STRUCTURAL ENGINEERING AND MATERIALS PROGRAM
INFORMATION FOR NEW GRADUATE STUDENTS

General Information
(1) Attached are sheets with information regarding courses and policies.
(2) Other information is provided in the:
   - University Graduate Catalog, available at http://secure.graduateschool.vt.edu/graduate_catalog/
   - Timetable of classes is available through Hokie SPA at http://hokiespa.vt.edu.
   - SEM Program homepage - http://www.cee.vt.edu/sem/ - also accessible from the CEE homepage

Signing-in and Advisor Assignment
(1) Upon arriving, please see Debbie Cooper in 107 Patton to sign-in and to be assigned an Interim Faculty Advisor who will assist you in the selection of courses during the first semester.
(2) If you will be receiving a Graduate Teaching Assistantship (GTA) or a Graduate Research Assistantship (GRA), you need to meet with the graduate student advisor in 211D Patton to complete employment paperwork.
(3) International students should also go to the International Student Office in the Graduate Life Center for assistance and information.

Fall Social Event
The Structural Engineering and Materials Program will have a get-together in the early part of September. The event will be held at the Murray Structural Engineering Laboratory. Further information will be provided later. Please plan to attend.

Mailboxes & Desks
- You will be given a mailbox in 107 Patton; please check it regularly.
- A limited number of desks are available in the suite of offices in 309 Patton Hall and will be assigned after the first week of the semester. Due to a limited number of desks, desks are given to GRA's and GTA's, and to students working with professors on unfunded research.
- Students who are working on research projects at the Murray Structural Engineering Laboratory should see Professor Eatherton regarding desk assignments at the lab.
- You cannot be assigned a desk in 309 Patton if you have a desk at the Murray Structural Engineering Laboratory.
- All students without desks are eligible to have a locker in 309 Patton. Please let Debbie know if you are interested in having a locker assigned to you.

PID and Internet Access
New students should receive their PID number (for internet access) through the mail one or two months before school starts. If this does not occur, please check the following web page: https://my.vt.edu/mdsAuth/start.html.
STRUCTURAL ENGINEERING AND MATERIALS GRADUATE PROGRAM
IN CIVIL AND ENVIRONMENTAL ENGINEERING

AT VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

The Structural Engineering and Materials graduate program at Virginia Tech offers the Master of Science and Ph.D. degrees in Civil and Environmental Engineering. There are usually 50 to 80 graduate students in the program, with 10 to 15 students working toward the Ph.D. degree. The objective of the program is to provide a quality education that is well-balanced in structural analysis and design, and in theoretical and practical considerations. Students learn classical structural mechanics, study the behavior of engineering materials, and explore modern computational techniques to prepare them for a consulting or research career path. Students are encouraged to explore supporting courses offered in the Engineering Science and Mechanics Department.

Structural Engineering and Structural Materials Degree Requirements

Requirements for the degree programs are as follows:

Master of Science Thesis Option: a minimum of 24 course credits (not including seminar or research and thesis credits) is required. Students may take a maximum of 6 credits of 4000 level courses, must take a minimum of 18 credits of courses at the 5000 level or higher, and must take at least 6 credits of CEE 5994 (Research and Thesis). The thesis option is preferred for students with Via fellowships. Upon completion of the thesis, a public oral defense is required.

Master of Science Non-thesis Option: students may take a maximum of 6 credits of 4000 level courses and must take a minimum of 24 credits at the 5000 level or higher (not including seminar credits), with a minimum of 30 total credits. Students following the M.S. non-thesis option have two choices:

(a) Students may take 3 credits of CEE 5904 Project and Report, and then take an oral examination in which they are asked questions about their report and coursework. If they do not pass this exam, they must wait at least 15 weeks before retaking it. Only two attempts at passing this exam are allowed.

(b) Students may take a written exam covering the coursework taken by the student. If they do not pass this exam, they must take an oral exam. The three faculty members that make up the student's committee grade the written and oral exams. Rules governing the exit exam are attached.

Ph.D. Program: 90 semester credit hours (not including seminar credits) beyond the B.S. degree, a Qualifying examination, a Preliminary examination, and a Final oral examination are required. The Qualifying Exam is a combined written/oral exam which is offered twice each year in January and May. Students must pass the exam by the end of their second semester. Students may elect to take the exam in their first semester, and if they pass they may continue in the Ph.D. program. If they fail this attempt, they may take the exam again in their second semester. A student may also elect to wait and take the exam only once at the end of their second semester. Students that do not pass the attempt at the end of the second semester will not be allowed to continue in the Ph.D. program.
The Ph.D. Qualifying Exam shall consist of a written part and an oral part. The decision of pass/fail is made based on the overall performance of the student on both parts of the exam.

