

12/31/2021 (Undergraduate students, who got an "A" or an "A-" grade in their EE354L, do not have to submit [HW#1](#))

Dear EE457 students of Spring 2022,

Please use Firefox browser or Microsoft Edge browser to open the EE457 links (which start with http://, and not with https://)



Wish you all a very Happy, Healthy, and Prosperous New Year, 2022!!!
Welcome to EE457! Hope you all had a safe and restful winter vacation!

About two-thirds of the students in EE457 are usually graduate students doing their first semester at USC. If you are one of them, then welcome to USC and to the ECE Department too!

First things first! Please check that you do not have any time conflicts with the three exams as there are no make-up exams. EE457 exams are design exams and are 3 hours long.

Extract from the syllabus (http://www-classes.usc.edu/engr/ee-s/457/ee457_Sp2022_exams/EE457_Syllabus_Spring_2022.pdf):

Quiz (~11%): Friday, Feb. 11, 2022, 05:00 PM - 08:00 PM PST
Midterm (~23.5%): Friday, Mar. 25, 2022, 05:00 PM - 08:00 PM PST
Final Exam (~33.5%): Wednesday, May 11, 2022, 03:30 PM - 06:30 PM PST **Please check**

First three weeks are important to all EE457 students who have not taken EE354L (previously called EE254L/EE201L).

EE457 (Computer Systems Organization) course provides you with foundation material needed to proceed to higher courses such as EE557, EE577a, EE533, and EE560.

If you are a continuing undergraduate student who did not get an A in your EE354L, the rest of this document applies to you also.

The prerequisite course, EE354L (previously called EE254L or EE201L), has been waived for the graduate students but our experience over the last 30 years tells us that most graduate students do not come with adequate introduction to logic design necessary for this course. So, I am providing some make up material which helps them to "survive" in the first three weeks of this course. This material is not difficult, but it is not too easy either. It is not quite intuitive, so it takes substantial time and effort (and creativity and imagination). So, I ask the graduate students to put in at least **30 hours** in the next 2.5 weeks (12/31/2021 to 1/17/2022) preparing for EE457. We have assignments due from the 2nd week of classes and it will be **overwhelming** if you do not put in time to make up for the lack of prerequisite knowledge. Due dates can be seen in this [calendar](#).

Detailed information about what you should do before the start of the semester is given in this "Study plan for the first three weeks" (provided in two formats):

pdf: http://www-classes.usc.edu/engr/ee-s/457/ee457_Sp2022_exams/EE457_Study_Plan_for_first_3_weeks.pdf

docx: http://www-classes.usc.edu/engr/ee-s/457/ee457_Sp2022_exams/EE457_Study_Plan_for_first_3_weeks.docx

Please download the .docx file also, as depending on the browser or pdf reader you use, the links in the pdf file may or may not work. Please use Firefox browser or Microsoft Edge browser to open the EE457 links (which start with http://, and not with https://). If any of the links do not work, please email me and I will try to rectify the problem quickly.

It will be great if you go through most of the items provided below and actually complete the [HW#1](#) and [HW#1B](#). Undergraduate students, who got an "A" or an "A-" grade in their EE354L, do not have to submit [HW#1](#). They need to submit a "Waiver Note". Please see HW#1 posting on D2L.

Best wishes,

Gandhi Puvvada

What do I want the graduate students to do in the first three weeks:

Please seek help whenever you need from the teaching team, but not through email. If it is a very simple/short question, you can use Ed Discussion (D2L=>MyTools=>Ed Discussion), but otherwise, please come and meet us well prepared to ask your question. After every lecture, go through the material covered in the lecture and prepare your list of questions to ask.

