CS 594, Microprocessor-Based System Design, Fall, 2019

CS 594L, Microprocessor-Based System Design Laboratory, Fall, 2019

- Instructor: Abu Asaduzzaman
- Department: Electrical Engineering and Computer Science (EECS)
- Office Location: 253 Jabara Hall (JB) building
- Telephone: +1-316-978-5261
- E-mail: Abu.Asaduzzaman@wichita.edu
- Preferred Method of Contact: In person during office hours or via e-mail
- Office Hours: Monday/Wednesday 11:00AM–12:20PM
- Classroom, Day/Time: 261JB, Monday/Wednesday 2:00–3:15 PM
- Lab-room, Day/Time: 262 John Bardo Center, Monday 3:45–6:15 PM
- Prerequisites: CS 238, CS 394
- Teaching Assistant (TA) for Lab: Vikas Thammanna Gowda
- TA Contact: E-mail – vxthammannagowda@shockers.wichita.edu

How to use this syllabus

This syllabus provides you with information specific to this course, and it also provides information about important university policies. This document should be viewed as a course overview; it is not a contract and is subject to change as the semester evolves. Any changes should be shared via lecture and/or Blackboard.

University Policies and Procedures

The Wichita State University Policies and Procedures Manual can be found at: https://www.wichita.edu/about/policy/.

Academic Integrity

Students at Wichita State University are expected to uphold high academic standards. WSU will not tolerate a lack of academic integrity. Students are responsible for knowing and following the Student Code of Conduct (see https://www.wichita.edu/about/policy/ch_08/ch8_05.php) and the Student Academic Honesty policy (see https://www.wichita.edu/about/policy/ch_02/ch2_17.php). When
the faculty member determines sanctions are warranted for violations of academic integrity, regardless of severity, the faculty member must report the infraction to the Office of Student Conduct and Community Standards. If you need more information about the process or wish to appeal a decision, please visit https://www.wichita.edu/about/student_conduct/AcademicDishonesty.php.

All homework (HW) assignments in this course are individual assignments (unless otherwise stated). Students can discuss with others, but they should not write the solution together; one’s submission (wording/coding) should be substantially different from others’ submissions. “Collaboration is good, cheating is not!” There will be severe consequences for academic dishonesty. Cheating (such as copying word-for-word from other sources) in any test will automatically result in an F grade for the course; this applies to all the parties involved (including the ones who help/show).

Course Description

Introduces how to design and develop microprocessor-based systems. Studies how to service interrupts and interface the processor chip with various input/output (I/O) devices. Special-purpose chips/modules, such as interrupt controllers, programmable I/O devices, and sensor modules, are integrated into systems designed in class/lab. Lab assignments give hands-on experience.

Definition of a Credit Hour

CS 594 is a 4 credit-hour course (with a 0 credit-hour CS 594L Lab). Success in this 4 credit-hour course is based on the expectation that students will spend, for each unit of credit, a minimum of 45 hours over the length of the course (normally 3 hours per unit per week with 1 of the hours used for lecture) for instruction and preparation/studying or course related activities for a total of 180 hours.

For more information on courses and credit hour offerings, please go to: https://www.wichita.edu/academics/academic_affairs/DefinitionAndAssignmentOfCreditHours.php.

Measurable Student Learning Outcomes

Measurable Student Learning Outcomes: Undergraduate Level

After passing this course, undergraduate students will be able to:

- Understand the fundamental concepts, challenges, and opportunities of microprocessor-based systems.
- Apply knowledge effectively on studying simple to moderate microprocessor-based systems as appropriate.
- Understand the importance and benefits of microprocessor-based systems and engage in life-long learning of microprocessor based (embedded and/or Internet of Things) systems for professional success.
Measurable Student Learning Outcomes: Graduate Level

After passing this course, graduate students will be able to:

- Design and develop microprocessor-based systems using hardware (such as DEMOEM board) and software (such as CodeWarrior).
- Analyze and critically assess microprocessor-based systems, their applications, and related research articles.
- Understand the importance and benefits of microprocessor-based systems and engage in life-long learning of microprocessor-based (embedded and/or Internet of Things) systems for professional success.

Required Texts/Readings

Textbook

No textbook.


Other Readings

Class notes and lab manual/assignments will be made available via WSU Blackboard.

Handouts on servicing interrupts and interfacing input/output devices (i) in Assembly Language using EASy68K/IDE68K editor/assembler and (ii) in C/C++ Language using CodeWarrior software package and DEMOEM hardware boards will be made available via WSU Blackboard.

