

microEP Graduate Program 2006 PhD Candidacy Exam Guidelines

March 17, 2006

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 sixth 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're going to find this to be a lot of work and perhaps a bit more stressful than what you're used to. 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're successfully past 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 17 at 1:00 PM in the Multi Media Resource Center in the Gibson Annex building. You will receive a copy of each of the three exams, one for Electronics, Chemistry and Biology, and Photonics. You will be required to choose one of the three exams to take.

Then you will work on this exam, preparing an initial solution to the given problem, along with as much scientific justification and reflection on engineering or business tradeoffs as you can provide without access to any reference materials. This initial solution will be handed in no later than 4:00 PM and will form the basis for your effort during the coming week. You are expected to bring your own pens and a calculator to the exam. Laptops will not be allowed. As many "blue books" as you like will be provided for you to record your responses. A scan of your initial solution will be made and returned to you by e-mail by Friday at 6:00 PM.

The initial exam solution turned in before 4:00 PM on March 17th should address the following items:

- 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

Your initial solutions will be based on your estimations of various tradeoffs. In the final exam you are expected to expand on your initial solution. In the event that upon further study you discover fatal flaws in your initial approach, deviations from the initial solution will be allowed but must be carefully explained and justified. In this event, a maximum of one page of your final exam can be devoted to such explanation.

Following the initial session, you can request exam clarifications from the MicroEP exam administrator, Professor Ron Foster until noon on Saturday the 18th. You can ask any question you want, and Professor Ron Foster will either answer it then, get the answer from the Professor who wrote the exam, or tell you that you're not entitled to an answer. (From past experience, the answer to most of your questions is: "read the exam"). After that, the questions he will be willing to answer will be sharply curtailed.

Ron Foster can be contacted starting Monday:

cell phone: (479) 236-0494
blackberry: (479) 387-8236
email: rbfoster@arkansas.net

Backup contact after Wednesday, noon is Ken Vickers:

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

The completed examination must be returned to Renee Hearon in the microEP office by 9:00 a.m. Monday March 27th. 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 a.m. SHARP!**

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.

It is anticipated that the submitted solutions will be completely graded by the faculty within two weeks. If in grading the solutions the faculty feels that the intent of an answer is unclear, the candidate may be required to join the grading committee to orally discuss his solution. A minimum of twenty-four hours notice will be given to the candidate to prepare for this discussion.

Areas of Emphasis

Three exams were created using the following concentrations:

- Electronics
- Photonics
- Chemistry and Biology

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 nano scale. We anticipate that your response will give appropriate treatment to all of these areas.

Examination format

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

1. 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.
2. Use one inch margins on sides, top, and bottom.
3. Line spacing may be no smaller than single spacing.
4. 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 of the grading faculty.
5. 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 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. Your 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.

6. Don't use a dedicated cover sheet - just put the title on the top of the first page and start writing.
7. It is not necessary to fully restate the problem – use your pages wisely to bring new information to the evaluators.
8. 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.

Special 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 understanding of the microelectronics-photonics field.