

# **microEP Graduate Program 2009 PhD Candidacy Exam Guidelines**

**March 13-23, 2009**

## **Introduction**

This exam is unlike any that you have ever taken before because it tests 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 ninth time we have 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 your customary assignments. But we think that this approach is more representative of the type of intellectual task you will be doing for the rest of your life either in industry or academia. We hope that when you have successfully passed this exam, you will give us feedback on the process so we can continue to improve our methods.

## **Logistics**

You will meet on Friday, March 13th at high noon in PHYS 134. You will receive a copy of each of the three exams, with each exam focused on the development of an advanced application in one of the following areas:

- Biological
- Environmental
- Communications

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

Following this initial session, you can request exam clarifications from the microEP exam administrator, Professor Matt Gordon, until noon on Saturday the 14th. You can ask any question you want, and Prof. Gordon will either answer it then, get the answer from your panel's chairman, or tell you that you are 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 Dr. Gordon is:

cell phone: (479) 422-3538  
home phone: (479) 521-6416  
work phone: (479) 575-4458  
email: [mhg@uark.edu](mailto:mhg@uark.edu)

Contact information for Prof. Vickers (if you cannot reach Dr. Gordon) is:

cell phone: (479) 841-8876  
home phone: (479) 443-4130  
work phone: (479) 575-2875  
In-laws' phone: (870) 793-7907 (Thursday through Sunday)  
email: [vickers@uark.edu](mailto:vickers@uark.edu)

The completed examination must be returned to Renee Hearon in the microEP office by 9AM on Monday, March 23rd. You may hand it in early if you want, but it will not be accepted late (not even one minute – this is like an NSF proposal with a local time cutoff). You are required to submit the following:

- One hardcopy printout with your dated signature on each page.
- A CD with PDF and Word versions of your final document.
- A PDF version of your final document to the “Final Exam Submission” assignment on the TurnItIn site.

**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 up to one hour in length, and will be scheduled during the week of March 30th. 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 from the written examination material, but there is no restriction or limit 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, but may take longer depending of several factors.

**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**

Each exam was created so that either a material or device emphasis could be used. You will choose your emphasis by percentage between these two areas with no area receiving less than 20% of your discussion. You may choose to pursue an electronic, photonic, or combination approach to your solution.

In addition, the exams have been designed to balance the 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 your solution will be expected to address:

- Current state-of-the-art – what you know of the field
- Your Proposed Solution - describe your solution to the problem, including both the scientific/engineering basis and the methods of applying this to a workable solution. Be sure to include the significance and novelty of your 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. You are required to submit your final document to

[www.TurnItIn.com](http://www.TurnItIn.com), and are encouraged to submit early revisions to the site to assure you have no inadvertent plagiarized material in your document (see page 5 for more details on this program and its use).

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 review panel members 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 information contained in this document to replace “nnnnn” with a random five-digit number of your choice and use this as the footer of your document. Choose a number sequence that will not be associated with you by any member of the assessment panel.
7. Start your document with a one page Executive Summary that clearly introduces the science basis for your solution as well as the engineering approach. You should also precisely summarize the novel elements of your proposed solution.
8. Include as the second page a Risk Assessment Roadmap (defined at the end of this document)
9. You are limited to a maximum of 15 additional 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 ranked list of publications examined as part of the intellectual property question should also be included as an appendix. No other appendices are allowed.*
10. Do not use a dedicated cover sheet - just put the title on the top of the first page and start writing.
11. 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.

### **www.TurnItIn.com Details:**

You now have access to the plagiarism site [www.TurnItIn.com](http://www.TurnItIn.com) through a license provided by the Graduate School. You can go to the site, log yourself in, and then register yourself as a student in the "class" I have set up below. You will need to use the listed class number and password sometime in the registration process.

We will set up several Assignments in TurnItIn for your convenience (there is limit to one submission per 24 hours for each assignment). However, the last document (must be a single PDF file) that you submit to [www.TurnItIn.com](http://www.TurnItIn.com) in the "Final Exam Submission" folder will be the printout distributed to the review panel members for evaluation. NOTE: The "Final Exam Submission" assignment folder will only allow a single submission that cannot be overwritten, so please make sure that this truly is the final revision of your paper.

Class

Number	Class Name	Password
2571170	<u>PhD Candidacy Exam</u>	candspr2009

You may then submit your exam as many times as necessary for plagiarism checking to the assignments called "Draft Submission 1," "Draft Submission 2," "Draft Submission 3," or "Draft Submission 4." This system will return a report to you in as little as an hour and sometimes as long as a day. This report will show you the parts of your document that contain text used in other documents in its database. These identified text segments will fall into several classes:

- Expected (can be ignored): Required labeling on your document's title pages, titles of papers in references, etc.
- Trivial (can probably be ignored, but think about it carefully): Lists of factual elements, common short phrases, etc.
- Marginal (requires some thought, but should probably be changed): Phrases from equipment descriptions, language used in your own prior published papers, etc.
- Terrible (probably needs to be changed or document will be rejected): Series of phrases that track similar phrases in another document.
- Catastrophic (must be changed or document will be rejected): Exact duplicate content in normal body of your document.

We will check the originality report ONLY of your final submission in that "Final Exam Submission" folder (this must be the same document that you submit to the microEP office), so be sure that you are satisfied with your final exam copy. The exam panel will use the originality report in their evaluation, and any plagiarism will be grounds for failure.

Please note that our experience is that you cannot cut and paste a body of text into your document and change it enough through editing to make it your own words. Instead, consider

reading several bodies of work on a subject, put those papers away, and then write what you wish to reader to understand from those works in your own words.

**Risk Assessment Roadmap**

You are one of the lead technologists in your company and have been given the task described in the exam. This task spans from materials science to system definition, but you have been given the freedom to define on which areas your proposal will focus. The form shown below will be the second page of your proposal, and will be the road map by which your proposal will be evaluated.

The form has four basic illustrative categories, but you should add lines as needed to indicate how you are approaching the problem solution. On each line you should indicate the source of that component of your work (from "off the shelf" to "outcome of pure research"). From your company's perspective, the higher the level of new intellectual property imbedded in your solution the higher the differentiation of the product delivered, and the higher the potential profit. Of course, this must be balanced by the higher risk and cost of depending strongly on research outcomes for product development success.

	Not Applicable		Using Known Science/Tech		Modifying Known Science/Tech		Requiring Pure Research
Base Materials							
Processes							
Devices							
Systems							

**Area of Emphasis:    Materials \_\_\_\_\_                      Devices \_\_\_\_\_**

**Enter a percentage for each. The two numbers should add to 100% and no single number can be less than 20%.**