San José State University  
College of Engineering/Electrical Engineering  
EE287, CMOS ASIC Engineering, Section 2, Spring, 2021

Course and Contact Information

Instructor(s): Morris Jones  
Office Location: E295 – Online  
Telephone: (408) 507-4698 (cell)  
Email: morris.jones@sjsu.edu  
Office Hours: M & W 6-7PM  
Class Days/Time: T & Th 6:00PM – 7:15PM  
Classroom: TBD sjsu.instructure.com (Canvas)  
Prerequisites: EE 271 or undergraduate equivalent. (Students should be able to create Verilog designs before taking EE287)

Course Description

EE287 is an overview of CMOS ASIC concepts and design. Industry tools will be used to illustrate principles taught. Overall concepts will be tied together by a design project. Project team work will be stressed.

Course Format

Technology Intensive, Hybrid, and Online Courses

The class will be Hybrid with online instruction and lab work until the COVID-19 restrictions lift. The restrictions may not suddenly lift, but may be a progressive change of restrictions. The instructor will make all lectures available online if/when the course returns to campus.

The class will use technology for instruction and lab work. This requires Internet connectivity, a computer, a web cam is a plus for lecture interaction, and required for online exams. Most laptops have a webcam built-in. 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)

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. (sjsu.instructure.com) You are responsible for regularly checking with the messaging system through MySJSU/Canvas to learn of any updates.

Course Goals

Course Learning Outcomes

Upon successful completion of this course, students will be able to:
• Practice and demonstrate critical thinking
• Use requirements and translate them to a high level design language
• Explain capabilities and limitations of CMOS logic and adjust designs to best use CMOS ASIC technologies.
• Demonstrate common ASIC team rules, and articulate the purposes for such rules.
• Apply industry synthesis tools to achieve desired project objectives.
• Use module interfaces, pipe lining, design for test, test pattern generation, and BIST.
• Modify designs to achieve performance objectives.
• Perform an ASIC design from requirements to timing verification

Required Texts/Readings

Textbook
There is no text book. The class is taught from notes, and industrial materials. All notes are on the Canvas website at sjsu.instructure.com

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)

Students are required to have an electronic device (laptop, desktop or tablet) with a camera and built-in microphone. SJSU has a free equipment loan program available for students.

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 outcome based. Grades will not be adjusted to solve student Grade 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.

Quizzes: Quizzes on the assigned readings are online on the Canvas learning management system. You are expected to read the materials before class discussion. Some reading quizzes allow multiple attempts. Some are timed. Check on each quiz in canvas to understand the limits before taking the quiz. Do not expect all quizzes to allow multiple attempts, or the same number of attempts. Do not assume a quiz is timed. Most Reading quizzes are due before class. There may be quizzes in class. In general, these are unannounced. Student participation in the in class discussion areas in Canvas may also count as quizzes points
Homework: Homework consists of a mix of analysis, design, and documentation problems. Analytical and CAD based techniques will be required to solve some problems. The homework is designed to reinforce lecture concepts and prepare the student for exams, class projects, and job interviews. Homework assignment due dates may be found in the Canvas learning management system. On time submission is required. Plan ahead, do assignments early.

All homework shall be submitted individually using the online Canvas system. Canvas can be accessed at [http://sjsu.instructure.com](http://sjsu.instructure.com). Code submissions are required in Canvas, and code submissions will be made automatically to a plagiarism checking system by the run scripts. The plagiarism checking system may also run code, and be used in grading. You must run the code with the provided unmodified scripts. No homework is accepted in class, by email, canvas message attachments, or under the office door.

Individual homework may be checked for possibly copying. You are expected to do your own original design work. 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 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: The project is a group 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. 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.

Midterm assessment: Covers the first half of the semester. This will be individual papers. There may be different topics for different students. A plagiarism score of less than 10% is required on turnitin, or a zero will be awarded on the Midterm assessment.

Final assessment: This semester, there will be an individual design activity for the final assessment.

“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.”
The CLO's are shown by the following activities. They are assessed on the midterm and the final activities to measure and ensure understanding.

<table>
<thead>
<tr>
<th>Activity</th>
<th>CLO</th>
</tr>
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<tbody>
<tr>
<td>Project</td>
<td>1,2,3,4,5,8</td>
</tr>
<tr>
<td>Design HW2</td>
<td>4,5,6,7</td>
</tr>
<tr>
<td>Paper 1</td>
<td>3</td>
</tr>
</tbody>
</table>

**Final Examination or Evaluation**

“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.”

This semester, the final evaluation will be an individual design project submission. This is in addition to a group project submission. The code will be checked for copying. Students may have different final evaluation projects assigned, and you may not have the same individual final evaluation project as other students.

