San José State University  
College of Engineering/Electrical Engineering  
EE 272, CMOS SOC Design, Section 1, Fall, 2021

Course and Contact Information
Instructor(s): Morris Jones  
Office Location: E295 (It’s a lab, knock on the door farthest from the elevator)  
Telephone: 408-507-4698 (Cell)  
Email: morris.jones@sjsu.edu  
Office Hours: Tu 6-7PM, Friday by appointment  
Class Days/Time: Tu Th 7:30PM - 8:45PM  
Classroom: E329  
Prerequisites: EE271 or equivalent undergraduate experience

Course Description
The course covers topics in System-on-Chip design and verification with SystemVerilog. Major topics include top-down SoC design; design metrics, techniques, and system-level synthesis; IP integration and system-level verification; SystemVerilog design hierarchy, data types, assertions, interfaces, verification constructs, and testbench structures. UVM and in depth verification are in EE 273

Course Format
The course is in person this semester.

Technology Intensive, Hybrid, and Online Courses
The class will use technology for instruction and lab work. This requires Internet connectivity, a computer, a web cam is a plus to get online help. Most laptops have a webcam built-in. Students will be required to perform assignments in a lab using industrial tools. Most students want to access the lab remotely. This requires the SJSU free VPN software. (Search for VPN on the SJSU website), and a RDP client program (Free in MS, MAC, and linux)

Depending on COVID restrictions, some class activities and/or office hours may need to move online. This requires high speed internet access, and a computer/phone capable of running Zoom.

Faculty Web Page and MYSJSU Messaging
Course materials such as syllabus, handouts, notes, assignment instructions, etc. can be found on the Canvas learning management system course website. (https://sjsu.instructure.com) You are responsible for regularly checking with the messaging system through MySJSU/Canvas to learn of any updates.

Some students have multiple email accounts. Make sure you are checking the email in MYSJSU and Canvas regularly.

Course Goals
Students become SystemVerilog proficient by practicing assignments and projects. Students learn to enjoy the SOC design team experience through a hands on approach.
**Course Learning Outcomes (CLO)**

LO1. Understand SoC design methodology and apply it to application specifications  
LO2. Apply SoC design flow for a specific SoC design project  
LO3. Partition and map an application specification to SoC architecture  
LO4. Develop and use of SoC buses for a SoC design  
LO5. Perform system-level synthesis, which includes binding, scheduling, and resource sharing  
LO6. Design and implement different types of IP cores based on required specifications

Upon successful completion of this course, students should be able to:

1. Translate a specification to a SOC architecture and design  
2. Understand and demonstrate which System Verilog constructs are synthesizable

**Required Texts/Readings**

**Textbook**  

**Other Readings**

Other readings are posted on Canvas, and are free from the Library, or on the web.

**Other technology requirements / equipment / material**

The class will use technology for instruction and lab work. This requires Internet connectivity. Students will be required to perform assignments in a remote access lab using industrial tools. They will require the SJSU free VPN software. (Search for VPN on the SJSU website), and a RDP client program (Free in MS, MAC, and linux)

SJSU has a free equipment loan program available for student computers. See Learn Anywhere website for current Wi-Fi options on campus.

**Library Liaison**

If you need help with library materials, contact the Engineering Liaison Librarian, Rachel Silverstein  
rachel.silverstein@sjsu.edu

**Course Requirements and Assignments**

Grading is fair and outcome based. Fair implies all students are treated the same. Grades will not be adjusted to solve students personal issues. You get what you earn! No exceptions are granted. It is important to keep up and apply yourself consistently during the semester. The course elements are weighted to a total of 100% which is used for grade determination.

The course is scheduled in person. Please be aware that changing COVID issues may require a transition to hybrid or online. If that happens, The following could change.

Reading Quizzes (5%): These are online Canvas Quizzes due before the class. They are to help you gain feedback on materials studied in the various course readings. Many may be taken more than once if you find you need to go back and revise the reading. Check on Canvas for each quiz details.
Homework (20%): Homework will consist of a mix of analysis, design, and documentation problems. Analytical and CAD based techniques will be required to solve problems. The homework is designed to reinforce lecture concepts and prepare the student for the exams and class project. Homework assignments will be due according to the green sheet. Online and in class assessments (quizzes) may be included in the homework scores. In class quizzes are not scheduled or announced. All quizzes are on the Canvas learning management system.

