Instructor: Dr. Arslan Munir, Scrugham Engineering and Mines 206, Email: arslan@unr.edu

Office Hours: MW 5:15 - 5:45 PM, MW 3:15 - 3:45 PM, and by appointment.


Prerequisites:
- CS 219 Computer Organization
- CPE 301 Embedded Systems Design

Course Objectives: Although traditional embedded systems design leverages low-power microprocessors, there has been a recent shift towards high-performance embedded computing due to the proliferation of compute-intensive embedded applications (e.g., smart phones, home automation, network intelligence, cyber-transportation systems). This course provides a comprehensive understanding of the state-of-the-art in high-performance embedded systems. The course aims at guiding students to achieve high levels of performance from embedded systems and further motivate students for design and analysis of high-performance embedded systems.

Course Outline:

Chapter 1: Embedded & Cyber-Physical Computing . . approx 4 days
Chapter 2: CPUs ................................................. approx 3 days
Chapter 3: Programs .............................................approx 2 days
Chapter 4: Processes & Operating Systems ............approx 2 days
First Exam .........................................................1 day
Chapter 5: Multiprocessor Architectures ...............approx 2 days
Chapter 6: Multiprocessor Software .................approx 2 days
Chapter 7: Hardware/Software Co-Design ...........approx 3 days
Chapter 8: Cyber-Physical Systems .................approx 2 days
Second Exam .........................................................1 day
Chapter 9: Advance Research Topics ..................approx 4 days
Grading Policy:

- Exams: 50%
- Homework assignments and class participation: 5%
- Course project: 40%
- Course project class presentation: 5%

Grading Scale:

- A : 88 - 91; A+: 92 - 100
- B-: 75 - 79; B: 80 - 83; B+: 84 - 87;
- C-: 63 - 65; C: 66 - 70; C+: 71 - 74
- D-: 51 - 54; D: 55 - 58; D+: 59 - 62
- F : 0 - 50 (or caught cheating)

Course Project: An integral part of this course is a course project. The details of the course project will be provided in a separate document.

Course Policies:

- All course materials will be posted on the WebCampus.
- Unless instructed otherwise, use of electronic devices including laptops and cell phones is not allowed during lectures.
- Students are expected to demonstrate professionalism and courtesy by either silencing or turning off all cell phones and/or other alarm or audible indicator devices.
- No pets are allowed in the classroom.
- There will be two exams for this course. Students should plan on taking the exams on the scheduled times. Permission to take exams on other dates than scheduled will not be given, except for extreme medical emergencies. In case of any emergency situation, a student needs to provide a convincing documentation for it. The exams will be closed books and closed notes. The use of electronic devices such as laptops and cell phones, etc., are prohibited during exams.
- Students are expected to attend, and be on time, for every class. This demonstrates professionalism and consideration for your fellow students and your Instructor. While the course does not have an attendance policy, students who miss class and/or are late for class may experience an impact on their grade by missing classroom activities and/or quizzes.
- Students are expected to turn in all assigned materials in a timely manner.

*Students will have one week to appeal for their grades after the graded assignments/exams are returned if they think there is a problem/issue with the grading.
The Instructors reserve the right to add to, and/or modify any of the above policies as needed to maintain an appropriate and effective educational atmosphere in the classroom. In case of any change in the course policy, all students will be notified in advance of the new and/or modified policy.

**Important Dates:**

- **First Day of Classes** : August 25
- **Add Deadline (without permission from instructor)** : August 29
- **Labor Day Holiday** : September 1
- **First Exam** : October 13
- **Drop Deadline (with “W” received)** : October 29
- **Second Exam** : November 26
- **Project Deadline** : December 10

**Academic Integrity:** Students are encouraged to study together, however each student must individually prepare his/her solutions. Cheating or plagiarism is not permitted and will be sanctioned according to the UNR policy on Academic Standards. Students should carefully read the section on Academic Dishonesty found in the UNR Student Handbook.