Other reading materials (such as Internet of Things, research articles, web pages, etc.) will be made available via WSU Blackboard.

Other Equipment/Materials

Students will be provided hardware, software, and service supports so that they can complete lab assignments and projects. More information will be available in class/lab as/if needed. Each student-group will be given one “Microprocessor Tool-Box” to use. “Microprocessor Tool-Box” should have a DEMOEM board (microprocessors, etc.) and required accessories. Lab is equipped with IDE68K, EASy68K, and CodeWarrior software packages.

Class Protocol

There are points on class/lab performance. It is expected that students arrive to the assigned room before class/lab starts. Students are always encouraged to ask
questions, especially if they find ambiguity in assignments and materials covered.

**Grading Scale**

WSU uses a +/- grading scale for final grades and to calculate grade point averages. In this class, grades are assigned according to the following chart. (Other classes might assign grades differently: Be sure to understand the different grading scales in all of your classes.)

<table>
<thead>
<tr>
<th>Points/Percentage</th>
<th>Letter Grade</th>
<th>Grade Points</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>93 and up</td>
<td>A</td>
<td>4.00</td>
<td>A range denotes excellent performance</td>
</tr>
<tr>
<td>90 – less than 93</td>
<td>A-</td>
<td>3.70</td>
<td></td>
</tr>
<tr>
<td>87 – less than 90</td>
<td>B+</td>
<td>3.30</td>
<td></td>
</tr>
<tr>
<td>83 – less than 87</td>
<td>B</td>
<td>3.00</td>
<td>B range denotes good performance</td>
</tr>
<tr>
<td>80 – less than 83</td>
<td>B-</td>
<td>2.70</td>
<td></td>
</tr>
<tr>
<td>77 – less than 80</td>
<td>C+</td>
<td>2.30</td>
<td></td>
</tr>
<tr>
<td>73 – less than 76</td>
<td>C</td>
<td>2.00</td>
<td>C range denotes satisfactory performance</td>
</tr>
<tr>
<td>70 – less than 73</td>
<td>C-</td>
<td>1.70</td>
<td></td>
</tr>
<tr>
<td>67 – less than 70</td>
<td>D+</td>
<td>1.30</td>
<td></td>
</tr>
<tr>
<td>63 – less than 67</td>
<td>D</td>
<td>1.00</td>
<td>D range denotes unsatisfactory performance</td>
</tr>
<tr>
<td>60 – less than 63</td>
<td>D-</td>
<td>0.70</td>
<td></td>
</tr>
<tr>
<td>0 – less than 60</td>
<td>F</td>
<td>0.00</td>
<td></td>
</tr>
</tbody>
</table>
Assignments

List of grading assignments/components and values toward final grades are shown below. For quiz, exam, and project, different grading scales will be used for undergraduate and graduate students. For classroom performance, homework, and lab, the same grading scale will be used for all students. Homework/Lab assignments and their due dates will be announced in class/lab and/or made available via Blackboard. Similarly, the due dates for Quiz, Exam, and Project will be announced in class and/or made available via Blackboard.

<table>
<thead>
<tr>
<th>Grading Assignments/Components</th>
<th>Undergraduate</th>
<th>Graduate</th>
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</thead>
<tbody>
<tr>
<td>Classroom Performance</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>Homework (five of six, take home)</td>
<td>10%</td>
<td>10%</td>
</tr>
<tr>
<td>Lab (ten, short quiz and experiment)</td>
<td>10%</td>
<td>10%</td>
</tr>
<tr>
<td>Quiz (two of three, 30-minute in classroom)</td>
<td>12%</td>
<td>10%</td>
</tr>
<tr>
<td>Exam-1 (~ Week 5, TBD, 70-minute in classroom)</td>
<td>15%</td>
<td>13%</td>
</tr>
<tr>
<td>Exam-2 (~ Week 10, TBD, 70-minute in classroom)</td>
<td>15%</td>
<td>13%</td>
</tr>
<tr>
<td>Exam-3 (cumulative, TBD, 70-minute in classroom)</td>
<td>20%</td>
<td>16%</td>
</tr>
<tr>
<td>Project (Proposal, Presentation, and Report)</td>
<td>15%</td>
<td>25%</td>
</tr>
</tbody>
</table>

Extra Credit

Extra credits are possible as/if needed. Depending on class performance after Week 10, if required, extra credit assignments and their due dates will be determined.

