FOS Exam Expectations and Study Material (Updated Jan 2020)

Telecommunication, Signal and Image Processing (Dr. Sesay)

Exam Expectation:
These exam questions are based on fundamentals of signal processing as applied to analog and digital communications. Problems are primarily based on concepts rather than problem details and will be graded accordingly. Specifically the areas covered are:

Study Material:
Fundamentals of Probability and Random Processes. Chapter 5 from "Fundamentals of Communication Systems" (2nd Ed.), John G. Proakis Masoud Salehi, Pearson.

Analog-to-Digital Conversion. Chapter 7 (Sections 7.1-7.6) from "Fundamentals of Communication Systems" (2nd Ed.), John G. Proakis Masoud Salehi, Prentice Hall.

Digital Modulation Methods in an Additive White Gaussian Noise Channel. Chapter 8 (Sections 8.1 – 8.7.3) from "Fundamentals of Communication Systems" (2nd Ed.), John G. Proakis Masoud Salehi, Pearson.

Coding for Reliable Communications. Chapter 13 (Sections 13.1- 13.2.3) from "Fundamentals of Communication Systems" (2nd Ed.), John G. Proakis Masoud Salehi, Pearson.

Power and Control Systems (Dr. Nowicki – Power Systems and Dr. Westwick – Control Systems)

Exam Expectation:
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 material will be mostly focused on 3rd and 4th year undergraduate courses such as ENEL 585 (intro to power electronics), ENEL 587 (Power system analysis), ENEL 441 (Control systems). Students are expected to know the fundamental concepts which are covered in the aforementioned courses. In particular the following study material are recommended for exam preparation.

Study Material:
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. Chapters 2, 3, 4, 5, 6, 8 and 13 from Modern Control Systems (12th Ed.), R.C. Dorf, and R.H. Bishop, Pearson.

Software Engineering (Dr. Far)

Exam Expectation:
The FOS exam will test your basic knowledge in the areas of software engineering and data structures and 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 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. Suggested study material:

Study Material:
Databases. Chapters 1-15 from Database Systems: A Practical Approach to Design,

Implementation and Management (6th Ed.), T. Connolly, and C. Begg, Pearson.

Data structures and algorithms. Chapters 2-5, 7, 9, 10 from Data Structures and Algorithm Analysis in Java, M.A. Weiss. Pearson.

Object-oriented design and design patterns. Chapters 1, 2, 4-6, 8-11 from Object oriented software engineering, practical development using UML and Java, T. Lethbridge, and R. Laganiere, McGraw-Hill.

P.Morin, Open Data Structures (in Java), http://opendatastructures.org/ods-java.pdf - free web based text book (Ch. 2,3,5,6,11,12)

Software Engineering bu Ian Sommerville, 10th Edition, Addison Wesley, 2015 (Ch 2-9)

Biomedical Engineering (Dr. Murari)

Exam Expectations:
The biomedical engineering FOS exam is meant for Ph.D. students applying electrical engineering ideas to the fields of biology and medicine. Two main areas where these 2 fields intersect are: 1. The role of electrical signals in transmitting information in biological systems such as action potentials and biopotentials. 2. The role of electrical engineering concepts in measuring aspects of hiological 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.

Study Material:
Sensors and biopotential electrodes. Chapters 2, 5 from Medical Instrumentation: Application and Design (4th Ed.), J.G. Webster, Wiley.

Origin of biopotentials. Chapter 4 from Medical Instrumentation: Application and Design (4th Ed.), J.G. Webster, Wiley.

Biopotential amplifiers and signal processing. Chapters 3, 6 from Medical Instrumentation: Application and Design (4th Ed.), J.G. Webster, Wiley.

Medical Imaging Systems. Chapter 12 from Medical Instrumentation: Application and Design (4th Ed.), J.G. Webster, Wiley.

Circuits and Electronics (Dr. Murari)

Exam Expectations:
The circuits and electronics FOS exam is meant for Ph.D. students applying electrical engineering circuits and electronics to their fields of study. Two main areas of interests are:

1. A general understanding of 1st and 2nd order linear circuits and the ability of analyze them using common tools such as Laplace, Fourier Transforms.
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.

Study Material:
First and second order circuits. Chapters 7, 8 from Fundamentals of Electric Circuits (5th Ed.), C. Alexander, and M. Sadiku, McGraw-Hill.

Frequency response, Fourier and Laplace transforms. Chapters 14-17 from Fundamentals of Electric Circuits (5th Ed.), C. Alexander, and M. Sadiku, McGraw-Hill.

Bipolar and MOS Transistor circuits. Chapter 7 from Microelectronic Circuits (7th Ed.), A.S. Sedra, and K.C. Smith, Oxford University Press.

Computer Engineering (Dr. Mike Smith)

Exam Expectations:

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 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

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 if 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.

Study Material:
Review of computer architecture, microcontrollers and their instruction sets; Interfacing using common input/output devices – e.g. SPI, GPIO; Strategies for interrupt handling and exception handling; Interfacing combining code using functions implemented in high level and assembly languages; Real time operating systems; Software and hardware optimizations to achieve real time operations; Processor characteristics needed to match the requirements for typical DSP applications; Hardware and software optimization techniques including multiple busses; Super-scalar and other highly parallel instruction sets, critical timing paths; Optimizing compilers and multi-processor operation. Digital Design and Computer Architecture (2nd Ed.), by D. Harris, and S.L. Harris, Morgan Kaufmann Publishers.

Interrupt handling, DMA and interfacing. Source material TBD.

RF Circuits and Applied Electromagnetics (Dr. Vyas)

Exam Expectations:
Resistance, capacitance or inductance using electrostatic and magnetostatic field analysis and vector calculus. Electricl and magnetic fields boundary conditions. Transmission line theory and matching networks. RF Amplifier Classes.

Study Material:
Electromagnetic fields and waves. Chapters 4, 5, 7-12 from Elements of Electromagnetics (6th Ed.), M. Sadiku, Oxford.

Microwave amplifiers. Chapters 2-4 from Microwave Transistor Amplifiers: Analysis and Design (2nd Ed.), G. Gonzalez, Prentice Hall.

RF and Microwave Circuits. Chapters 1-7, 10, 12 from Microwave Engineering (4th Ed), David M.Pozar, Wiley.