1. Please install several tools including Modelsim on your laptop (windows laptop) as per the following note.

http://www-classes.usc.edu/engr/ee-s/457/ee457_tools/EE457_README_first.pdf

Use the following userID and 10-digit StudentID to access the following installation guide and to download the installation files for Modelsim SE 10.6e

User name: **ltrojan**

10-digit ID for Password: **1010101010**

[\[classes.usc.edu/ee201/01O100ool111/f0r_UsC_oN1y/MSim_SE_10.6e/ModelSim_SE_10_6e_Installation_by_USC_students.pdf\]\(https://ece-classes.usc.edu/ee201/01O100ool111/f0r_UsC_oN1y/MSim_SE_10.6e/ModelSim_SE_10_6e_Installation_by_USC_students.pdf\)](https://ece-</p></div><div data-bbox=)

https://ece-classes.usc.edu/ee201/01O100ool111/f0r_UsC_oN1y/MSim_SE_10.6e/ModelSim_SE_10_6e_Installation_by_USC_students.pdf

If you do not have a Desktop/Laptop running windows 10, please buy one (or consider the alternatives stated at the bottom of [EE457_README_first.pdf](#)).

2. In the first week of classes, we cover the following 6 topics. However, I want you to watch the 6 short videos on the 6 topics at the following web directory **before the first day of classes**.

http://www-classes.usc.edu/engr/ee-s/457/ee457_first_lecture/ .

(a) DPU and CU design (b) Mealy machine example -- Divider Design (c) Data registers -- clocking and controlling (d) Loop Counter Incrementation and Terminal Value Checking (e) ME (Mutually Exclusive) and AI (All Inclusive) rules in designing a state diagram (f) State diagram Design examples

3. Notice that, while HW#1 and HW#1B are assigned, the HW#1A is provided with solution to serve as a practice item. It has four problems. I suggest that you do at least the 2nd problem (Make A close to B) and verify your work with the solution. Come to us if you do not understand the solution.

4. Then start working on HW#1 followed by HW#1B.

5. Watch the 6 Verilog lectures listed later in this document.

Complete the Verilog code for the HW#1A 2nd problem (Make A close to B) and verify. This is for practice only. It is worthwhile to go through the following procedural steps to simulate and submit:

Procedural steps illustration (from EE201L):

<http://www-classes.usc.edu/engr/ee->

[s/201/RTL_coding/ee201_RTL_exercises_Sp2010/EE201L_Introducing_the_procedure_associated_with_HW8A.pdf](http://www-classes.usc.edu/engr/ee-s/201/RTL_coding/ee201_RTL_exercises_Sp2010/EE201L_Introducing_the_procedure_associated_with_HW8A.pdf)

<http://www-classes.usc.edu/engr/ee->

[s/201/RTL_coding/ee201_RTL_exercises_Sp2010/EE201L_Introducing_the_procedure_associated_with_HW8A.avi](http://www-classes.usc.edu/engr/ee-s/201/RTL_coding/ee201_RTL_exercises_Sp2010/EE201L_Introducing_the_procedure_associated_with_HW8A.avi)

Note: If you do not see picture when playing .avi video files, then you need TSCC codec from

<https://www.techsmith.com/codecs.html>

6. Start working on the lab 1 of EE457 (Min/Max Finder -- 6 parts, but only 4 parts will be assigned).

Feel good that you are able to follow the first week of lectures (which are covered at a fast rate).

First week's lecture notes and webcasts reviewing EE201L material (.pdf files for slides + .avi **or** .wmv files for video):

You need to install on your PC [TechSmith TSCC Codec](#) to view .avi video files.

