course materials.

Go to the TA's of your focus areas for help in solving any problems you may see in your resources. They can be extremely helpful in reviewing concepts quicker than it would
take for you to read the book. They can also show you the tricks I mentioned earlier that may save you calculation time or help you better understand the concept.

Form a study group for motivational purposes.

Go to the NCEES (National Council of Examiners for Engineering and Surveying) website they have a good free reference handbook that is very concise with alot of the electrical engineering equations you may need to know on the exam the website is: http://www.ncees.org click on: FE Reference Handbook and you will see the pdf files for all the different areas

Thirdly:
Prioritize your time. It is extremely important that you get this exam out of the way. You may have to consider putting your classes on hold or other things for a week or two. Consider passing the prelims your full time job from now until it is time to take the exam. So, give it priority #1. Remember a full time job requires at least 8hrs of work/day. Don't worry the investment is well worth it and being over prepared never hurt you during an exam but the reverse is not true.

Lastly:
Go into the exam knowing that you will pass because you have studied and shown yourself approved. Many times we allow these big exams to measure our anxiety instead of our knowledge of the test material. Your confidence in your answers will show itself on how you communicate them. Pretend as if you are writing the solution as a presentation to a client. Meaning you should show all the steps in the correct order needed to get the solution. Also, be sure to write down all assumptions that you make and have your answer easily displayed.

2.

I took the exam last fall and here’s what I did to prepare: I took two of the previous exams (downloaded from the website) using four hours each to make sure I paced myself well enough and then graded myself based on the answers available. I also looked at two or three other previous tests without actually taking the full 4 hours. That gave me a better feel for the types of problems that have been asked. After finding a few things I felt rusty on, I went back and looked at old class notes and textbooks to brush up. I passed the test the first time, so I guess that preparation helped. I did all of that the Saturday before the exam, so it was fresh in my mind. It was a long day, but …

3.

I think it is most helpful to find out who the professors in the core areas are and as much as possible check their class websites and their sample tests (if they are not password protected or on webct). This will be very helpful because I remember when I did the
exam, there were questions on there that were very similar to questions the profs use in their class examinations.

Also, the bioengineering questions can sometimes make the difference. The questions are not that difficult "computationally" and don’t really require as much preparation.

4.

I found having a study group (a group focused on preparing not playing) made all the difference.

5.

This would only apply to students who have five years of professional experience and are interested in state licensure, but I think it is worth sharing for those who may benefit. I decided to study for two birds with one stone and scheduled the PE exam and ECE Prelim in the same semester, and it worked out quite well. The exam prep materials I used were:

http://ppi2pass.com/catalog/servlet/MyPpi_pr_EERM6
http://ppi2pass.com/catalog/servlet/MyPpi_pr_EEPP6

The topical overlap between the two exams is not perfect, but it is pretty close - worth attempting to leverage in my opinion.

6.

I have not passed the prelims yet. But I think I have a strategy that will help me pass the prelims! The strategy is to make "formula pages" with all the formulas and important points that you study in a subject. This will help me summarize the information compactly and also will help me to memorize the formulas, and remember the important information.

7.

The first time I took the prelim, I tried to study by myself using the old exam copies as a guide. It didn't work so well but it did provide useful information about what was on the test and how it was arranged.

The most useful thing I did was to join a group of friends that were also about to take the prelim. Each of us had a different area of expertise and, with all of us together, we had nearly 80% of all the material on the test covered. We each took turns teaching the rest of the group how to solve various prelim level problems that matched our skill sets including showing each other any tips and tricks to make it easier. This worked quite well as we all passed the prelim after that.
It was a lot of studying, though. We met three times per week, about five hours per meeting, for two months. But we had it in our minds to study and pass the prelim so we could put it behind us and move on.

8.

What a great idea! Here are my contributions:
1. Put consistent effort in the preparation and start early
2. Make a list of important formula and physical constants and memorize them
3. Look at the relevant undergrad texts and do the problems
4. When preparing, choose those areas which interest you most and spend 70% of your time on them. As a backup, spend 30% of your time on other areas which you have some interest, just in case there are easy questions from these areas.
5. Practice, practice and practice

9.

1- Take the exam as soon as you can.
2- Determine 4-5 areas in which you feel comfortable after checking previous years' exams. Focus on them during your preparation.
3- Solve all related problems appeared in the previous years.
4- In the exam, go over each question and determine the ones that you can solve or at least have an idea about the solution. Work on them and don't attack every problem, this will definitely save time.

10.

In order of importance this is how I would study for the prelim if I had to do so again:

1) Study Old Tests

You really need to go over about three or more old tests. I say three because that will start to give you a good sample for the type of questions and the difficulty of the questions. Look at every question and pick out which ones you'd answer, which ones appear every year, which ones you'd need just a little bit of studying to be able to tackle, and which ones which you have no idea about.

There really is no substitute for this for several reasons. Since you are trying to optimize the number of questions that you can answer well during the fixed time period, familiarity with questions that appear every year is worth a lot. A lot of the questions don't change from year to year, for instance the state transition problems, or some computer engineering problems that are basically rote. Being able to knock out 3 or 4 questions quickly is a huge edge.

2) Refresh on Old Material
Of the questions that fell into the "you'd need just a little bit of studying to be able to tackle" category, make sure you find a good text on these types of problems and study the fundamentals. For DSP folks, maybe this area would be control theory since lots of the math is the same. For computer engineers, maybe this is solid state electronics. Center your efforts on the practice problems and refresh yourself on formulas and key concepts so that you can tackle problems. Study with people from different areas in ECE. The group I studied with had lots of complimentary people and was very good.