**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), major assessments and the group project.

Determination of Grades is by the percentage obtained out of 100% for all course items. The items are weighted Reading and in class Quizzes and in class discussion participation 10%, homework 25%, project 20%, Midterm 20% 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 or rounding may occur. The following grading chart is guaranteed, but the class reserves the right to use one with lower percentages for the same grade.

Grades:

A = 100 to 95 percent  
A minus = 94.99 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.

Zoom Classroom Etiquette

- Mute Your Microphone:
  - To help keep background noise to a minimum, make sure you mute your microphone when you are not speaking.
- Be Mindful of Background Noise and Distractions:
  - Find a quiet place to “attend” class, to the greatest extent possible.
  - Avoid video setups where people may be walking behind you, people talking/making noise, etc.
  - Avoid activities that could create additional noise, such as shuffling papers, listening to music in the background, etc.
- Position Your Camera Properly:
  - Be sure your webcam is in a stable position and focused at eye level.
- Limit Your Distractions/Avoid Multitasking:
  - You can make it easier to focus on the meeting by turning off notifications, closing or minimizing running apps, and putting your smartphone away (unless you are using it to access Zoom).
- Use Appropriate Virtual Backgrounds:
  - If using a virtual background, it should be appropriate and professional and should NOT suggest or include content that is objectively offensive or demeaning.

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.

This course or portions of this course (i.e., lectures, discussions, student presentations) will be recorded for instructional or educational purposes. The recordings will only be shared with students enrolled in the class through Canvas. The recordings will be deleted at the end of the semester. 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, and register with the AEC.

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. They are included below, but may change.

Before Coming to Campus (as of 8/10/20. Check on www.sjsu.edu for any updates)

Symptom Monitoring

Students, faculty, and staff who have been instructed or permitted to return to campus must conduct symptom monitoring every day before traveling to (or, for on-campus residents, moving through) campus. You must be free of ‘ANY’ symptoms potentially related to COVID-19.

At this time, these symptoms include one or more of the following:

1. Cough
2. Shortness of breath or difficulty breathing
3. Fever
4. Chills
5. Repeated shaking with chills
6. Runny nose or new sinus congestion
7. Muscle pain or body aches
8. Headache
9. Sore throat
10. Fatigue
11. Nausea
12. Vomiting
13. Diarrhea
14. New GI symptoms
15. New loss of taste or smell

You may not return to campus if you have:

Traveled to/from a country that has been flagged by the Centers for Disease Control and Prevention's (CDC) travel advisory within the last 14 days,

Been in close contact with someone who has traveled to/from one of the countries on the CDC’s travel advisory within the last 14 days,

Tested positive for COVID-19. The local Public Health Department will be notified by the testing agency when an individual tests positive for COVID-19. Even if you aren’t exhibiting symptoms, SJSU requests that you complete a “Reporting a Case of COVID-19” online form. A report case manager will contact you shortly after the initial survey. They will offer support resources and inquire about recent on-site activity and university related contacts that could require notification.

Contact Tracing

If you test positive for COVID-19 in Santa Clara County, someone from the County of Santa Clara’s contact tracing team will contact you. This procedure is used to help inform you of care and resource options, as well as help identify other people you might have come in contact with, in order to properly take precautions to prevent the spread of the virus. You will be interviewed on the following topics:
1. Symptom monitoring and care access:
   a. How are you feeling;
   b. Do you have access to a primary care provider? If not, you will be provided resources on how to be connected to one;
   c. How to monitor your symptoms;
   d. How to properly isolate and quarantine yourselves in their residence;
   e. If you cannot safely isolate and quarantine yourself in their residence (e.g., no private space to do so), you will be referred to housing resources and services.

2. You are considered a close contact of a COVID-19 positive person if you were within 6 feet for 15 minutes or more, regardless of whether either person was wearing a face covering, during the period the COVID-19 positive person is considered contagious.

Contact tracers will then follow-up with the individuals identified by you in order to notify them, encourage them to quarantine themselves, educate them on self-monitoring, and provide resources as needed. They will also be interviewed for potential individuals they were in contact with within a certain time period and contact tracing protocols will be repeated with those individuals.

Please note, that contact tracers will never ask for financial information, social security numbers, or for immigration status/citizenship.

Populations at Higher Risk for COVID-19 Infection

According to the CDC, individuals with certain conditions may have a higher risk for COVID-19 infection. Those conditions may include:

1. Older adults (aged 65 years and older)
2. People with HIV
3. Asthma (moderate-to-severe)
4. Chronic lung disease
5. Diabetes
6. Serious heart conditions
7. Chronic kidney disease being treated with dialysis
8. Severe obesity
9. Being immunocompromised

University Policies

Per University Policy S16-9 (http://www.sjsu.edu/senate/docs/S16-9.pdf), 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.