1. Chapter #1 Intro.

http://www-classes.usc.edu/engr/ee-s/457/ee457_first_lecture/ee457x1_Chapter1_microarchitecture.pdf
http://www-classes.usc.edu/engr/ee-s/457/ee457_first_lecture/1_EE457_Chapter1_microarchitecture.avi

2. DPU and CU

http://www-classes.usc.edu/engr/ee-s/457/ee457_first_lecture/ee457x2_DPU_CU.pdf
http://www-classes.usc.edu/engr/ee-s/457/ee457_first_lecture/2_DPU_CU.wmv

3. Mealy machine example -- Divider Design

http://www-classes.usc.edu/engr/ee-s/457/ee457_first_lecture/ee457x3_Moore_Mealy_Divider.pdf
http://www-classes.usc.edu/engr/ee-s/457/ee457_first_lecture/3_Divider_Mealy_example.avi

4. Data registers -- clocking and controlling

http://www-classes.usc.edu/engr/ee-s/457/ee457_first_lecture/ee457x4_Data_Registers.pdf
http://www-classes.usc.edu/engr/ee-s/457/ee457_first_lecture/4_Data_Registers_with_Data_Enable.avi

5. Loop Counter Incrementation and Terminal Value Checking

http://www-classes.usc.edu/engr/ee-s/457/ee457_first_lecture/EE457x5_P1_loop_counter.pdf
http://www-classes.usc.edu/engr/ee-s/457/ee457_first_lecture/EE457x5_P2_loop_counter_example_doubling_A.pdf
http://www-classes.usc.edu/engr/ee-s/457/ee457_first_lecture/EE457x5_P3_loop_counter_ee102_midterm1_Sp2005_Q4_question_and_solution.pdf
http://www-classes.usc.edu/engr/ee-s/457/ee457_first_lecture/EE457x5_P3_loop_counter_ee102_midterm1_Sp2005_Q4_transparencies.pdf
http://www-classes.usc.edu/engr/ee-s/457/ee457_first_lecture/5_Loop_Iteration_Counter.avi

6. ME (Mutually Exclusive) and AI (All Inclusive) rules in designing a state diagram

http://www-classes.usc.edu/engr/ee-s/457/ee457_first_lecture/ee457x6_P1_mutually_exclusive.pdf
http://www-classes.usc.edu/engr/ee-s/457/ee457_first_lecture/ee457x6_P2_ME_AI_tables.pdf
http://www-classes.usc.edu/engr/ee-s/457/ee457_first_lecture/6_Mutually_Exclusive_All_Inclusive.avi

7. State diagram Design examples

http://www-classes.usc.edu/engr/ee-s/457/ee457_first_lecture/ee457x7_State_Diagram_Design_examples.pdf
http://www-classes.usc.edu/engr/ee-s/457/ee457_first_lecture/7_State_Diagram_Design_examples.avi

EE457 HW#1 (Due: [calendar](#))

Undergraduate students, who got an “A” or an “A-“ grade in their EE354L, do not have to submit HW#1 (ee457_hw1_r1.pdf) .

However, they need to submit a HW#1 Waiver application. Please see HW#1 posting on D2L

Homework #1 (16 pages) Revised in Fall 2020

http://www-classes.usc.edu/engr/ee-s/457/ee457_Homeworks/HW1/ee457_hw1_r1.pdf

On-campus students will be given hard-copies of the assignment in the first week of classes.

State Diagram design: If you are new to this topic, first go through these ([.pdf](#) [.avi](#)).

Additional help on the first 10 pages (first two questions related to datapath design) of this homework:

The first 10 pages of this homework are from the EE101/EE354L homework on datapath design for which solution and webcast are provided below. Do not just copy the solution. Understand the solution. If you are new to this topic, please watch the webcast also.

EE101 items on datapath: [ee101_hw_on_datapath.pdf](#) [ee101_hw_on_datapath_sol.pdf](#)
[ee101_hw_on_datapath.mp4](#)

HW#1A (for practice only, not for submission)

This HW#1A is an additional practice for graduate students who did not take EE354L (previously called EE254L/EE201L) here at USC. You do not need to submit this.

http://www-classes.usc.edu/engr/ee-s/457/EE457_HW1A/EE457_HW1A_EE201L_RTL_Exercises.pdf

Additional help on next page.

Solution: Please do not show this to the EE354L students as it is an assignment in their course:

http://www-classes.usc.edu/engr/ee-s/457/EE457_HW1A/DO_NOT_SHOW_TO_EE354L_students/

Help on HW#1A (for practice only, **not** for submission)

Watch these webcasts one at a time and then complete the state diagram. Check with the solution.

