PhD PRELIMINARY WRITTEN EXAMINATION READING LIST

COMMUNICATIONS
Textbook example: R. Ziemer and W. Tranter, "Principles of Communications", Wiley
Typically covered in a course such as EE4501 Communications Systems.

SIGNAL PROCESSING
Typically covered in a course such as EE4541 Digital Signal Processing.
Review of linear discrete time systems and sampled and digital signals; Fourier analysis, discrete and fast Fourier transforms; interpolation and decimation; design of analog, infinite-impulse response and finite impulse response filters; quantization effects.

CONTROLS
Textbook example: C.F. Franklin, J.D. Powell, and A. Emami-Naeini, "Feedback Control of Dynamic Systems", Addison-Wesley
Typically covered in a course such as EE4231 Linear Control Systems: Designed by Input/Output Methods.

ANALOG AND DIGITAL ELECTRONICS
Textbook example: Sedra and Smith, Microelectronic Circuits", Oxford Univ. Press
Typically covered in a course such as EE 3115 Analog and Digital Electronics.

SEMICONDUCTOR MATERIALS
Textbook example: Neaman, "Semiconductor Physics and Devices"
Typically covered in a course such as EE 5163 Semiconductor Properties and Devices I.

SEMICONDUCTOR DEVICES
Textbook example: Pierret, "Semiconductor Device Fundamentals", Addison-Wesley
Typically covered in a course such as EE3161 Semiconductor Devices.
Elementary semiconductor physics; physical description of pn junction diodes, bipolar junction transistors, field-effect transistors.
OPTICS

- Typically covered in a course such as EE5624: Optical Electronics. Fundamentals of lasers, including propagation of Gaussian beams, optical resonators, ABCD matrix methods, basic interactions between light and atomic systems, and theory of laser oscillation. Polarization optics, Jones calculus, optics of crystals, electro-optic modulation, acousto-optic modulation.

FIELDS AND TRANSMISSION LINES
- Typically covered in a course such as EE3601 Transmission Lines and Fields. Transmission lines, sinusoidal and time domain excitation. Electrostatic and magnetostatic fields, interaction with dielectric and magnetic materials. Time-varying electromagnetic fields. Propagation and reflection of electromagnetic waves. Metallic and optical wave guides, and antennas.

POWER SYSTEMS AND POWER ELECTRONICS
AND

- Typically covered in a course such as EE4721 and EE 4741 (question will cover material from both courses).

EE 4721. Introduction to Power System Analysis.
AC power systems; analysis of large power system networks; mathematics and techniques of power flow analysis, short circuit analysis, and transient stability analysis; use of a power system simulation program for design. Integral lab.

EE 4741. Power Electronics.
Switch-mode power electronics; switch-mode DC power supplies; switch-mode converters for DC and AC motor drives, wind/photovoltaic inverters, interfacing power electronics equipment with utility system; power semiconductor devices, magnetic design, electro-magnetic interference (EMI). Integral lab.
Software
SOFTWARE

The software exam tests facility and skill in computer programming in high-level languages such as C, C++, and Matlab, including the basics of compilation and program building. It also tests knowledge of basic data structures (eg., trees, linked lists, hash tables, etc.) and fundamental algorithms (such as sorting, graph traversal, etc.).

Textbook examples:


Relevant courses:

1. EE 4940: Practical Programming and Scripting for Engineers/Scientists

2. CSci 4041: Algorithms and Data Structures
COMPUTER AIDED DESIGN

Syllabus:


Textbook examples:


AND


Relevant courses:

The CAD WPE exam tests the application of concepts learned in UG courses such as Linear Systems and Circuits (EE2011), Signals and Systems (EE3015) and Semiconductor Devices (EE3161). The syllabus for the CAD WPE is also covered in the introductory graduate-level CAD course sequence EE5301 and EE5302. (For EE5302, only material taught in the first 8 weeks of class are relevant to the CAD WPE).

Web page:

- Further details relevant to the syllabus for the CAD WPE are at: https://potol.ece.umn.edu/CAD-WPE/
**COMPUTER ARCHITECTURE**

AND


► Typically covered in a course such as EE5361 Computer Organization and Design

Introduction to computer architecture. Aspects of computer systems, such as pipelining, memory hierarchy, and input/output systems. Performance metrics. Examination of each component of a complicated computer system.

Digital Design

AND

"Digital Systems Design using VHDL", Charles H. Roth, Jr., PWS Publishing Co. [The questions will be related to design concepts but not to the specifics of any hardware description language.]

► Typically covered in courses such as: EE 2301 & EE4301

EE 4301. Digital Design with Programmable Logic.
Introduction to system design and simulation. Design using VHDL code and synthesis. Emulation using VHDL code.


**MAGNETICS**

Typically covered in a courses such as: EE 5653

Physics of diamagnetism, paramagnetism, ferromagnetism, antiferromagnetism, ferrimagnetism; ferromagnetic phenomena; static and dynamic theory of micromagnetics, magneto-optics, and magnetization dynamics; magnetic material applications..