The Written Exam is a four-hour exam, consisting of six questions in the following subject areas:

- Mechanics of Materials
- Structural Analysis (Classical or Matrix Methods)
- Structural Dynamics
- Design of Reinforced Concrete or Prestressed Concrete Structures
- Design of Steel Structures
- Mathematics

A sample instruction sheet for the written Qualifying exam is attached. Students are expected to solve all problems. The mathematics question may be given as a set of two or three short problems, with each part covering a different subject. A list of subjects covered in the math problem will be provided to the student.

The Oral Exam is 90 minutes in duration, and covers the same subject matter as the written exam. This exam should be scheduled no later than two weeks after the written exam. Usually, questions on the oral exam will be based on the student’s performance in the written exam. Students may not bring material (e.g., written notes) to the oral exam.

A student who has failed the Qualifying Exam at the end of their second semester may re-apply to the PhD program in the SEM program area at a future date. At least two years must elapse between the end of their second semester and the semester for which they are re-admitted. After re-admittance, the student is allowed the same opportunities to pass the qualifying exam as a newly admitted PhD student.

The Preliminary Exam consists of a written part and an oral part. The written part consists of the research proposal, which is a preliminary draft of the dissertation with complete literature review, scope and objectives, methods and preliminary results. The committee may also present questions to the student for take-home written solution one week prior to the date of the oral exam. The oral part includes a presentation of the Student’s Research Proposal, general technical questions from the exam committee, and questions related to the written take-home problems if applicable. The Preliminary exam should be taken by the end of the second year in the Ph.D. program and at least six months must elapse between the Preliminary exam and the final defense date. Students are given two chances to pass the Preliminary Exam.

The Final exam consists of an oral defense of the Ph.D. Dissertation. Graduate School rules should be followed for the timing of this exam. In the rare circumstance that a student fails the Final exam, a second opportunity to pass the exam will be given no later than two academic semesters after the first attempt. Students that do not pass on the second attempt will not be allowed to continue in the Ph.D. program.

Other General Information:

If a student fails to make satisfactory progress toward the degree, permission may be denied to continue the program. Students whose cumulative GPA falls below 3.0 are placed on probation and become ineligible for assistantships.

The Graduate Honor Code establishes a standard of academic integrity. Compliance with the Graduate Honor Code requires that all graduate students exercise honesty and ethical behavior in all their academic pursuits at Virginia Tech. The Constitution of the Graduate Honor System is given in an Appendix of the Graduate Catalog, which can be accessed from the CEE web page. It describes violations such as cheating, plagiarism, and falsification, and the associated penalties.

Duties of students receiving assistantships are described in the letter giving the offer of aid and in the contract signed by the student, and by the supervising faculty member.
Master's theses and Ph.D. dissertations are submitted to the university electronically. Instructions are given on the Electronic Thesis and Dissertation (ETD) homepage located at http://scholar.lib.vt.edu/theses. Workshops on ETD are given periodically by the Graduate School.

During the academic year, students who have a fellowship, scholarship, or graduate assistantship (GA), including teaching and research assistantships, must take a minimum of 12 credits hours per semester. Unfunded students must take a minimum of 9 credit hours per semester. Audited courses are not counted toward the minimum. Graduate students are not required to enroll during summer sessions unless they are taking courses (e.g., students working on research during the summer are not required to sign up for CEE 5994 or 7994). Students registered for 12 or more credits may audit one course; students registered for 9-11 credits may audit two courses.

Lab Safety Training

Before beginning work at the Murray Structural Engineering Laboratory all graduate students will accompany their advisor/principal investigator for an introduction to the laboratory director and laboratory technical staff. During this initial visit, the graduate student will be asked to fill out a Student Information form and a student file will be created.

After a file is created, the student will be instructed on the procedure for online safety training. There are nine online safety modules and all nine must be completed before the student is allowed to perform any work on the laboratory floor.

Upon completion of the safety training, the student will be given a formal tour of the laboratory. During this time, a copy of the laboratory safety policies and procedures will be discussed and required safety equipment will be issued to the student.
Requirements for Structural Engineering Majors

For the structural engineering major, each student's Master's or Ph.D. program must include the following basic requirements:

1. Fulfill required background courses listed in Graduate Policies and Procedures Manual of the Department of Civil and Environmental Engineering.
2. CEE 5944 Seminar, one Fall and one Spring semester consecutively.
3. Referring to Table 1, all M.S. and Ph.D. students are required to take at least three courses from the Structural Mechanics and Structural Analysis categories (including at least one from each of these two categories) and at least two courses from the Structural Design category. A course from the Structural Materials category can be substituted for one of the Structural Design courses. After these requirements are met, the student can work with their advisor to tailor their plan of study to meet their own interests and professional goals.