Right-click on the video file and download it. Do not stream the videos. The server is not meant for video streaming. If the video does not play on your computer, then you need to install TSCC codec from TechSmith. TechSmith links are provided below.

<http://www.techsmith.com/download.html>

<http://download.techsmith.com/tsc/tsc.exe>

1. The last question (Q#4) of EE201L quiz of Spring 2010

Q#4 Convert Inches to Feet and further to Yards

http://www-classes.usc.edu/engr/ee-s/201/EE201L_Sp2010_Exams/ee201_Quiz_Sp2010_Pages_9_10_DataPath_Inches_Feet_Yards Lec_mht.pdf

.mp4 video file

Right-click on the .mp4 file link below and select "Save Target as" to download.

<http://www-classes.usc.edu/engr/ee->

[s/201/EE201L_Sp2010_Exams/ee201_Quiz_Sp2010_Pages_9_10_DataPath_Inches_Feet_Yards.mp4](http://www-classes.usc.edu/engr/ee-s/201/EE201L_Sp2010_Exams/ee201_Quiz_Sp2010_Pages_9_10_DataPath_Inches_Feet_Yards.mp4)

2. The **first 3** questions of the EE201L RTL coding exercises:

http://www-classes.usc.edu/engr/ee-s/201/RTL_coding/ee201_RTL_exercises_Sp2010/

The assignment (only the **first 6** pages)

<http://www-classes.usc.edu/engr/ee->

[s/201/RTL_coding/ee201_RTL_exercises_Sp2010/EE201L_RTL_exercises_Spring2010.pdf](http://www-classes.usc.edu/engr/ee-s/201/RTL_coding/ee201_RTL_exercises_Sp2010/EE201L_RTL_exercises_Spring2010.pdf)

Q#1 Largest Number Divisible by 7

http://www-classes.usc.edu/engr/ee-s/201/RTL_coding/ee201_RTL_exercises_Sp2010/EE201L_RTL_exercises_Spring2010_Q1.pdf

.wmv file:

Right-click and select "Save Target as" to download EE201L_RTL_exercises_Spring2010_Q1.wmv

<http://www-classes.usc.edu/engr/ee->

[s/201/RTL_coding/ee201_RTL_exercises_Sp2010/EE201L_RTL_exercises_Spring2010_Q1.wmv](http://www-classes.usc.edu/engr/ee-s/201/RTL_coding/ee201_RTL_exercises_Sp2010/EE201L_RTL_exercises_Spring2010_Q1.wmv)

Q#2 Make A close to B

http://www-classes.usc.edu/engr/ee-s/201/RTL_coding/ee201_RTL_exercises_Sp2010/EE201L_RTL_exercises_Spring2010_Q2.pdf

.wmv file:

Right-click and select "Save Target as" to download EE201L_RTL_exercises_Spring2010_Q2.wmv

<http://www-classes.usc.edu/engr/ee->

[s/201/RTL_coding/ee201_RTL_exercises_Sp2010/EE201L_RTL_exercises_Spring2010_Q2.wmv](http://www-classes.usc.edu/engr/ee-s/201/RTL_coding/ee201_RTL_exercises_Sp2010/EE201L_RTL_exercises_Spring2010_Q2.wmv)

Q #3 Copying two parts of a sorted array

http://www-classes.usc.edu/engr/ee-s/201/RTL_coding/ee201_RTL_exercises_Sp2010/EE201L_RTL_exercises_Spring2010_Q3.pdf

.wmv file:

Right-click and select "Save Target as" to download EE201L_RTL_exercises_Spring2010_Q3.wmv

<http://www-classes.usc.edu/engr/ee->

[s/201/RTL_coding/ee201_RTL_exercises_Sp2010/EE201L_RTL_exercises_Spring2010_Q3.wmv](http://www-classes.usc.edu/engr/ee-s/201/RTL_coding/ee201_RTL_exercises_Sp2010/EE201L_RTL_exercises_Spring2010_Q3.wmv)

HW#1B (Due: [calendar](#))

Selected 9 pages (First 6 pages 1/12-6/12 and last 3 pages 10/12-12/12) of the 12-page HW#1B
http://www-classes.usc.edu/engr/ee-s/457/ee457_HW1B/ee457_HW1B_r1.pdf

Hard copies will be provided to you in class in the first week.

