CISE Ph.D. Qualifying Exam Syllabus Systems Area

Introduction
The system area covers three sub-areas in computer architecture, programming language, and operating system with the following topics.

Computer Architecture
- Trends in technology, area, power, performance and reliability
- Instruction-set architecture
- Processor pipeline and advanced micro-architecture issues
- Memory hierarchy
- Multiprocessor and multicore architectures
- I/O subsystems including storage systems
  Crosscutting issues: architecture, compiler and operating systems

Programming Language Principles
- Programming language syntax: context-free grammars and parsers
- Names, scope, and binding
- Data types and data abstraction
- Control flow and procedural abstraction
- Block structure and activation records
- Programming language paradigms: imperative, object-oriented, functional, logic, concurrent
- Programming language semantics: operational, attribute grammars, denotational, axiomatic

Operating System
- Concurrent processes/threads
- Client/server and object models
- Shared-memory interprocess communication
- Message-passing interprocess communication
- Remote procedure call and remote object invocation
- Distributed synchronization: mutual exclusion and leader election
- Naming and location services
- Memory consistency and data coherency
- Security: cryptography, mutual authentication protocols, distributed access control

Relevant Courses
- CDA 5155 – Computer Architecture Principles
- COP 5555 – Programming Language Principles
- COP 5615 – Distributed Operating System Principles

Reading List (latest available edition of all listed books)
- Computer Architecture: A Quantitative Approach, John L. Hennessy and David Patterson, Morgan Kaufmann Publishers.

- Programming Languages: Principles and Practice, K.C. Louden, Thomson Brooks/Cole
- Programming Language Pragmatics, M. L. Scott, Morgan Kaufmann Publishers.
- Formal Syntax and Semantics of Programming Languages, K. Slonneger and B. L. Kurtz, Addison Wesley.
- Distributed Systems: Principles and Paradigms, Andrew Tanenbaum and Maarten van Steen, Prentice Hall.
- Distributed Operating Systems and Algorithms, Randy Chow and Theodore Johnson, Addison-Wesley.