### Table 1

<table>
<thead>
<tr>
<th>Structural Mechanics</th>
<th>Structural Analysis</th>
<th>Structural Design</th>
<th>Structural Materials</th>
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<tr>
<td>** 5464 Structural Dynamics &amp; Earthquake Engineering</td>
<td>** 5414 Finite Element Analysis of Structures</td>
<td>4454 Masonry Structural Design</td>
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<td>** 5400 Design of Prestressed Concrete</td>
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<td>6404 Dynamics of Structures</td>
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<td>5470 Design for Seismic Load Effects</td>
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<td>5480 Steel Bridge Design</td>
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<td>** 5744 Topics in Steel Design</td>
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<td>5984 Wind Engineering</td>
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<td>6424 Advanced Prestressed Concrete</td>
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<td>SBIO 4314 Design of Wood Structures</td>
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<td>SBIO 5324 Timber Engineering</td>
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** Course is strongly recommended for graduate degree
All courses are 3 credit hours unless noted. Note that 3000-level courses cannot be taken for graduate credit.

### Fall 2020

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Instructor</th>
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<tr>
<td>CEE 3404</td>
<td>Theory of Structures</td>
<td>Koutromanos, Sarlo</td>
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<td>CEE 3424</td>
<td>Reinforced Concrete Structures I</td>
<td>Roberts-Wollmann</td>
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<tr>
<td>CEE 3434</td>
<td>Design of Steel Structures I</td>
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<td>CEE 3684</td>
<td>Civil Engineering Materials</td>
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<td>Advanced Structural Concretes</td>
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<td>CEE 5410</td>
<td>Intermediate Reinforced Concrete Structures</td>
<td>Jacques</td>
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<td>CEE 5420</td>
<td>Computer Analysis of Structures I</td>
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<td>CEE 5430</td>
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<td>CEE 5470</td>
<td>Design for Seismic Loads</td>
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<td>CEE 5480</td>
<td>Steel Bridge Design</td>
<td>Hebdon</td>
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<td>CEE 5610</td>
<td>Mechanics of Composite Materials</td>
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<td>Nonlinear Finite Element Analysis</td>
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<td>CEE 5944</td>
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### Spring 2021

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<tr>
<td>CEE 3404</td>
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<td>Shakiba, TBD</td>
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<td>CEE 3804</td>
<td>Computer Applications in CEE</td>
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<td>CEE 3954</td>
<td>Bridges, Builders, &amp; Societies</td>
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Tentative Courses 2021-2022

All courses are 3 credit hours unless noted. Note that 3000-level courses cannot be taken for graduate credit.

Fall 2021

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Spring 2022

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Related Courses

Students in the Master's degree program are encouraged to take courses outside of the structures program to broaden their background. Many alternatives are available, especially in the engineering science and mechanics, construction, geotechnical, materials, mathematics, and statistics. At the Ph.D. level it is desirable for the student to develop additional depth in structural mechanics, mathematics, and continuum mechanics.

Civil Engineering
CEE 4014  Estimating, Production, and Cost Engineering  
CEE 4024  Construction Control Techniques  
CEE 4534  Earth Pressures and Foundation Structures  
CEE 5060  Built Environment Information Modeling and Processing  
CEE 5504  Risk Analysis in Geotechnical Engineering  
CEE 5534  Foundation Engineering I  
CEE 5544  Foundation Engineering II  
CEE 6984  Advanced Soil Dynamics

Engineering Science and Mechanics
ESM 4024  Adv Mechanical Behavior Materials  
ESM 4044  Mechanics of Composite Materials  
ESM 4084  Engineering Design Optimization  
ESM 4614  Probability-based Modeling, Analysis, and Assessment  
ESM 5014  Introduction to Continuum Mechanics  
ESM 5124  Theory of Elasticity  
ESM 5144  Deformation and Fracture of Materials  
ESM 5304  Mechanical and Structural Vibrations

Mathematics
Math 4425  Fourier Series and Partial Differential Equations  
Math 4445-4446 Introduction to Numerical Analysis  
Math 4454  Applied Mathematical Modeling  
Math 4564  Operational Methods for Engineers  
Math 4574  Vector and Complex Analysis for Engineers

Mechanical Engineering
ME 5514  Mechanical and Structural Vibrations

Statistics
Stat 4004  Methods of Statistical Computing  
Stat 4604  Statistical Methods for Engineers  
Stat 4705-4706 Probability and Statistics for Engineers  
Stat 5615-5616 Statistics in Research

Geological Science
GEOS 5154  Strong Motion Seismology and Seismic Hazard Analysis
Structural Engineering and Materials Faculty and Their Research

Alexander S. Brand, Assistant Professor, P.E., Ph.D., University of Illinois at Urbana-Champaign. Cementitious composites, materials characterization, materials science, sustainability, pavement design.