All homework shall be submitted individually using the online Canvas system. Canvas can be accessed at http://sjsu.instructure.com. No homework is accepted under the office door, in an email, or a canvas comment. If you are traveling for work or an emergency, contact the professor at least 2 days before the assignment is due for an extension (One allowed per semester). No extensions will be granted within 2 days of an assignment due date.

Individual homework may be checked for possibly copying. Homework that demonstrates plagiarism will receive a score of '0'. Note that translation or modest changes are considered plagiarism. No consideration will be made for who copied who.

Developing professional discipline through on time homework submission is expected and required. The canvas system will not inform you an assignment is late. Homework is not accepted late. Homework must be submitted through the electronic system. No homework is accepted on paper, through email, message attachments or other means. Submitting late homework in another assignment slot will receive zero score. If you will be out of town, or not available when homework is due, submit homework early. If you require accommodation you must contact the instructor and get approval two days before the homework is due.

Several homework assignments require design and debug. This may take several days/weeks. Students are required to analyze the assignments, and start early enough to complete the assignments according to the schedule.

Class Project (25%): The project is a design/debug problem. The specifications will be found on Canvas. Randomly assigned teams of 2-4 people work on the project. The team size varies each semester. The project will not be accepted late. A maximum of 50% of the project score can be earned if the design does not pass the tests. To discourage “borrowing” of other designs, successful designs will be run through a recursive difference engine, and the score will be reduced to zero if similar in any significant way to other submitted designs. Both design teams will be penalized. The instructor will not attempt to determine which design was copied. Don’t share project designs with other teams.

Midterm (25%): Covers the first half of the semester. All exams are closed book, no notes. You will be seated randomly in the class, and there may be multiple versions of the exam. Depending on changing COVID19 restrictions, exams may be online using a system that will make a video recording of your exam. If you do not wish to be recorded, please drop the class. You should bring a calculator and writing instruments to the exam. Programmable calculators are not allowed unless completely cleared. Cell phones may not be used in exams. Photo ID is required for an exam. Exams are a mix of theory, design, coding, and computation.

Final (25%): Covers the entire semester. Same rules as the midterm.

“Success in this 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 three hours per unit per week) for instruction, preparation/studying, or course related activities, including but not limited to internships, labs, and clinical practica. Other course structures will have equivalent workload expectations as described in the syllabus.”
Academic Dishonesty:

Students who are suspected of cheating during an exam will be referred to the Student Conduct and Ethical Development office and depending on the severity of the conduct, will receive a zero on the assignment or a grade of F in the course. Grade Forgiveness does not apply to courses for which the original grade was the result of a finding of academic dishonesty.

San Jose State University
Electrical Engineering Department
EE Department Honor Code

The Electrical Engineering Department will enforce the following Honor Code that must be read and accepted by all students.

"I have read the Honor Code and agree with its provisions. My continued enrollment in this course constitutes full acceptance of this code. I will NOT:

- Take an exam in place of someone else, or have someone take an exam in my place
- Give information or receive information from another person during an exam
- Use more reference material during an exam than is allowed by the instructor
- Obtain a copy of an exam prior to the time it is given
- Alter an exam after it has been graded and then return it to the instructor for re-grading
- Leave the exam room without returning the exam to the instructor."

Measures Dealing with Occurrences of Cheating

Department policy mandates that the student or students involved in cheating will receive an "F" on that evaluation instrument (paper, exam, project, homework, etc.) and will be reported to the Department and the University. A student's second offense in any course will result in a Department recommendation of suspension from the University.

Final Examination or Evaluation

The final exam is cumulative, and covers the entire semester with emphasis on the last half of the semester.

