# Ph.D. Diagnostic and ME Comprehensive Examination
# Fall 2016
Last updated on 8/23/16

## Examination Guidelines

- The examination is "closed-book" and no formula sheet is allowed.  Some questions include reference formulas.  A scientific calculator is allowed.
- This is a four-hour examination.
- M.E. students need to answer five questions, but no more than two from the mathematics group. The ME students' responses are graded at a master's level.
- Ph.D. students need to answer eight questions, but no more than three from the mathematics group. The Ph.D. students' responses are graded at a doctoral level.
- The answers to only five (M.E.) or eight (Ph.D.) questions need to be turned in separate blue books.
- Students need to abide by Old Dominion University's honor pledge. No material shall be shared without prior permission of the proctor(s).
- Copies of sample examinations are available at **https://www.odu.edu/ece/students/graduate**

## Examination Topics

| Problem | Topic | Suggested Text and Chapters or Topics | Primary Faculty Member(s) |
|---|---|---|---|
| A1 | **MATH** Complex Variables and Differential Equations | Complex functions, analyticity & the Cauchy-Riemann equations, contour integration & the residue theorem, linear differential equations with constant coefficients, integrating factors, initial-value problems, method of undetermined coefficients, power series solutions. <br> 1) "Complex Variables and Applications," 3rd Edition, J. W. Brown and R. V. Churchill, McGraw-Hill, 1995, Chapters 1 – 7. <br> 2) "Elementary Differential Equations and Boundary Value Problems" 9th ed., W. E. Boyce and R. C. DiPrima, Wiley, 2008, Chapters 1 – 6. | Dr. Xiao |
| A2 | **MATH** Vector Calculus | "Advanced Engineering Mathematics," E. Kreyszig, 10th ed., Wiley 2011, Chapters 9 – 10 | Dr. Zemlin |
| A3 | **MATH** Linear Algebra | 1) "Linear Algebra with Applications," G. Williams, Jones and Bartlett Publishers 2010. Chapters 1 – 5. <br> 2) "Linear Algebra and Its Applications," G. Strang, 4th edition, Brooks/Cole Publishing 2006, Chapters 1 – 6. | Dr. Popescu |
| A4 | **MATH** Probability | "Probability and Statistics" A. Papoulis, Prentice Hall, 1990, Chapters 1 – 6, 8, 9. | Dr. Gray |

## CIRCUITS & ELECTRONICS

| | | | |
|---|---|---|---|
| **B1** | **CIRCUITS** Sinusoidal Steady State Analysis | "Electric Circuits," J. W. Nilsson & Susan A. Riedel, $9^{th}$ ed., Prentice Hall, Chapters 7 – 10. | Dr. Lakdawala |
| **B2** | **CIRCUITS** Circuit Analysis with the Laplace Transform | "Electric Circuits," J. W. Nilsson & Susan A. Riedel, $9^{th}$ ed., Prentice Hall, Chapter 13. | Dr. Lakdawala |
| **B3** | **ELECTRONICS** | "Microelectronic Circuits," A. S. Sedra and K. C. Smith, $5^{th}$ ed., Oxford Univ. Press, New York, 1998. Chapters: 2-5. | Dr. Namkoong |

## SYSTEMS, SIGNAL AND IMAGE PROCESSING

| | | | |
|---|---|---|---|
| **C1** | **IMAGE PROCESSING** | "Digital Image Processing," R. C. Gonzalez and R. E. Woods, $3^{rd}$ ed., Prentice Hall, 2007, Chapters 1 – 4. | Dr. Krusienski |
| **C2** | **DIGITAL SIGNAL PROCESSING** Discrete-Time System Analysis | "Linear Systems and Signals," B. P. Lathi, $2^{nd}$ ed., Oxford, 2005, Chapters 3, 5. | Dr. Li |
| **C3** | **DIGITAL SIGNAL PROCESSING** Sampling and Fourier Analysis of Discrete-Time Signals and Systems | "Linear Systems and Signals," B. P. Lathi, $2^{nd}$ ed., Oxford, 2005, Chapters 8, 9. | Dr. Li |
| **C4** | **CONTROL SYSTEMS** | "Control Systems Engineering," N. S. Nise, $6^{th}$ ed., Wiley, 2011, Chapters 2 – 11, Secs. 12.1 – 12.2. | Dr. González |
| **C5** | **COMMUNICATION SYSTEMS** | "Fundamentals of Communication Systems," J. G. Proakis and M. Salehi, Pearson/Prentice-Hall, 2005. Chapters 1 – 7. | Dr. Popescu |
| **C6** | **COMMUNICATION NETWORKS** | • Data Link Layer error detection and correction methods <br> • Sliding window protocols <br> • Multiple access protocols (Aloha variants, CSMA with CD/CA) <br> • Routing algorithms (Link State, Distance Vector, RIP, OSPF) <br> • TCP congestion control <br><br> 1) "Computer Networks," A. S. Tanenbaum, Prentice Hall, $5^{th}$ Ed., 2011, Sections 3.1 – 3.4, 4.1 – 4.2, 5.1 – 5.6, 6.2, 6.4, 6.5. <br> 2) "Computer Networking: A Top-Down Approach," J. F. Kurose and K. W. Ross, $5^{th}$ ed., 2010 Chapters 1, 3 – 5. | Dr. Xin |