3) Generalize, Don't Memorize

Try to compress the formulae into as few as possible. For instance, it doesn't pay to memorize every Laplace transform, instead memorize the definition and a few key ones and work them out during the exam if they come up. You should have time to work out basic things if you do what I said earlier and tackle a few of the rote problems quickly.

When you are studying, make *one* equation sheet and keep it close when you are working problems out. Since you can't take anything with you on the test, the less you have on here the better. If you are spending time memorizing equations, you are concentrating on the wrong things.

4) Learn New Material (Least important)

You just don't have time to do this unless you are having trouble answering 8 questions. If you have trouble answering 8 questions on the practice exams, then you need to do this. If this is the case, you probably will be on the borderline of passing. You may want to sit in on a few senior level classes to get a feel for them and not be discouraged if you fail the first time. The prelim really tests breadth and not depth. You could already be doing excellent research and fail the prelim!

11.

As a veteran (and near casualty!) of the prelim, I have a few pointers to share...

1) Don't assume that reviewing undergraduate material encountered at another school will prepare you for the exam. Be sure to study the Georgia Tech curriculum. Most of the textbooks used in GT undergrad classes are available on reserve at the library. Those that aren't can usually be borrowed from other students or purchased on the web.

2) Use old prelim exams as a study aid, but don't depend on them exclusively. If you only study the old tests, you may quickly learn to how solve the specific questions on the old exams without mastering the underlying material. Watch out, because this can give you a false sense of security! A good way to combat this problem is to take advantage the websites maintained by many of the ECE professors. Often, these websites contain old homework and exam problems (with solutions!). Working all of these problems is a good way to ensure that you've mastered the material and aren't just memorizing solutions to old prelims.
3) Study, study, study... Start studying early, study on your own, and study with a group of students from other TIG's.

4) If you have trouble the first time, don't give up! Lots of successful people have setbacks in life; how they cope with it is what sets them apart.

12.

The most important thing is to prepare for at least ten questions, so that in case there are any hard questions from one of the areas of your choice you can still attempt 8 questions.

13.

This may be a no-brainer, but Dr. Hertling's talk to the research seminar Class* regarding the prelim seemed to be right on target with respect to passing. If you could get him to write that up, that would be very helpful. The main point of deciding ahead of time which problems to focus on was especially appropriate. The only thing I would add is to be prepared for perhaps one more field, in case one of the problems you plan for ends up being a doozie (it happened to me).

My personal study strategy was simply to go back through my undergrad class notes and, more importantly, to work (or re-work) as many book problems as possible. As long as the professors stick to "classic" problems for the prelim (which Dr. Hertling said he was trying to encourage), this seemed to work very well. Again, this strategy seems to me to be a given, but it worked in my case.

*Dr. Hertling retired as Associate Chair for Graduate Affairs in spring 2004. Below is an updated synopsis of the suggestions he made during his ECE 8010 talk:

**Prelim Advice and Strategy**

1. Read the whole exam first (even the problems in areas that are not familiar to you) and start with problems you can work. You should also identify problems you can partially work.

2. You have to work 8 problems in 4 hours, therefore, never work on one problem longer than 30 minutes (unless you have 7 other problems finished). Tests are time management exercises and your job is to maximize your score in the allotted time. Your goal is to get at least 65% in the 4 hour exam period.

3. Be prepared to answer questions in at least 4 areas. Two areas are not enough since getting a 10 on 4 problems is only 40 points. You need 52 points to pass. Your strategy should be to get nearly 40 points in your two strongest areas and then at least half credit on 4 other problems. That would give you approximately 60 points out of the possible 80 points and clear passing
4. You may also be able to get partial credit in areas you did not concentrate your studying. Even if you cannot completely work a problem, if you can prove that you understand the basics and at least get it set up you will receive some credit. Do not assume that you cannot work a problem in a certain area. For example, a recent exam had a bioengineering problem with an op amp circuit. Even if you are not familiar with or have ever studied bioengineering, if you can solve the op amp circuit you can get some credit. Every exam in recent years has had several problems with a circuit given so you should be able to analyze and solve circuits. Remember, this is the ECE prelim exam so you should be able to analyze a simple circuit! If a problem has a circuit with 5 nodes you should be able to write and solve 4 node equations and you would receive some credit. A blank problem always receives a grade of 0. Do not, however, submit extraneous, superfluous, or incorrect work. That only indicates you do not know how to work the problem correctly.

5. Tests are also communications exercises. You must communicate to the person grading the problem that you understand the problem, know how to set up a solution, and do the solution. Even if you cannot completely solve a problem you want to communicate that you can set it up and are on the right track. If there is an equation or something you need but cannot remember, state what you cannot recall, why it is needed, how you would use it, etc.

6. In summary, clearly communicate what you know. Think “setup, solution, answer” for your submitted work. Filling pages with incoherent and hard to follow work is not a good way to receive a high grade. Don’t try to bluff – the exam problems are submitted by experts in the respective areas. You are not going to fool them! The way to get the highest score on a problem is to submit a neat and easy to follow solution that makes it obvious to the grader that you understand the problem, demonstrate you can formulate a successful strategy to solve the problem, and hopefully arrive at the correct answer.

GOOD LUCK!!!