Finley A. Charney, Professor, P.E., Ph.D., University of California-Berkeley. Structural analysis, structural dynamics, earthquake engineering, wind engineering, behavior of structures.

Matthew R. Eatherton, Associate Professor; P.E., Ph.D., University of Illinois at Urbana-Champaign. Steel structures; high performance seismic force resisting systems; earthquake engineering; experimental research and methods.

Matt Hebdon, Assistant Professor, Ph.D. Purdue University. Behavior and design of steel bridges, fatigue and fracture of steel structures, historic structure preservation, field testing and monitoring, corrosion of metals.

Eric Jacques, Assistant Professor, Ph.D., University of Ottawa. Blast resistant design, reinforced concrete structures, infrastructure resilience.


Roberto Leon, Burrows Professor and SEM Coordinator, P.E., Ph.D., University of Texas. Behavior and design of steel and composite connections and structures, serviceability of composite floors, high performance materials, progressive collapse of bridges, community resilience.

Carin Roberts-Wollmann, Professor, P.E., Ph.D., University of Texas. Reinforced and prestressed concrete, concrete time dependent behavior, field testing of bridges, bridge behavior and design.

Rodrigo Sarlo, Ph.D., Virginia Tech. Structural Health Monitoring, infrastructure instrumentation and testing, Smart Cities, sensing and data fusion, vibrations and structural dynamics.

Maryam Shakiba, Assistant Professor, Ph.D., Texas A&M University. Multi-physics multi-scale modeling of civil engineering materials, microstructural characterization of damage, and resiliency and sustainability of civil infrastructure materials.

Emeritus Faculty

Siegfried M. Holzer, Alumni Distinguished Professor Emeritus; Ph.D., Illinois. Application of finite element method; multimedia courseware development.

Thomas M. Murray, Professor Emeritus; P.E., Ph.D., Kansas. Steel structures; serviceability aspects of design; pre-engineered building design; testing of full-scale structural components.

Raymond H. Plaut, Professor Emeritus; Ph.D., California-Berkeley. Stability of structures; inflatable structures; structural dynamics; adhesion; blast loading; cable dynamics; vibration isolation; geomembranes; railway joints.

Richard E. Weyers, Professor Emeritus; P.E., Ph.D., Penn State. Concrete durability; concrete bridges, steel corrosion.

Kamal B. Rojiani, Professor Emeritus, P.E., Ph.D., University of Illinois at Urbana-Champaign. Structural safety and reliability; code calibration; risk analysis; computer applications; programming methodologies.
Appendix A

Rules governing the final exam for coursework-only M.S.

- MS coursework-only students should notify the SEM coordinator by December 15 of the previous year if they desire to graduate at the end of the Spring semester or Summer term and by May 15 if they expect to graduate at the end of the Fall semester.

- The SEM coordinator will assign committee chairs and committee members for all MS coursework only students.

- The written exams must be turned into the program area coordinator to distribute to the committee members no later than the Friday of the fourth week of the semester of graduation. The format for the written exam is presented below.

- The committee will evaluate the written exams and grade as pass or fail. If two of the three committee members give a failing grade, an oral exam must be scheduled. The procedure for the oral exam is described below.

- If the oral exam is also deemed a failing effort, the student must schedule a second exam during the last two weeks of the semester.

Format for written exit exam

The exit exam for the coursework only option consists of a collection of "summaries" from each graduate structural engineering course completed by the time the exam is taken. The general protocols for preparing the summaries are as follows:

1. The summary must be your own work, and a statement to that effect must be clearly written on each summary.

2. The summaries can be written by hand, using a word processor, or a calculation package such as Mathcad.

3. The summary must be neat and well organized. Use sketches where needed. Where appropriate show all computational units (kip, inch) and signs (positive, negative, tension, compression).

