QE TOPICS AND REFERENCES

The student is responsible for reading the ECE document "Rules and Procedures for the Ph.D. Qualifying Examination."

AUTOMATIC CONTROL

AC-1 Linear Systems

- *Modern Control Engineering*, by K. Ogata, Fourth Edition, Prentice Hall, Upper Saddle River, 2002, Chapters 1--10

AC-2 LTI and LT Systems---State-Space Approach

- *Linear Systems Theory and Design*, by Chi-Tsong Chen, Oxford University Press, (1999). ISBN #0-19-511777-8
- Lecture notes from ECE 602

AC-3 Optimization

- *An Introduction to Optimization*, by E.K.P. Chong and S.H. Zak, John Wiley and Sons, second edition, (2001).

BIOMEDICAL IMAGING AND SENSING

BE-1 Principles of Imaging

Coverage: Physical principles underlying medical imaging systems and associated mechanisms of image formation, with emphasis on radiographic, nuclear and magnetic resonance techniques.

Recommended Reading:

1. Medical Imaging Signals and Systems, by Jerry L. Prince and Jonathan M. Links, Pearson Prentice Hall (2006), Chapters 4-9, 12-13.
2. Principles of Magnetic Resonance Imaging, by Zhi-Pei Liang and Paul C. Lauterbur, IEEE Press (2000), Chapters 2-5.
3. Introduction to Biomedical Imaging, by Andrew Webb, Wiley Interscience (2003), Chapters 1, 2, 4.

BE-2 Biomedical Instrumentation (not offered for the August 2008 QE—to be offered in the future)

Coverage: Principles and circuits underlying measurement of important physiological parameters with emphasis on electrodes, biopotential measurements, safety, non-invasive measurements.

Recommended Reading:

1. Medical Instrumentation, by John G. Webster, Wiley (1997), chapters 1,2, 3, 5,6, 10, 14.

2. Principles of Applied Biomedical Instrumentation, 3rd Edition, L.A. Geddes and L.E. Baker, John Wiley, 1989

BE-3 Biomedical Signal Processing

Coverage: Application of signal processing concepts and algorithms to measurement, amplification, filtering and transformations of signals in a biological context; emphasis on linkage between physiology, measurement systems and the obtained measurements.

Recommended Reading:

1. Introduction to Digital Signal Processing, 3rd Edition, J. G. Proakis and D. G. Manolakis, Prentice Hall (1996).

2. From Neuron to Brain, John G. Nicholls *et al*., Sinauer Associates (2001), Chapters 1-2, 5-7, 17-22

3. Bioelectrical Signal Processing in Cardiac and Neurological Applications, Leif Sörnmo and Pablo Laguna, Academic Press (2005), Chapters 3-4, 6-7.

COMMUNICATIONS & SIGNAL PROCESSING

CS-1 Probability and Random Processes

Coverage: Events, independence, random variables, distribution and density functions, expectations, and characteristic functions, dependence, correlation, and regression, multi-variate Gaussian distribution, stochastic processes, stationarity, ergodicity, correlation functions, spectral densities, random inputs to linear systems, Gaussian processes.

Recommended Reading:

1. Probability, Random Variables, and Stochastic Processes, 4th Edition, Papoulis, McGraw-Hill, 2002

CS-2 Signal Processing

Coverage: Discrete signals, systems, and transforms, linear filtering, fast Fourier transform, nonlinear filtering, spectrum estimation, linear prediction, adaptive filtering, and array signal processing.

Recommended Reading:

1. Introduction to Digital Signal Processing, 3rd Edition, J. G. Proakis and D. G. Manolakis, Prentice Hall, 1996

CS-3 Communications

Coverage: Analog and digital communication systems; analog message digitization, signal space representation of digital signals, binary and M-ary signalling methods, detection of binary and M-ary signals, comparison of digital communication systems in terms of signal energy and signal bandwidth requirements.

Recommended Reading:

1. Principles of Communication, 5th Edition, Ziemer and Tranter, John Wiley & Sons, Inc., 1990

2. Introduction to Digital Communications, Michael B. Pursley, Prentic Hall, 2004

CS-4 Networking

Coverage: Design, analysis and operation of computer communication and telecommunication networks; packet and circuit switching, the OSI standards architecture and protocols, elementary queueing theory for performance evaluation, random access techniques, local area networks, reliability and error recovery, and integrated networks.

Recommended Reading:

1. Telecommunication Networks: Protocols, Modeling and Analysis, M. Schwartz, Prentice-Hall, 1987

2. Communication Networks Fundamental Concepts and Key Architectures, 2nd Edition, Leon-Garcia, McGraw Hill, 2003

CS-5 Image Processing

Coverage: Digital image processing techniques for enhancement, compression, restoration, reconstruction, and analysis; 2-D signals and systems, image analysis, image segmentation; achromatic vision, color image processing, color imaging systems, image sharpening, interpolation, decimation, linear and nonlinear filtering, printing and display of images; image compression, image restoration, and tomography.

Recommended Reading:

1. Handbook of Image & Video Processing, Al Bovik, Academic Press, San Diego, 2000

COMPUTER ENGINEERING

CE-1 Theory

- *Introduction to Algorithms, Second Edition*
  by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, 1184 pages. Publisher: The MIT Press; 2nd edition (September 1, 2001) ISBN: 0262032937. Chapters 2, 3, 4, 5, Section II except for Chapter 9, 11, 12.1, 12.2, 12.3, Part IV introduction, Chapters 15.1, 15.2, 15.3, 16.1, 16.2, 16.3, 22, 23, 24, 25.1, 25.2 and 34.

