**microEP Graduate Program**

**2018 PhD Candidacy Exam Guidelines**

### January 5-16, 2018

# **Introduction**

This exam is unlike any that you have ever taken before because it evaluates professional behaviors that may not have been formally assessed 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 evaluating 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 that moves the boundaries of knowledge outward. 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 seventeenth 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, January 5th, 8:00 AM in NANO 105. 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 three areas:

* Materials (MAT)
* Photonics (PHOT)
* Biologics (BIO)

Weather contingency: in the event weather delays this meeting, you will be notified by email of a subsequent time to meet to pick up the exam.

Before you leave the room, you will indicate on a sign-up sheet which of the three exams you intend to take. However, you will be allowed to take all three exams with you and you will be given until 12:00 noon on Saturday, January 6th, to change your selection to another exam. You must send an e-mail to Drs. Rick Wise, Keith Roper, Panneer Selvam, and Renee Hearon if you wish to change to another exam. The e-mail must explicitly state your intention to change:

I, (your name), have decided to change to (exam name) as my Microelectronics-Photonics written candidacy exam.

If there is any ambiguity in your statement to change exams or if you do not notify by the required time (12 noon, Sat, January 6th), you will be responsible for continuing with the exam you selected on Friday – NO EXCEPTIONS. You will receive an e-mail confirmation of your decision to change exams. If you do not receive this e-mail confirmation, contact Dr. Roper or Dr. Selvam by phone (before 12:00 noon, Sat, January 6th).

Following this initial session, you can request exam clarifications from the microEP exam administrator, Professor Keith Roper, until noon on Saturday the 6th. You can ask any question you want, and Prof. Roper will either answer it then 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. Keith Roper is:

 cell phone: (801) 891-8921

 email: dkroper@uark.edu

Contact information for Dr. Selvam (if you cannot reach Dr. Roper) is:

 cell phone: (479) 236-2387

 home phone: (479) 521-1023

 work phone: (479) 575-5356

email: rps@uark.edu

Before you leave the room on Jan 5th, you will receive a scheduled time to turn in your exam on Tuesday, January 16th, 2018. The completed examination must be returned to Renee Hearon in the microEP office by the start of your scheduled time. Please follow the process below for your submission.

1. Generate a PDF version of your final document.[[1]](#footnote-1)
2. Submit that PDF to the plagiarism web site.
3. Print the PDF onto paper, date and sign each page, and bring that hardcopy to the microEP office by the scheduled time.
4. Bring an electronic copy of your final document in PDF Format *on a new, clean flash drive* and the printed, signed and dated copy to the microEP office by the scheduled time.
5. Name the file ‘nnnnn.pdf’ where ‘nnnnn’ is the self-selected 5-digit code in your footer.
6. From the computer in Renee’s office, email the PDF document to Renee, and receive a confirming email from Renee that the document was received.

**NO EXAMS WILL BE ACCEPTED AFTER YOUR SCHEDULED TIME**

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 Wednesday February 7th to Tuesday February 13th. 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.

The evaluation will be finalized by the assessment panels and approved by the microEP faculty within one week after the panel discussions, but may take longer depending on 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.

Library Hours can be found at: <http://libinfo.uark.edu/hours/default.asp?date=1/1/2017>

Access to most of the electronic databases, journals and books are available only from on campus and can be accessed through this link <http://www.informaworld.com>. Paper books or journals will not be available when Mullins Libraries are closed.

You may ***NOT*** discuss this exam in any fashion (oral, written, sign language, smoke signal, etc.) with any person except the microEP exam administrators. 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 will allow an emphasis in either material/processes or device/systems. Your emphasis may be from 20 to 80% materials/processes; the difference will be in device/systems (100% total). You may choose to pursue an electronic, photonic, or combination approach to your solution.

The examiners will assess your understanding of both the science and engineering aspects of your selected problem. 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

This document provides 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 a website for plagiarism evaluation, 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. The first page should include the title, and an Executive Summary that (i) introduces the science basis for your solution; (ii) describes the engineering approach; and (iii) summarizes 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 pages beyond these two pages for your proposal (including diagrams and illustrations). A proposal less than 15 full pages is unlikely to be comprehensive. You may find important information must be left out in order to compress the response to 15 pages. Be sure to leave yourself time to edit the responses to meet the limit.

*NOTE: Two required appendices are not counted toward the fifteen page limit. The list of references cited in the proposal [Appendix 1] and a ranked list of publications examined as part of the intellectual property question [Appendix 2]. No other appendices are allowed.*

1. Do not (i) use a cover page or (ii) 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 time allotted for 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.

**CAUTIONS:**

1. Save often. Computers can crash. Save your written work often and in several locations (hard drive; email yourself; thumb drive).
2. For an unexpected emergency, contact Dr. Roper or Dr. Selvam as soon as you can.
3. Do not share your document with anyone until after the full process is complete.

**Plagiarism Check Website Details:**

You will have access to a plagiarism site for document evaluation. When it shows text that may be plagiarized they 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 plagiarism report ONLY of your final submission (this must be the same document that you submit to the microEP office for panel evaluation), 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 from a clear screen in your own words what you wish the reader to understand from those works.

**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.

From your company's perspective, the higher the level of new intellectual property embedded 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 when new products depend strongly on research outcomes for product development success.

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

**Area of Emphasis: Materials/Processes \_\_\_\_\_\_\_\_ Devices/Systems \_\_\_\_\_\_\_\_**

1. “LaTEX software can create formatting issues when converted to Word or .pdf; take this into consideration when planning your timeline.” University of Arkansas Thesis and Dissertation Guide [↑](#footnote-ref-1)