Depending on changing COVID19 restrictions, exams may be online using a system that will make a video recording of your exam. If you do not wish to be recorded, please drop the class. You should bring writing instruments to the exam. Programmable calculators are not allowed unless completely cleared. Cell phones may not be used in exams. Photo ID is required for an exam. Exams are a mix of theory, design, coding, and computation.

“Faculty members are required to have a culminating activity for their courses, which can include a final examination, a final research paper or project, a final creative work or performance, a final portfolio of work, or other appropriate assignment.”

Grading Information

Grade information is available online and in real time on the canvas learning management system. Please remember that unsubmitted assignments are not considered a zero in canvas until the semester ends, when they will convert to zeros. The grade will be a combination of homework, quizzes (online on Canvas), exams and a project.

Determination of Grades is by the percentage obtained out of 100% for all course items. The items are weighted Reading quizzes 5%, Homework and other quizzes 20%, project %25, Midterm 25% and Final 25%. The class has no extra credit. It is important that all students are treated fairly, and have the same opportunities
in the class. Don’t ask for or expect a “special” consideration at the semester end. Grades are calculated to two decimal places. Truncation may occur.

Grades:

A = 100 to 97 percent  
A minus = 96.99 to 90 percent  
B plus = 89.99 to 87 percent  
B = 86.99 to 84 percent  
B minus = 83.99 to 80 percent  
C plus = 79.99 to 77 percent  
C = 76.99 to 73 percent  
C minus = 72.99 to 70 percent  
D plus = 69.66 to 67 percent  
D = 66.99 to 63 percent  
D minus = 62.99 to 55 percent  
F = 54.99 to 0 percent

Classroom Protocol

Students will turn their cell phones off or put them on vibrate mode while in class. They will not answer their phones in class. Students whose phones disrupt the course and do not stop when requested by the instructor will be referred to the Judicial Affairs Officer of the University.

Some activities may occur on Zoom. Students will mute microphones on Zoom unless speaking, or asking a question. This reduces audio feedback loops from systems using speakers.

Students will keep all conversations on the Chat box positive and professional. Students who violate this will be referred to the Judicial Affairs Officer of the University, and may be blocked from future class zoom meetings.

Students are required to follow the University COVID-19 policy whenever they come to campus. Check the SJSU website often for the latest information as requirements from several layers of government change frequently.

This course or portions of this course (i.e., lectures, discussions, student presentations) may be recorded for instructional or educational purposes. The recordings will only be shared with students enrolled in the class through Canvas. If, however, you would prefer to remain anonymous during these recordings, then please speak with the instructor about possible accommodations (e.g., temporarily turning off identifying information from the Zoom session, including student name and picture, prior to recording).

Students are not allowed to record without instructor permission

Students are prohibited from recording class activities (including class lectures, office hours, advising sessions, etc.), distributing class recordings, or posting class recordings. Materials created by the instructor for the course (syllabi, lectures and lecture notes, presentations, etc.) are copyrighted by the instructor. This university policy (S12-7) is in place to protect the privacy of students in the course, as well as to maintain academic integrity through reducing the instances of cheating. Students who record, distribute, or post these materials will be referred to the Student Conduct and Ethical Development office. Unauthorized recording may violate university and state law. It is the responsibility of students that require special accommodations or assistive technology due to a disability to notify the instructor.
University Policies

Per University Policy S16-9, relevant university policy concerning all courses, such as student responsibilities, academic integrity, accommodations, dropping and adding, consent for recording of class, etc. and available student services (e.g. learning assistance, counseling, and other resources) are listed on Syllabus Information web page (https://www.sjsu.edu/curriculum/courses/syllabus-info.php). Make sure to visit this page to review and be aware of these university policies and resources.
EE272 / SOC Design, Fall 2021, Course Schedule

The following are the intended topics for discussion. The class often gets ahead of the following topics, and then reviews.

The items labeled QUIZ are Canvas quizzes (online quizzes) each students should perform outside of class online. There may be unscheduled quizzes during the semester. The items labeled HW are homework assignments. The homework assignments can be found and must be turned in on the Canvas System.

In class quizzes are not scheduled. Quizzes may be announced on Canvas which are not on this schedule. A password obtained in class may be required.

