

microEP Graduate Program 2007 PhD Candidacy Exam Guidelines

March 16, 2007

Introduction

This exam is unlike any you've ever taken because it's testing you for skills that may not have been emphasized previously. Throughout your undergrad years, you were given information and, very shortly after that, were asked to give it back on a test or homework or a project. In the microEP Candidacy Exam, we are testing your accumulated skills in understanding a problem, putting it into the context of available technology, and using your own knowledge base to synthesize a novel solution. Furthermore, it is particularly important for you to be able to make your concepts understandable to someone who is not intimately familiar with either the problem or your way of solving it.

This is the seventh time we've used this type of exam and it will be a work in progress for as long as we follow this concept. In that regard, it is also a test for us in evaluating your skill sets. You are going to find this to be a lot of work and perhaps a bit more stressful than what your customary assignment. But we think that this approach is more representative of the type of intellectual task you'll be doing for the rest of your life either in industry or academia. We hope that when you've successfully passed this exam, you'll give us some feedback on the process so we can continue to improve our methods.

Logistics

You will meet on Friday, March 16th at high noon in PHYS 134. You will receive a copy of each of the four exams,

- Advanced Devices in Electronics at the Micro to Nanoscale (including associated materials and processing)
- Advanced Devices in Photonics at the Micro to Nanoscale (including associated materials and processing)
- Advanced Devices in Chemistry/Biology at the Micro to Nanoscale (including associated materials and processing)
- Advanced Micro to Nanoscale Materials (with emphasis on applications and device processing)

You will be required to choose one of the four exams before you leave the room. You will take that hardcopy exam with you and will leave the remaining three exams with the exam administrator.

Following this initial session, you can request exam clarifications from the microEP exam administrator, Professor Ken Vickers until noon on Saturday the 17th. You can ask any question you want, and Prof. Vickers will either answer it then, get the answer from your panel's

chairman, or tell you that you're not entitled to an answer (from past experience, the answer to most questions will be, "read the exam"). All questions and answers will be sent to all students affected by the information. After this initial 24 hour period, the questions that will be answered will be sharply curtailed.

Contact information for Prof. Vickers is:

cell phone:	(479) 841-8876
home phone:	(479) 443-4130
work phone:	(479) 575-2875
email:	vickers@uark.edu

The completed examination must be returned to Renee Hearon in the microEP office by 9AM on Monday, March 26th. You may hand it in early if you want, but it will not be accepted late (not even one minute – this is like a NSF proposal with a local time cutoff). You are required to submit one hardcopy printout, with dated signature on each page. You will also submit one electronic file on a CD containing your Word document, with your dated signature on the label of the CD. Do not email these files.

NO EXAMS WILL BE ACCEPTED AFTER 9:00 AM SHARP!

All students will be scheduled to discuss their work with their exam's assessment panel members. This discussion will be one hour in length, and will be scheduled during the week of April 2nd. Each student will be expected to bring to the exam a PowerPoint file with slides discussing the critical aspects of their solutions, including slides with all figures from their written report. A projector and computer will be supplied, although students may bring their own computers if they wish. All questions will originate in the written examination material, but there is no restriction or limits on content area during the following discussions.

It is anticipated that the final evaluation will be completed by the assessment panels and approved by the microEP faculty within one week after the panel discussions.

Sources for information authorized during examination

You may use any written source of information in formulating your answer. This does include on-line searches and internet materials. If you are using textbooks that are in any of the university libraries, please do not check them out. Your microEP colleagues taking this exam may also need to use them in the course of formulating their own answers.

You may **NOT** discuss this exam in any fashion (oral, written, sign language, smoke signal, etc) with any person except the microEP exam administrator. It is emphasized that your major advisor should specifically not be approached in casual conversation on your approach or progress to date. It is expected that you will have casual contact with faculty, microEP students, and other candidates during your exam week. General conversations with your colleagues are not restricted during this week, but it is your responsibility to immediately disengage from any conversation that might be construed to pertain to the examination process.

Areas of Emphasis

Four exams were created using the following concentrations:

- Electronics (with materials and processing)
- Photonics (with materials and processing)
- Chemistry and Biology (with materials and processing)
- Materials (with applications and processing)

In addition, the exams have been designed to balance assessment of your understanding of both the science and engineering aspects of the given problems. Your solution will concentrate on the use of advanced materials, processing, and devices at the micro and nanoscale. We anticipate that your response will give appropriate treatment to all of these areas.

While specific instructions will be given in each examination document, In general you solution will be expected to address:

- Current state-of-the-art – what you know of the field without using any references
- Your Proposed Solution - describe your solution to this problem, including both the scientific/engineering basis and the methods of applying this to a workable solution
- Testing and Qualification – how will you prove that the device works and is reliable
- Cost considerations – as contributing to your decision on a solution

The review panels will be strongly interested in your synthesis of knowledge gained from multiple sources into new approaches and ideas. While a solution may be found by piecing together component ideas that are appropriately cited, a solution that depends heavily from plugging prior work together in a new fashion will rarely be a better solution than one based on synthesized new approaches.

Examination format

We are providing this document as a template for you to use, but in general:

1. It is critically important to fully reference any materials directly copied from another source. Material that meets the criteria for use of quotations (but are not in quotes) will be considered as plagiarized – *even if you have your document's text marked with a reference that takes you to the exact paragraph in the original document*. Plagiarism will be grounds for failure without grading of content.
2. Proper citations of paraphrased single source information must be rigorous.
3. Use 12 point, Times New Roman font. Smaller font may be used in diagrams or figures, provided it is readable to the exam graders when printed on normal office printers.
4. Use one inch margins on sides, top, and bottom.
5. Lines must be single spaced.
6. Modify the footer of the document to replace “nnnnn” with a random five-digit number of your choice. Choose a number sequence that will not be associated with you by any member of the assessment panel.
7. You are limited to a maximum of 15 pages in your problem solution (including diagrams and illustrations). We believe that it is impossible to fully answer the given problems in less than 15 pages, and we also believe that you will feel that you are leaving out critical information in order to compress the response to 15 pages. Since you will probably initially develop much more than 15 pages, please be sure to leave yourself time to edit the responses to meet the limit.
NOTE: Two appendices will be allowed that will not be counted toward the fifteen page limit. The bibliographic list of any references you feel are appropriate in your solution should be included as an appendix. A second list of publications examined as part of the intellectual property question should also be included as an appendix.
8. Don't use a dedicated cover sheet - just put the title on the top of the first page and start writing.
9. It is not necessary to fully restate the problem – use your pages wisely to bring new information to the assessment panel members.

Final Note to Candidates

This is a PhD capability assessment process and should be approached with a great deal of seriousness. It is anticipated that fully answering the questions in the exam should require the full nine days accomplishing the examination process (reflection, solution, documentation, reflection, and final documentation). Answers are expected to contain the level of detail necessary to fully evaluate your PhD level approach and understanding of a complex problem in the microelectronics-photonics field.