CE-2 Compilers

- Crafting a Compiler with C, Charles N. Fischer and Richard J. LeBlanc, Jr. 812 pages. Publisher: Addison Wesley (July 1, 1991) ISBN: 0805321667. Chapters 2.4, 3, 4, 5 (except for 5.7), 6.1, 6.2, 6.6, 7, 8, 9, 10.1, 10.2, 11.1, 11.2, 12.1, 12.2, 12.3, 12.4, 13, 15 (except for 15.8) and 16.
- The paper: Automatic program parallelization, Banerjee, U.; Eigenmann, R.; Nicolau, A.; Padua, D.A. Proceedings of the IEEE, Volume: 81 , Issue: 2 , Feb. 1993 Pages:211 - 243 Available through http://www.lib.purdue.edu/.

CE-3 Artificial Intelligence (will not be offered August 2008)

- *Artificial Intelligence: A Modern Approach,* by Stuart Russell and Peter Norvig. pp.1-723. first edition, Prentice-Hall, (1995). ISBN 0-13-103805-2.

CE-4 Architecture

- *Computer Architecture: A Quantitative Approach*, by John L. Hennessy and David A. Paterson, Morgan Kaufmann Publishers, fourth edition, (2007). Chapters 1 through 6 and Appendix A, B, and C. **Note that Chapter 4 is new material compared to past offerings.**

CE-5 Operating Systems (to be offered in future semesters)

ENERGY SOURCES & SYSTEMS

ES-1 Energy Conversion and Reference Frame Theory

- Analysis of Electric Machinery and Drive Systems, by P.C. Krause, O. Wasynczuk, and S. D. Sudhoff, Chapters 1 and 3 IEEE Press, (2002).

ES-2 Electric Machinery (Induction, PM, Wound-Rotor Synchronous)

- *Analysis of Electric Machinery and Drive Systems,* by P.C. Krause, O. Wasynczuk, and S. D. Sudhoff, Chapters 4, 5 and 6, IEEE Press, (2002).

ES-3 Power Electronics and Electric Drives

- *Analysis of Electric Machinery and Drive Systems,* by P.C. Krause, O. Wasynczuk, and S. D. Sudhoff, Chapters 11 and 13, IEEE Press, (2002).

FIELDS & OPTICS

FO-1 Statics 1

Topics may include but are not limited to:

Electrostatics
Magnetostatics
Energy and Force Relations
Boundary Conditions
Quasistatics – L, C, R derivations

- David Chang, Field and Wave Electromagnetics, Chapters 1-6.

FO-2 Dynamics 1 : Propagation, transmission and radiation

Topics may include but are not limited to:

Planewaves
Antennas
Arrays
Waveguides
Interference
T-lines
Boundary Conditions

- David Chang, Field and Wave Electromagnetics, Chapters 7-11

FO-3 Dynamics 2 : Time Varying Fields and Maxwells Equations

Topics may include but are not limited to:

Displacement Current
Faraday's Law
Separation of variables
Boundary conditions
Image theory

- David Chang, Field and Wave Electromagnetics, Chapters 7-11

MICROELECTRONICS & NANOTECHNOLOGY

(formerly Solid State Devices & Materials (SS)

MN-1 Semiconductor Fundamentals

- R. F. Pierret, Advanced Semiconductor Fundamentals, Vol. VI in the Modular Series on Solid State Devices, 2nd edition, Prentice Hall, © 2003.

- R. F. Pierret, Semiconductor Device Fundamentals, Addison-Wesley, © 1996; Chapters 1-3, Appendix A.

MN-2 Junction Devices

(pn junction diodes, optoelectronic diodes, Bipolar Junction Transistors, Heterojunction Bipolar Transistors, Schottky diodes, and related basic fabrication issues)

- R. F. Pierret, *Semiconductor Device Fundamentals,* Addison-Wesley, © 1996; Chapters 4-11, 14.

MN-3 Field Effect Devices

(MOS-Capacitor, MOSFET, and basic fabrication issues)

- R. F. Pierret, *Semiconductor Device Fundamentals*, Addison-Wesley, © 1996; Chapters 16-19.

VLSI & CIRCUIT DESIGN

VC-1 Modeling, Analysis, and Design of Transistors/Inverters/Logic Gates

- Semiconductor Device Fundamentals, R. F. Pierret, Prentice-Hall, 1996, ISBN No. 0-201-54393-1.

- Digital Design Principles and Practices, 3rd Edition, John Wakerly, Prentice Hall, ISBN No. 0-13-769191-2.

- Digital Integrated Circuits: A Design Perspective, 2nd Edition, Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, Prentice Hall, 2003, ISBN No. 0-13-090996-3.

VC-2 Modeling, Analysis, and Design of Combinational/Sequential Logic

- Digital Design Principles and Practices, 3rd Edition, John Wakerly, Prentice Hall, ISBN No. 0-13-769191-2.

- Digital Integrated Circuits: A Design Perspective, 2nd Edition, Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, Prentice Hall, 2003, ISBN No. 0-13-090996-3.

- Synthesis and Optimization of Digital Circuits, Giovanni De Micheli, McGraw-Hill College, 1994, ISBN-10: 0070163332, ISBN-13: 9780070163331.

VC-3 Modeling, Analysis, and Design of Single-Stage Amplifiers/Differential Amplifiers/Operational Amplifiers

- Analog Integrated Circuit Design, David Johns & Ken Martin, Wiley, ISBN 0-471-14448-7.

- Design of Analog CMOS Integrated Circuits, Behzad Razavi, McGraw Hill, ISBN 0-07-238032-2.

- Microelectronic Circuits, Adel Sedra & Kenneth Smith, Oxford, ISBN 0195142519.