Late Assignments

For homework assignments, late submissions will not be accepted after five days from the original due date/time. Up to 50% points may be subtracted for any late submission. Exceptions include documented emergency situations and prior consents.

Missed Tests and Labs

Makeup for missed tests (Quiz, Exam, and Project) and labs will be given only when there is a genuine reason, with clear proof. It is students’ responsibility to provide the proof; if the reason for missing a test is illness, a doctor’s note will be required. Students should contact the instructor before any makeup test.

Important Academic Dates

For fall 2019 semester, classes begin on August 19, and end on December 5. The last
date to drop a class and receive a W (withdrawn) instead of F (failed) is October 29.
There are no classes on September 2 (Labor Day), October 12 (2 PM)-15 (Fall
BREAK), and November 27 – December 1 (Thanksgiving Recess). The final exam
period is December 7–12, 2019.

Disabilities

If you have a physical, psychiatric/emotional, or learning disability that may impact on
your ability to carry out assigned course work, I encourage you to contact the Office of
Disability Services (DS).

The office is located in Grace Wilkie, room 203, (316) 978-3309 (voice/tty) (316-854-
3032 videophone). DS will review your concerns and determine, with you, what
academic accommodations are necessary and appropriate for you. All information and
documentation of your disability is confidential and will not be released by DS without
your written permission.

Counseling & Prevention Services

WSU Counseling & Prevention Services (CAPS) provides quality mental health
services to enrolled students by licensed providers and presents programs and
trainings on topics promoting personal growth and optimal wellbeing. Services are by
appointment, low cost and confidential. They are located in room 320 of Grace Wilkie
Hall and will move to the new YMCA/Student Wellness Center in January. Their
phone number is (316) 978-3440. CAPS is open during regular University business
hours. If you have a mental health emergency while Counseling & Prevention Service
is not open, please call 911 or COMCARE Crisis Services at (316) 660-7500 for 24-
hour assistance.

Diversity and Inclusion

Wichita State University is committed to being an inclusive campus that reflects the
evolving diversity of society. To further that goal, Wichita State University does not
discriminate in its employment practices, educational programs or activities on the basis
of age (40 years or older), ancestry, color, disability, gender, gender expression, gender
identity, genetic information, marital status, national origin, political affiliation, pregnancy,
race, religion, sex, sexual orientation, or status as a veteran. Retaliation against an
individual filing or cooperating in a complaint process is also prohibited. Complaints or
concerns related to alleged discrimination may be directed to the Office of Institutional
Equity and Compliance, Wichita State University, 1845 Fairmount, Wichita, KS 67260,
telephone 316-978-3187.

Intellectual Property

Wichita State University students are subject to Board of Regents and University
policies (see http://webs.wichita.edu/inaudit/ch9_10.htm) regarding intellectual property
rights. Any questions regarding these rights and any disputes that arise under these

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policies will be resolved by the President of the University, or the President's designee, and such decision will constitute the final decision.

**Shocker Alert System**

Get the emergency information you need instantly and effortlessly! With the Shocker Alert System, we will contact you by email the moment there is an emergency or weather alert that affects the campus. Sign up at [www.wichita.edu/alert](http://www.wichita.edu/alert).

**Student Health Services**

WSU's Student Health Services (SHS) provides professional medical care and health education to enrolled students by licensed health care providers. General health care services are available ranging from routine and preventive care to managing acute illnesses and minor injuries. SHS offers convenient onsite laboratory and medication services including vaccinations. Staff are available to provide health education on a variety of topics, both in and out of the classroom setting. SHS is located in 209 Ahlberg Hall and will move to the new YMCA/Student Wellness Center in January 2020. Hours are 8:00 a.m. to 5:00 p.m., Monday through Friday, and the phone number is (316) 978-3620. Check out [www.wichita.edu/shs](http://www.wichita.edu/shs) for health information and access to myShockerHealth, the online patient portal where students can schedule appointments, send a secured message to a healthcare provider, check immunizations and more. All services are confidential.

**Title IX**

Wichita State University is committed to the elimination of sexual misconduct, relationship violence, and stalking within the University community. These incidents may interfere with or limit an individual's ability to benefit from or fully participate in the University's educational programs. Students are asked to immediately report incidents to the University Police Department, (316) 978-3450 or students may contact Sara Zafar, J.D., Title IX Coordinator at (316) 978-5177 or Sara.zafar@wichita.edu.

