

**Power and Control Systems (Dr. Majid Pahlevani represents this area on the FoS exam committee)**

The FOS exam in power and control areas is to evaluate the student's background in the fundamental concepts of power electronics, power systems, and control systems. The materials will be mostly focused on the third and fourth year undergraduate courses such as ENEL 585 (introduction to Power Electronics), ENEL 587 (Power System Analysis), ENEL 441 (Control Systems). Students are expected to know the fundamental concepts which were covered in the aforementioned courses. In particular, the following study materials are recommended for the exam preparation:

Power Electronics: Chapter 1, Chapter 7 (section 7-1 to 7-4), and Chapter 8 (section 8-1 to 8-4) from "Power Electronics: Converters, Applications, and Design" (2nd Ed.), N. Mohan, T.M. Undeland, and W.P. Robbins, Wiley.

Power Systems: Chapter 2 and Chapter 5 from "Power System Analysis and Design", J. D. Glover, M. S. Sarma, and T. J. Overbye, Cengage Learning.

Control Systems: Chapter 2, Chapter 4, Chapter 5, and Chapter 8 from "Modern Control Systems" (12th Ed.), R.C. Dorf, and R.H. Bishop, Pearson.

### **Computer Engineering (Dr. Mike Smith represents this area on the FoS exam committee)**

Field of study exams are designed to check your experience in a particular area. However although you may have considerable experience in that area the actual experience you have had is different from others taking that particular FOS and different from the details in the text book. That makes it difficult for me to set a fair exam and you to study for it. My approach to solve this problem is to do something I have done in all my computer engineering classes.

I am asking those interested in writing the computer engineering FOS to demonstrate their knowledge in this area by putting themselves in my place.

Indicate by email to [Mike.Smith@ucalgary.ca](mailto:Mike.Smith@ucalgary.ca) that you are interested in taking the computer engineering FOS exam.

Send by email a series of appropriate questions that, when answered, would demonstrate your broad knowledge in the area.

Sent the question to me by email at [smithmr@ucalgary.ca](mailto:smithmr@ucalgary.ca)

You need to follow these criteria

- 1) Choose 4 different areas from the suggested text book when making up questions
- 2) Suggest appropriate questions in each of those areas
- 3) The questions -- and the answers you will later provide -- should demonstrate that you have the general knowledge to teach a tutorial as a TA on that area to a group of 3rd year students taking a computer engineering course.
- 4) It is okay to make a question that discusses a different processor which you studied during your courses rather than the one in the proposed book
- 5) I am not interested in any straight programming questions unless a small section of code illustrates some important big picture answer. For instance -- impact on code speed of pipeline, register forwarding.
- 6) My final exams in the regular classroom are typically of the format 6 questions each on one page -- Answer any 4. First part of each question discusses some general idea around the subject area in a short format. Followed by a longer more detailed question. You don't have to follow that format as my requirement is -- demonstrate that you have the knowledge to teach a tutorial on that area to a group of 3rd year students taking a computer engineering course.

My evaluation of your expertise in the FOS will cover both the quality of the questions you propose, and the actual answers to the related questions that I set. I will make up questions based on, but not identical to, your questions.

I feel that inter-student discussion of concepts is a key part of preparing for an exam. If enough people are interested, we can do a short tutorial with interested students -- with you explaining the answer to your questions. I will send all questions proposed to me by all students interested in the computer engineering FOS who have sent me proposed questions.

**Biomedical Engineering (Dr. Kartikeya Murari represents this area on the FoS exam committee)**

The biomedical engineering Field of Study exam is meant for PhD students applying electrical engineering ideas to the fields of biology and medicine. Two main areas where these two fields intersect are:

1. The role of electrical signals in transmitting information in biological systems, such as action potentials and other biopotentials.
2. The role of electrical engineering concepts in measuring aspects of biological systems, such as electrophysiology and imaging.

The exam focuses on a broad understanding of the concepts important in the above areas. It is not meant to test minutiae, specific details or solving applied problems.

**Telecommunications, Signal and Image Processing (Dr. John Nielsen represents this area on the FoS exam committee)**

These exam questions are based on fundamentals of signal processing as applied to analog and digital communications. Specifically the areas covered are:

Random processes, fundamentals of probability and processes, random communications signals.  
Chapter 1 from Communication Systems (4th Ed.), S. Haykin, Wiley.

Modulation, analog and digital, baseband and carrier. Chapters 2-4 from Communication Systems (4th Ed.), S. Haykin, Wiley.

Signal space analysis. Chapter 5 from Communication Systems (4th Ed.), S. Haykin, Wiley

Questions are primarily based on concepts rather than problem details and will be graded accordingly.

**Software Engineering (Dr. Hadi Hemmati represents this area on the FoS exam committee)**

The FoS exam will test your basic knowledge in the areas of software engineering and data structures & algorithms. The exam will focus on material you may expect to find in a typical undergraduate curriculum in computer science/software engineering. The overall goal of the exam is to serve as a "sanity check" to determine your grasp of fundamental concepts in these areas. The emphasis will NOT be on testing you on advanced/niche topics in these areas. Furthermore, the goal is to test your ability to apply concepts as opposed to testing your ability to memorize large volumes of information. Recommended textbooks in the two areas are provided to you as a study guide.

**Study material:**

- P. Morin, Open Data Structures (in Java), <http://opendatastructures.org/ods-java.pdf> — free web-based textbook.. (Ch. 2,3,5,6,11,12)
- Software Engineering, by Ian Sommerville, 10th Edition, Addison-Wesley, 2015 (Ch. 2-9)

**Circuits & Electronics (Dr. Brent Maundy represents this area on the FoS exam committee)**

The circuits and electronics Field of Study exam is meant for Ph.D. students applying electrical engineering circuits and electronics to their fields of study. Two main areas of interest are:

1. A general understanding of first and second order linear circuits and the ability to analyze them using common tools such as Laplace, Fourier transforms and two port networks.
2. A general understanding of bipolar and MOS Transistor circuits.

The exam focuses on a broad understanding of the concepts important in the above areas. It is not meant to test minutiae, specific details or solving applied problems.

**RF Circuits and Electromagnetics (Dr. Rushi Vyas represents this area on the FoS exam committee)**

Resistance, capacitance or inductance using electrostatic and magnetostatic field analysis and vector calculus.

Electric and Magnetic field boundary conditions.

Transmission line theory and matching networks.

RF Amplifier Classes.