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:

1. Take an exam in place of someone else, or have someone take an exam in my place
2. Give information or receive information from another person during an exam
3. Use more reference material during an exam than is allowed by the instructor

"
4. Obtain a copy of an exam prior to the time it is given
5. Alter an exam after it has been graded and then return it to the instructor for re-grading
6. 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.

Additional Information
Any course papers, presentations and quiz answers shall be written to graduate level writing standards. The course uses IEEE format for citations. Points may be deducted for writing issues.
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 notice. Please check on Canvas for each assignment.*

### Course Schedule

<table>
<thead>
<tr>
<th>Date</th>
<th>Topics, Readings, Assignments, Deadlines</th>
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</thead>
<tbody>
<tr>
<td>02/02/21</td>
<td>Delay in CMOS overview cmosdelay.pdf, Verilog Self Test</td>
</tr>
<tr>
<td>02/04/21</td>
<td>Cell types in 260 260c_pri_e.pdf</td>
</tr>
<tr>
<td>02/09/21</td>
<td>Latches and Ffs latches.pdf QUIZ 1, HW1 economic analysis</td>
</tr>
<tr>
<td>02/11/21</td>
<td>The clock cycle and paths clkcycle.pdf, Synthesis HW, Verilog Tutorial</td>
</tr>
<tr>
<td>02/16/21</td>
<td>Working with latches Discussion QUIZ 2, Choose Groups</td>
</tr>
<tr>
<td>02/18/21</td>
<td>Multiple clock Domains 200Mhz HW,First Design block diagram</td>
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<tr>
<td>02/23/21</td>
<td>Fifos QUIZ 3</td>
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<tr>
<td>02/25/21</td>
<td>Fixing Long Paths and Races examples, discussion</td>
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<tr>
<td>03/02/21</td>
<td>Working with timing First Design HW, QUIZ 4</td>
</tr>
<tr>
<td>03/04/21</td>
<td>A real library 260c_highpri_e.pdf, 300 Mhz HW</td>
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<tr>
<td>03/09/21</td>
<td>Delay models 260c_pri_e.pdf, Paper how to time logic (Midterm Assessment)</td>
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<tr>
<td>03/11/21</td>
<td>Timing closure, Place and Route HW</td>
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<tr>
<td>03/16/21</td>
<td>Clock distribution networks, Project introduction, State Machine HW</td>
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<tr>
<td>03/18/21</td>
<td>Debug Requirements</td>
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<tr>
<td>03/23/21</td>
<td>Clock Generation and PLLs, QUIZ Debug</td>
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<tr>
<td>03/25/21</td>
<td>Manf test intro, Paper How to fix timing problems (Midterm Assessment)</td>
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<tr>
<td>03/30/21</td>
<td>Spring Break – No class</td>
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<tr>
<td>04/01/21</td>
<td>Spring Break – No class</td>
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<tr>
<td>04/06/21</td>
<td>Manf test and D algorithm</td>
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<td>04/11/21</td>
<td>Spring Break – No class</td>
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<td>04/18/21</td>
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<td>04/26/21</td>
<td>Spring Break – No class</td>
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<td>05/03/21</td>
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<td>05/12/21</td>
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<td>05/17/21</td>
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<td>05/19/21</td>
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<td>05/24/21</td>
<td>Spring Break – No class</td>
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<tr>
<td>05/26/21</td>
<td>Spring Break – No class</td>
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<tr>
<td>Date</td>
<td>Topics, Readings, Assignments, Deadlines</td>
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<tr>
<td>04/08/21</td>
<td>Pins and Packaging</td>
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<tr>
<td>04/13/21</td>
<td>Power and Ground issues</td>
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<tr>
<td>04/15/21</td>
<td>Power and Ground Pins. Power estimation. Engine HW</td>
</tr>
<tr>
<td>04/20/21</td>
<td>Floor plan and impacts QUIZ 5 Power and ground pins</td>
</tr>
<tr>
<td>04/22/21</td>
<td>Scan based testing</td>
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<tr>
<td>04/27/21</td>
<td>Scan, PRN overview HW 5 D-Algorithm</td>
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<tr>
<td>04/29/21</td>
<td>PRN &amp; CRC</td>
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<tr>
<td>05/04/21</td>
<td>Bist – Concepts HW6</td>
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<tr>
<td>05/06/21</td>
<td>Final Evaluation Project introduction - Review</td>
</tr>
<tr>
<td>05/11/21</td>
<td>Group Project Presentations (5 minutes), Group Projects Due</td>
</tr>
<tr>
<td>05/13/21</td>
<td>Group Project Presentations (5 minutes)</td>
</tr>
<tr>
<td>5/20/21</td>
<td>Final Evaluation Presentations. Thursday, May 20 1945-2200 1715-1930 Final Evaluation Projects due</td>
</tr>
<tr>
<td></td>
<td>Individual Final Assessment Project presentation (5 minutes)</td>
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</tbody>
</table>