Students may also report incidents to an instructor, faculty or staff member, who are required by law to notify the Title IX Coordinator. If a student wishes to keep the information confidential, the student may speak with staff members of the Counseling and Prevention Services (316) 978-3440 or Student Health Services (316) 978-3620. For more information please refer to the Title IX Policy at [https://www.wichita.edu/about/policy/ch_08/ch8_16.php](https://www.wichita.edu/about/policy/ch_08/ch8_16.php).

**The Heskett Center and Campus Recreation**

Whether you are wanting to be active on campus, relieve the stress from classes or take care of your body, Wichita State Campus Recreation is the place for you. Campus Recreation, located inside the Heskett Center, contributes to the health, education, and development of Wichita State University students, faculty, staff, alumni, and community members by offering quality programs and services. With many programs and facilities which are free to all students and members, Campus Recreation offers its members
limitless opportunities. For more information about our services see www.wichita.edu/heskett.

**Video and Audio Recording**

Video and audio recording of lectures and review sessions without the consent of the instructor is prohibited. Unless explicit permission is obtained from the instructor, recordings of lectures may not be modified and must not be transferred or transmitted to any other person, whether or not that individual is enrolled in the course.

**CARE Team**

Wichita State University is committed to the safety and success of and cares about all members of the University community. If you or someone you know needs support, is distressed, or exhibits concerning behavior that is interfering with their own or others' academic or personal success or the safety of members of our community, resources and assistance are available. As your Faculty, I may seek support for you. If you or another member of our campus community is in need of help, please submit a concern at www.wichita.edu/ubit or call any CARE team member listed on that webpage. In case of emergency, please call the Wichita State University Police Department at (316) 978-3450 or 911.

**Concealed Carry Policy**

The Kansas Legislature has legalized concealed carry on public university campuses. Guns must be out of view, concealed either on the body of the carrier, or backpack, purse or bag that remains under the immediate control of the carrier. Gun owners must familiarize themselves with WSU’s Concealed Carry Policy at [http://webs.wichita.edu/?u=wsunews&p=weapons_policy_documents](http://webs.wichita.edu/?u=wsunews&p=weapons_policy_documents) and the Kansas Board of Regent’s policy at [http://www.kansasregents.org/about/policies-by-laws-missions/board_policy_manual_2/chapter_ii_governance_state_universities_2/chapter_ii_full_text#weapons](http://www.kansasregents.org/about/policies-by-laws-missions/board_policy_manual_2/chapter_ii_governance_state_universities_2/chapter_ii_full_text#weapons). If you believe that there has been a violation of this policy, please contact the University Police Department at 316 978-3450.

**Additional Concealed Carry Language for lab courses or other courses where student belongings are unattended and out of immediate control**

Under the Concealed Carry Policy, a backpack or other bag used to carry a handgun must be within the immediate control of the individual. This course requires students to leave belongings such as backpacks or other bags out of reach and unattended for the duration of class time. Students who choose to carry a concealed handgun in a backpack or other bag must plan each day accordingly and are responsible for making alternate arrangements as necessary. Wichita State does not provide publicly available secure storage for concealed handguns. If you believe that there has been a violation of this policy, please contact the WSU Police Department at 316 978-3450.
Names and Pronouns

Everyone has the right to be addressed as and referred to by the name and pronouns (including non-binary pronouns) that they choose and that correspond to their gender identity. Class rosters have a student’s legal name and do not include pronouns, therefore, all students will be asked in class to indicate the names and pronouns they use for themselves. A student’s chosen name and pronouns are to be respected at all times in the classroom.

First Generation Students

A first-generation (FGEN) college student is a student whose parents did not complete a four-year college degree. WSU strongly supports First Generation students and offers the following resources https://www.wichita.edu/student_life/firstgen/index.php.

Other: Important Notes

- Homework Submission: No e-mail submission. (Repeat) No e-mail submission. Everyone must turn in his/her own assignment in classroom, unless special permission is given.
- Project Report: One printed report should be submitted by each group. (In addition, the instructor may ask for an editable softcopy of the report.) NO late submission for project report.
- Communication via E-mail: You must use your WSU e-mail account for e-mail communication.
- Professionalism (e.g., proper manners) is highly expected.
- All academic dishonesty cases will be handled following the University Code of Academic Conduct. Please check the University Catalog for more information.

