Walla Walla University
CPTR-480 - Programming Embedded and Real Time Systems
Spring 2022, 4 credits

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Textbooks: Embedded Systems Fundamentals with ARM Cortex-M based Microcontrollers
A Practical Approach FRDM-KL25Z edition
by Alexander Dean (the book you used in ENGR-355).

[1] NXP Kinetis KL25 processor sub-family data sheet
[2] NXP Kinetis KL25 processor sub-family reference manual
        (Accessible on the class webpage where [1] and [2] are reference
        numbers shown on the class web page for these documents and which
        will be used to refer to them)

References: Freescale ARM Cortex-M Embedded Programming, 2ed
by Mazidi & Naimi. ISBN- 978-0997925982

General
 Description: The focus of this class is on the design, coding, and testing of software for
embedded systems for which time constraints are paramount. Software will target
an NXP KL25Z microcontroller interfaced to a variety of sensors etc.

Bulletin
 Description: Introduction to programming for embedded platforms running real-time
operating systems. Students will use cross-compilers and debuggers to write and
optimize code for embedded systems. Students will also write device drivers and
other programs which utilize real-time scheduling and inter-task communication.

Objectives: 1) Understand basics of software concurrency
2) Understand the architecture of an ARM Cortex M series CPU
3) Understand interrupts and interrupt handlers
4) Understand concurrent programming
5) Understand microcontroller I/O interfaces
        including timers, DMA, SPI, I2C, UARTs, A/D, D/A, etc.
6) Design and implement a significant time critical application.

Handouts: Occasionally there will be "handouts" that extend or clarify material covered in
the textbook. Unless stated otherwise, **you are responsible for the content of
these handouts** (typically they will be posted on the class web page)

Assignments: Homework and other assignments will be posted on the class web page. When
reading assignments are given **you are expected to read** them prior to the class
period they are listed for. ***Read!!!*** I expect it. Written assignments are due at the
start of class.

Late work: Not accepted unless one of the following conditions is met (but do inform me if you are getting behind or have questions) :
    a) A valid medical reason exists
    b) You confer in advance with the instructor and receive an ok.

Cheating: Will be rewarded. With scores of zero. And a possible F for the quarter. I expect anything you turn in for grading to be your work and represent your understanding of the material.

Grading:

Homework (& quizzes)	25%
Labs and project	35%
Exam I	20%
Exam II	20%

The instructor reserves the right to shift this distribution to best serve the needs of the class. Scoring generally follows 90,80,70,60% for A,B,C,D but scores may be curved when needed.

Missed exams will receive a score of zero and cannot be made up.

Exams: There will be two exams but no final. Show and tell at final exam time (required)

Homework: To promote good problem solving and facilitate grading, I require that the following guidelines be followed for hardcopy papers:
- Solutions are to be neatly written on engineering paper, sheets folded together lengthwise, and stapled. The following must be on the outside of the folded papers:
    CPTR 480
    your name
    assignment number
    due date
- The problem number must be clearly stated for each problem.
- Each problem solution must begin with a statement of the problem.
- Work must be neat and readable.
- Templates should be used for drawing logic diagrams
- Work you submit must be your own. Consultation with friends regarding concepts is expected when doing homework but solutions to assigned problems are to be your own work. This is also true for lab assignments when individual submissions are specified. There may be team submissions for some labs. Read lab assignment statements carefully.

See the Engineering Department Professionalism handout.

Class Time: Class meets at 10am MWF in CSP-164 (or CSP-316 on occasion)
Labwork: Lab on Tuesdays 2 to 5pm in CSP-316, the Digital Lab

Disability: If you have a physical and/or learning disability and require accommodations, please contact the Disabilities Support Services office at 527-2366 and also inform the instructor.

Walla Walla University (WWU) is a Seventh Day Adventist institution of higher education

Bulletin description of this class:
> Introduction to programming for embedded platforms running real-time operating systems. Students will use cross-compilers and debuggers to write and optimize code for embedded systems. Students will also write device drivers and other programs which utilize real-time scheduling and inter-task communication.

WWU Integrity policy:
> www.wallawalla.edu/academics/academic-administration/academic-policies/academic-integrity-policy/

WWU Emergency information
> WWU is committed to having a safe campus. Emergency information is at:
> www.wallawalla.edu/campus-life/student-life/campus-security

WWU Disability accomodations
> In addition to the phone number listed above, see:
> www.wallawalla.edu/?id=4318

WWU Title IX sex discrimination and sexual misconduct policy
> WWU prohibits all forms of sex discrimination and sexual misconduct including, but not limited to, sex-based intimidation and harassment, sexual harassment, domestic violence, dating violence, stalking and sexual violence. If you have been subjected to, or are aware of, an instance of sex discrimination or sexual misconduct, you are highly encouraged to report it to the Title IX coordinator, through the Title IX webpage, or by calling (509) 527-2141. The University has resources to help.
> Title IX coordinator email address: Erika.Sanderson@wallawalla.edu
> Title IX web page: www.wallawalla.edu/resources/human-resources-payroll/titleix/

Relationship of this class to the WWU core themes
> Excellence in Thought
>> This class helps students develop ability to perform design that requires excellence in thought.
> Generosity in Service
>> Course content does not directly address generosity in service although as an engineering professional there are opportunities to contribute professional service to the community.
> Beauty in Expression
>> There is beauty in carefully crafted designs and documentation that is clear, concise, and complete. Such is required in this class.
> Faith in God
>> A life with inner peace comes through faith in God.