*Dates and assignments can change with class or Canvas notice. Please check on Canvas for each assignment.*

### Course Schedule

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topics, Readings, Assignments, Deadlines</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>08/19/21</td>
<td>Verilog Review/ SV interfaces,,Intro.pdf,</td>
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<tr>
<td>2</td>
<td>08/24/21</td>
<td>Soc Concepts, reuse &amp; integration,Quiz Ch 5:Quiz Ch 6,,LRM 5,6</td>
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<td>2</td>
<td>08/26/21</td>
<td>Structures/ always * blocks,Quiz Ch 7:Quiz Ch 25,LRM 7&amp;25, SoCOverview.pdf,</td>
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<tr>
<td>3</td>
<td>08/31/21</td>
<td>Busses – Master-slave,,</td>
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<tr>
<td>3</td>
<td>09/02/21</td>
<td>Structures,,Bus notes</td>
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<td>4</td>
<td>09/07/21</td>
<td>AHB,Quiz AHB,</td>
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<td>4</td>
<td>09/09/21</td>
<td>Assignment operators,,</td>
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<tr>
<td>5</td>
<td>09/14/21</td>
<td>Message Passing/Rings,,LRM 10,11,Quiz CH-10-11</td>
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<td>5</td>
<td>09/16/21</td>
<td>Unions, Designing for reuse, IP standards,Design HW 1</td>
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<td>6</td>
<td>09/21/21</td>
<td>Packet based busses,Quiz CH9,LRM 9, notes</td>
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<td>6</td>
<td>09/23/21</td>
<td>Port Connections,,Packet notes,</td>
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<td>7</td>
<td>09/28/21</td>
<td>Error Handling,Quiz Ch 23,LRM 23</td>
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<td>09/30/21</td>
<td>Assertions,Design HW 2,Error notes</td>
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<td>10/05/21</td>
<td>Midterm Review,,Midterm study guide</td>
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<td>10/07/21</td>
<td>Midterm</td>
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<td>10/12/21</td>
<td>Looping Controls,Design HW 3:Quiz Ch 12, LRM 12</td>
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<td>9</td>
<td>10/14/21</td>
<td>Mult-master/Split transactions,Quiz Ch 4, LRM 4</td>
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<td>10</td>
<td>10/19/21</td>
<td>Final Project discussion,Assertions,</td>
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<tr>
<td>10</td>
<td>10/21/21</td>
<td>Fairness Techniques/ QOS 1,,LRM 10,11 review</td>
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<tr>
<td>11</td>
<td>10/26/21</td>
<td>Covergroups,,Scheduling notes</td>
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<tr>
<td>Week</td>
<td>Date</td>
<td>Topics, Readings, Assignments, Deadlines</td>
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<td>11</td>
<td>10/28/21</td>
<td>File I/O, Quiz Ch 16, LRM 16</td>
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<td>12</td>
<td>11/02/21</td>
<td>Verification intro, Quiz Ch 20-21, LRM 20,21</td>
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<td>12</td>
<td>11/04/21</td>
<td>Misc SV, Binary Tree, Verification notes</td>
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<td>13</td>
<td>11/09/21</td>
<td>PCIe, Covergroups, Quiz Ch 8, LRM 8</td>
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<td>11/11/21</td>
<td>Classes,</td>
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<td>14</td>
<td>11/16/21</td>
<td>Voting/budget based,</td>
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<td>14</td>
<td>11/18/21</td>
<td>Fifos / bandwidth smoothing, Fairness notes</td>
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<tr>
<td>15</td>
<td>11/23/21</td>
<td>Fifos / bandwidth smoothing, Bus design, Fifo notes</td>
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<tr>
<td>15</td>
<td>11/25/21</td>
<td>No Class, Thanksgiving Holiday</td>
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<tr>
<td>16</td>
<td>11/30/21</td>
<td>Project Lab time</td>
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<tr>
<td>16</td>
<td>12/02/21</td>
<td>Final Review, Design HW Project</td>
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Final Exam: E329 Thursday, December 9 7:45-10:00 PM