| | **PHYSICAL ELECTRONICS I** | | |
|---|---|---|---|
| **D1** | **ELECTROMAGNETICS** Maxwell Equations, Propagation, Reflection and Transmission of Plane waves | "Applied Electromagnetism," L. C. Shen and J. A. Kong, 3$^{rd}$ ed., Cengage Learning, Chapters 2 – 4. | Dr. Jiang |
| **D2** | **ELECTROMAGNETICS** Electrostatics | "Applied Electromagnetism," L. C. Shen and J. A. Kong, 3$^{rd}$ ed., PWS Foundation Engineering Series, Chapters 9 – 10. | Dr. Namkoong |
| **D3** | **LASERS** | "Laser Electronics," J. T. Verdeyen, 3$^{rd}$ ed., Prentice Hall, 1995, Chapters 6 – 11. | Dr. Elsayed-Ali |
| **D4** | **OPTICAL FIBER COMMUNICATIONS** | 1) "Optoelectronics," Wilson & Hawks, Prentice Hall, 3$^{rd}$ ed., 1998, Chapters 4, 7, and 8. 2) "Optical Fiber Communication," McGraw Hill, 4$^{th}$ ed., 2011, Chapters 1 – 4, 6 & 7, 11. | Dr. Laroussi |
| | **PHYSICAL ELECTRONICS II** | | |
| **E1** | **SOLID STATE ELECTRONICS** | "Semiconductor Devices," S. M. Sze, Wiley, 2$^{nd}$ edition 2001, Chapters 4 – 9. | Dr. Baumgart |
| **E2** | **PHYSICAL ELECTRONICS** | "Semiconductor Devices," S. M. Sze, Wiley, 2$^{nd}$ edition 2001, Chapters 1 – 4. | Dr. Marsillac |
| **E3** | **PLASMA SCIENCE AND DISCHARGES** | Maxwell-Boltzmann distribution, plasma frequency, Debye-shielding, drift, diffusion, plasma conductivity, waves in plasmas with no B field, reaction rates, particle dynamics. 1) "Introduction to Plasma Physics," F. F. Chen, Plenum Press, 1974. 2) "Principles of Plasma Discharges and Materials Processing," M. A. Lieberman and A. J. Lichtenberg, 2$^{nd}$ ed., Chapters 2 – 6, 14. | Dr. Laroussi |

| | | COMPUTER SYSTEMS | |
|---|---|---|---|
| **F1** | **MICROPROCESSORS** | • Ch. 1. Microprocessor systems, microcontrollers and integrated peripherals.<br>• Ch. 2.Programming microprocessors, assembly language programming, programmer's model, instruction set architecture, addressing modes, structured programming and pseudocode.<br>• Ch. 3. Assembly language parameter passing, using the stack and local variables, subroutines.<br>• Ch. 4. Microprocessor interfacing, dealing with timing problems, assembly coding for speed, pulse-width modulation.<br>• Ch. 5. Memories in microprocessor systems, program and data memory, efficient assembly coding for small memories.<br>• Ch. 6. Interrupts, exception handling, real-time processing.<br><br>"Microprocessor Systems Design: 68000 Hardware, Software, and Interfacing," A. Clements, PWS Publishing Company, 1997. | Dr. Belfore |
| **F2** | **DIGITAL SYSTEM DESIGN** | 1) "The designer's guide to VHDL," P. Ashenden, Morgan-Kaufman, 3rd ed., 2008. (VHDL reference)<br>2) "VHDL & Computer Design Fundamentals," M. Mand & C. Kime, 4th ed., Prentice Hall, 2008, Chapters 1 – 9.<br>3) "Digital Design Using VHDL," C. H. Roth and L.K. John, 2nd ed., Cengage Learning, 2007, Chapters 1 – 5, 8, 9. | Dr. Belfore |
| **F3** | **COMPUTER ARCHITECTURE** | • Ch. 2: Architecture Classification, Instruction Set Architecture<br>• Ch. 3: Number systems and arithmetic, IEEE (standard 754) floating point arithmetic.<br>• Ch. 4: Datapath and controller design, Pipelining - design, hazards, dependency resolution schemes<br>• Ch. 5: Memory system design, MMUs, caches and hierarchies, replacement policies. | Dr. Chen |
| **F4** | **ALGORITHMS** | "Introduction to Algorithms," T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein, 3rd ed., MIT Press, 2009, Chapters 2 – 4, 7, 9. | Dr. Belfore |
| **F5** | **DATA STRUCTURES**<br>Stacks, queues, and linked lists.  Binary trees. | • Comparison of elementary data structures such as stacks, queues, and linked lists<br><br>"Data Structures with C++ Using STL," W. Ford and W. Topp, 2nd ed., Prentice Hall, 2002, Chapters 5 – 13. | Dr. Chen |
| **F6** | **LOGIC/DIGITAL CIRCUITS** | Digital Design and Computer Architecture, Second Edition,  2012, by David Harris  and Sarah Harris | Dr. Xin |