Syllabus for ECE Qualifying Examination
Subject Area: Computer Systems

Helpful Resources:
The area exam will cover the topics listed below. The following resources may be helpful in studying the topics.

- **Cornell Undergraduate Courses:** ECE2400, ECE3140, CS4410, [CS4450]

Programs:
Instruction set architectures: instruction encoding, register organization, endianness, control flow; compiling, linking, and loading.

Calling conventions and Stack:
Parameter-passing conventions; stack structure; stack frame.

Interrupts and Exceptions:
Polling; interrupts; exceptions; software traps; system calls.

Process Management:
Time-sharing; context switching; scheduling: FCFS, round-robin, priority, SJF; aperiodic real-time: EDD/EDF; periodic real-time; rate-monotonic scheduling; inter-process communication.

Memory Management and Storage:
Program layout, stack, heap; Memory protection, translation, and virtualization: base/bound, paging, segmentation; TLB; virtual memory; memory allocation; basic I/O; storage.

Concurrency:
Critical sections; atomicity; mutual exclusion, progress, fairness; locks and monitors; RMW operations, t&s; ticket lock; semaphores; wait/signal; Hoare vs. Mesa semantics; readers and writers; producers and consumers; priority inversion, PIP, PCP.

Networking:
End-to-End argument, Physical networking: wireless, circuit-and packet-switched, mobile networks; data link: MAC addresses, error correcting codes; medium access: ethernet, wireless LANs, bridging; network layer: routing, congestion control, QoS; transport layer: sockets, UDP, TCP; application layer: remote procedure calls, DNS; security: basic crypto, symmetric key algorithms, public key, digital signatures, key management, firewalls/IPSec, authentication protocols, web security (SSL).

Note:
It is not enough just to be able to describe concepts; you will need to be able to apply concepts in new contexts, and also be able to evaluate design alternatives.