Other: Teaching Assistant

Laboratory TA:

Vikas Thammanna Gowda <vxthammannagowda@shockers.wichita.edu>
Office Hours/Room: Lab Hours, 262 John Bardo Center

Grading TA:

TBD
Office Hours/Room: TBD

The Lab TA should be in the lab for the entire session to assist students and grade lab assignments. The Grading TA (if any) should grade test papers. However, the TAs are not allowed to solve student problems (any problem). If students have any questions regarding the course materials and/or laboratory assignments, they should immediately contact the course instructor.
Other: Laboratory Information

CS 594L lab assignments will be done in a designated laboratory. Each lab session will have two parts: individual short quiz (50% points) and team activities (50% points). DEMOEM hardware-board (and CodeWarrior software-package) related problems must be solved as a group. A Lab TA should assist the students in the lab. In addition, the course instructor will be available as/if needed. The main purpose of the lab section is to provide students enough hardware, software, and service supports so that they can complete lab assignments and projects. The lab should be equipped with required software packages. Each student-group should be given one “Microprocessor Tool-Box” to use. “Microprocessor Tool-Box” should have a DEMOEM board (microprocessors, etc.) and required accessories. Students may install the software packages on their Laptop/PC and take the “Microprocessor Tool-Box” with them and work anywhere anytime. It must be noted that “Microprocessor Tool-Boxes” belong to the EECS Department and students are required to return all of them in good working condition at the end of the semester.

Other: Brief List of Topics to Cover

Introduction to Microprocessor-Based Systems

- Basic Organization of a Microprocessor: CPU, Memory, Registers, and Bus

Programming Microprocessor Systems using Assembly language

- Review Assembly Language using EASy68K/IDE68K software package
- Processing Interrupts; Interfacing Analog/Digital Serial/Parallel I/O

Programming Microprocessor Systems using C/C++ language

- Review C/C++ Language using CodeWarrior IDE and DEMOEM board
- Programming Timer, Sensor, liquid crystal display (LCD), etc.

Embedded Systems / Internet of Things

- Fundamental concepts and future of Embedded Systems
- Fundamental concepts and future of Internet of Things

Project/Research

- Sensing/Monitoring/Controlling Systems
- Low-Power Computing Systems
- Hardware-Based Security Systems
Tentative Schedule for **16-week class**

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>08/19, 08/21</td>
<td>CS 594: Course syllabus; Lab/Project; K-probe;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Homework Submission/Grading Policy; HW-1 Assign;</td>
</tr>
<tr>
<td>2</td>
<td>08/26, 08/28</td>
<td>HW-1 (Wed); Lab/Project: Groups; Lab-01 discussion; Microprocessor Architecture; IDE68K Assembly Language;</td>
</tr>
<tr>
<td>3</td>
<td>09/02, 09/04</td>
<td>HW-2 (Wed); Subroutine; Exceptions; Project: Topics, Grading; Proposal due on Week 11;</td>
</tr>
<tr>
<td>4</td>
<td>09/09, 09/11</td>
<td>Quiz-1 (Wed, 30 points, 30 minutes); Lab-02 discussion; Lab-01 (Mon); Programming Interrupts; Quiz-1 discussion;</td>
</tr>
<tr>
<td>5</td>
<td>09/16, 09/18</td>
<td>EXAM-1 (Wed, 70 minutes, Closed book); Lab-02 (Mon); Interfacing I/O; Exam-1/Lab-03 discussion;</td>
</tr>
<tr>
<td>6</td>
<td>09/23, 09/25</td>
<td>Timers; Lab-04 discussion; Proposal due on Week 11; Lab-03 (Mon); Team-Project: Topics, Grading, Proposal;</td>
</tr>
<tr>
<td>7</td>
<td>09/30, 10/02</td>
<td>HW-3 (Wed); DEMOEM/CodeWarrior; Lab-05 discussion; Lab-04 (Mon); Embedded programming with C;</td>
</tr>
<tr>
<td>8</td>
<td>10/07, 10/09</td>
<td>HW-4 (Wed); Quiz-2 and Lab-06 discussion; Lab-05 (Mon); Team-Project: Proposal, Grading, etc.</td>
</tr>
<tr>
<td>9</td>
<td>10/14, 10/16</td>
<td>Quiz-2 (Wed, 30 points, 30 minutes); Team-Project: Proposal due on Week 11; Analog/digital input/output; Interfacing Concept;</td>
</tr>
<tr>
<td>Week</td>
<td>Date</td>
<td>Note</td>
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</tr>
<tr>
<td>10</td>
<td>10/21, 10/23</td>
<td>Lab-06</td>
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<td>10</td>
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<td>12</td>
<td>11/25, 11/27</td>
<td>Exam-3</td>
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<td>12</td>
<td>12/02, 12/04</td>
<td>Lab-♥♥</td>
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<tr>
<td>Finals</td>
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