**Homework Policy:** Students are encouraged to study together, but each person must prepare his or her solutions and have a firm understanding of any work turned in. When you put your name on your homework, you are stating that it is your own work and not the work of another person. As a reminder of UNR academic standards, please read UNR policies and guidelines. Specifically, the following: “Plagiarism is defined as submitting the language, ideas, thoughts or work of another as one’s own; or assisting in the act of plagiarism by allowing one’s work to be used in this fashion.” This means that if another student asks to borrow your work to copy - JUST SAY NO - or you are participating in plagiarism.

**Student Outcomes and Course Outcomes:** The course outcomes are skills and abilities students should have acquired by the end of the course. These outcomes determine how the general CSE Student Outcomes apply specifically to this course. These outcomes are defined in terms of the ABET Accreditation Criterion 3: Student Outcomes. All CSE Student Outcomes are listed in the next subsection and those relevant to this course are identified in Table 1.

**CSE Student Outcomes:**

1. an ability to apply knowledge of computing, mathematics, science, and engineering.
2. an ability to design and conduct experiments, as well as to analyze and interpret data.
3. an ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs, within realistic constraints specific to the field.
4. an ability to function effectively on multi-disciplinary teams.
5. an ability to analyze a problem, and identify, formulate and use the appropriate computing and engineering requirements for obtaining its solution.
6. an understanding of professional, ethical, legal, security and social issues and responsibilities.

†Please check [UNR academic calendar](https://www.unr.edu) to verify these dates.
Table 1: Student outcomes and course outcomes for CS 491B/691B/791B

<table>
<thead>
<tr>
<th>CSE Student Outcomes</th>
<th>Course Outcomes</th>
<th>Assessment Methods/Metrics</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Students demonstrate a thorough understanding of embedded systems</td>
<td>Homework assignments &amp; examinations</td>
</tr>
<tr>
<td>2</td>
<td>Students will be able to analyze performance of various embedded architectures</td>
<td>Course project</td>
</tr>
<tr>
<td>3</td>
<td>Students will be able to design and evaluate specific embedded systems</td>
<td>Course project</td>
</tr>
<tr>
<td>4</td>
<td>Students will enhance their ability to communicate effectively with a range of audiences</td>
<td>Course project presentation</td>
</tr>
<tr>
<td>11</td>
<td>Students will be able to apply embedded systems knowledge, programming, simulation, and evaluation techniques to various embedded applications</td>
<td>Examinations and course project</td>
</tr>
</tbody>
</table>

7. an ability to communicate effectively with a range of audiences.
8. the broad education necessary to analyze the local and global impact of computing and engineering solutions on individuals, organizations, and society.
9. a recognition of the need for, and an ability to engage in continuing professional development and life-long learning.
10. a knowledge of contemporary issues.
11. an ability to use current techniques, skills, and tools necessary for computing and engineering practice.
12. an ability to apply mathematical foundations, algorithmic principles, and computer science and engineering theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.
13. an ability to apply design and development principles in the construction of software systems or computer systems of varying complexity.

**UNR Athletics:** If you are involved with any university-sponsored athletic activities that will have an impact on your attendance, please provide your Instructor with a letter from your coach and/or the UNR Athletic Department as soon as possible, but no later than the end of the second week of classes. This should include the official schedule of your activities which will impact your attendance throughout the semester.

**Academic Success Services:** Your student fees cover usage of the Math Center, Tutoring Center, and University Writing Center. These centers support your classroom learning; it is your responsibility to take advantage of their services. Please keep in mind that seeking help outside of class is
the sign of a responsible and successful student.

**Disability Statement:** If you have a disability for which you will need to request accommodations, please contact me or someone at the Disability Resource Center (Thompson Building, Suite 101), as soon as possible to arrange for appropriate accommodations.

**Class Recording:** Surreptitious or covert video-taping of class or unauthorized audio recording of class is prohibited by law and by Board of Regents policy. This class may be videotaped or audio recorded only with the written permission of the instructor. In order to accommodate students with disabilities, some students may have been given permission to record class lectures and discussions. Therefore, students should understand that their comments during class may be recorded.