4. Each summary must be no longer than five pages in length, and shall have the following parts:
   a. Your name, the date the summary is turned in, the course number, the course title, the name of the instructor, and the semester completed.
   b. A statement of course objectives, written in your own words.
   c. A statement indicating, in your view, the relevance of the course to the field of Structural Engineering and/or Structural Materials.
   d. A statement indicating, in your view, which was the most interesting topic in the course, and why.
   e. A statement indicating, in your view, which was the least interesting topic in the course, and why.
   f. A summary of one important topic in the course (your choice) suitable for presentation in a classroom. This summary is in effect, a set of “lecture notes” that you would present using a chalkboard in a timeframe of about 10-15 minutes. Examples include "Loss of Prestress", "Analyzing Continuous Beams", "Creep in Concrete", "The ASCE 7 Seismic Response Spectrum". The write up should illustrate your deep understanding of this one topic.

To assist in the development of your summaries, after you complete your first summary, you may submit this to your committee chair. The chair will review the summary and provide comments. Then you can proceed with your other summaries.
Rules governing oral exam if required

- Each student will prepare a 7 to 10 minute presentation based on each structural engineering or materials course (except for seminar) that is part of his or her plan of study. You will only be required to prepare a presentation on courses that you have completed and not the courses that you are currently taking. However, if you take the oral exam for a second time, you will be required to prepare a presentation on courses taken during your last semester.
- The focus of your presentations should be on 2 or 3 of the most important things that you learned in each course. You should provide technical details to demonstrate your knowledge.
- In the oral exam, you will be asked to make two of the presentations you have prepared. You won't know which two until you get into the exam. This way, you will be motivated to perform a comprehensive review of all the courses you have taken.
- The only visual aid you will be able to use is the chalkboard. The purpose of this requirement is to limit your preparation time, which could otherwise get out of hand if students were allowed to prepare fancy overheads or slides.
- You may refer to notes while making your presentation. We encourage you to practice your presentations in advance so that reliance on your notes is kept to a minimum, but the point is that you do not have to memorize all the presentations that you prepare.
- You must stick to the 7 to 10 minute time frame for each presentation. We won't interrupt you during your presentations. This will give you the opportunity to get relatively comfortable in the exam setting by being able to deliver a prepared presentation before we begin asking you questions.
- After each presentation, we will ask you questions about that presentation. It is possible that the questions will stray into material covered by other courses, but the focus will be on the courses you present. You will not be permitted to look at your notes during the question and answer portion of the exam.

Based on the exams that have been held using this format, the following suggestions are offered:

- The presentations that have been most successful have used the following pattern: To begin, give a very short introduction stating what the course covered and what particular topics you are going to address in your presentation. It is impossible to completely cover an entire semester course in 10 minutes, so you should choose 2 or 3 topics from the course that are especially interesting or significant to you. The remainder of your time should be spent on the 2 or 3 topics you chose. It is important that you show us technical details. Don't just recite lists.
- Don't write everything you say on the chalkboard. A principal use of the chalkboard should be to draw graphs. Remember to label axes on graphs. For some topics, it may also be appropriate to use the chalkboard for writing equations or illustrating procedures.
- It is very important to stick to the time frame. A presentation length under 7 minutes creates an impression that you didn't understand the material in the course. We will stop you if you go over the 10 minute limit.
- Practice your presentations beforehand. Get comfortable speaking and working at the chalkboard. Start at the upper left and work to the lower right.
- If you don't know the answer to a question, it's certainly all right to try to reason your way through it (we will help you), but do not try to fake your way through it. It's better to admit you don't know than it is to guess.
- If you do not pass the oral exam on your first attempt you may take the exam again before the end of the semester. You may be required to do some remedial work before your second attempt. Also, if you take the oral exam for a second time, you will be required to prepare a presentation on courses taken during your last semester.
Appendix B
Sample Qualifying Exam Instructions

Structural Engineering Ph.D. Qualifying Examination
Written Component

This Exam consists of six problems in fundamental areas, as shown below:

1. Structural Dynamics
2. Mechanics of Materials
3. Structural Analysis (classical or matrix)
4. Steel Design
5. Reinforced or Prestressed Concrete Design
6. Mathematics

The exam is closed book, closed notes. In some cases the exam administrator will provide references documents, such as ACI 318.

You are expected to solve all problems.

After you have completed the exam, place your solution sheets for each problem immediately after the problem statement the exam notebook.

The determination of your pass/fail status on the Ph.D. Qualifying Exam will be based on your combined performance on the written and oral portions of the exam.

Good luck!

Honor Code Pledge: I have not given or received unauthorized assistance on this exam. Further, in the future, I will not discuss this exam with anyone other than the problem authors.

Name ______________________________

Signature ___________________________