**FINAL EXAM – WEDNESDAY, NOVEMBER 18th, 5:00-7:00PM**

* **Final Project Q&A**
* **Final Exam Review**
* Characteristics of traditional operating systems
* Characteristics of real-time operating systems
* Key components of an RTOS
* Determinism vs non-determinism
* Latency
* Preemptive vs non-preemptive (cooperative) scheduling
* Round-robin scheduling of tasks with the same priority
* Deciding between using an RTOS and bare-metal programming
* Embedded vs real-time
* Scheduler analog in bare-metal programming
* Task analog in bare-metal programming
* Task priority, yielding to the scheduler
* Task stack and its significance
* Semaphores
* Queues, FIFOs, LIFOs
* Mutexes
* Timers
* Handles
* Blocking concepts, checking vs letting the scheduler do the work
* Writing the code in a task versus in a bare-metal state machine
* RTOS hazards – priority inversion and deadlock
* Priority inheritance
* Deadlock solutions
* HAL, BSP
* Linker segments
* Re-entrant functions
* Bluetooth Classic, Bluetooth Low Energy
* Issues with 2.4GHz (water, body can absorb this signal)
* Battery operating lifetime calculations, BLE low duty cycle of transmit, receive
* BLE software architecture (stack)
* BLE standard Host Controller Interface, ST Micro Application Command Interface
* BLE Central vs Peripheral vs Broadcaster vs Observer vs Client vs Server
* BLE states – advertising, discovery, connected
* BLE beacons and their application
* AWS IoT concepts – thing, device gateway, device shadow
* MQTT pub/sub model, role of broker, why it’s suited to IoT devices
* MQTT vs a message queue
* MQTT last will and testament feature
* MQTT topics and message filtering
* JSON concepts – name/value pairs, strings, numbers, objects, arrays, true, false, null
* TCP/IP network stack layers, protocols
* MAC addresses, OUI section, manufacturer-assigned address section
* Error detection methods
* WiFi encryption standards
* Socket concepts – establishing a socket as a client, as a server
* Encryption methods, advantages, used together
* MIM attack
* Test plan and report elements
* Review lesson notes
* Review quizzes
* Review assignments

**Class Notes**