Help on the last question (Q#1 of EE457 Quiz - Fall 2010) in HW#1B

You may want to review Signed number representation in 2's complement notation. I have provided information below.

Please watch the **first 20 minutes (from 00:13:00-00:33:00)** of the following lecture ([EE457Lx_20123329.wmv](#)):

Chapter 4 Part 1

Signed number representation in 2's complement notation,

Adder/Subtractor design for unsigned numbers and signed number -- overflow detection in each of them

Time: 1 Hour 2 minutes (from 00:13:00-01:15:00)

Open the following directory and download (not stream) the file [EE457Lx_20123329.wmv](#) and watch starting at **13-minute point**.

https://ece-classes.usc.edu/ee457/ee457_Ch4_P1_Lab3_ALU/Fall2012_Sept_18_20/

Verilog Introduction lectures:

Six lectures (together with slides) were posted at the link below to introduce the essential aspects of Verilog to the EE201L students (and to the graduate students in EE457, who are new to Verilog coding), so that they can get started with using Verilog for completing their labs. The lectures add up to 3 Hours 40 minutes.

<https://ece-classes.usc.edu/ee254/Verilog/>

0_Verilog_Main_Points_of_the_6_Lectures.pdf (if you already know Verilog, you can view this in lieu of the 6 modules)

https://ece-classes.usc.edu/ee254/Verilog/0_Verilog_Main_Points_of_the_6_Lectures.pdf

1_Verilog_Introduction_mht.pdf

https://ece-classes.usc.edu/ee254/Verilog/1_Verilog_Introduction_mht.pdf

1_Verilog_Introduction.avi (1 H 08 Minutes)

https://ece-classes.usc.edu/ee254/Verilog/1_Verilog_Introduction.avi

2_module_DataTypes_in_Verilog.pdf

https://ece-classes.usc.edu/ee254/Verilog/2_module_DataTypes_in_Verilog.pdf

2_module_DataTypes_in_Verilog.avi (23 minutes)

https://ece-classes.usc.edu/ee254/Verilog/2_module_DataTypes_in_Verilog.avi

3_behavioral_vs_structural_Verilog.pdf

https://ece-classes.usc.edu/ee254/Verilog/3_behavioral_vs_structural_Verilog.pdf

3_behavioral_vs_structural_Verilog.avi (17 minutes)

https://ece-classes.usc.edu/ee254/Verilog/3_behavioral_vs_structural_Verilog.avi

4_Sequential_Statements_in_Verilog.pdf

https://ece-classes.usc.edu/ee254/Verilog/4_Sequential_Statements_in_Verilog.pdf

4_Sequential_Statements_in_Verilog.avi (1 Hour)

https://ece-classes.usc.edu/ee254/Verilog/4_Sequential_Statements_in_Verilog.avi

5_blocking_non_blocking.pdf

https://ece-classes.usc.edu/ee254/Verilog/5_blocking_non_blocking.pdf

5_blocking_non_blocking.avi (56 minutes)

https://ece-classes.usc.edu/ee254/Verilog/5_blocking_non_blocking.avi

6_RTL_coding_style.pdf

https://ece-classes.usc.edu/ee254/Verilog/6_RTL_coding_style.pdf

6_RTL_coding_style.avi (33 minutes)

https://ece-classes.usc.edu/ee254/Verilog/6_RTL_coding_style.avi

EE254L_RTL_coding_style_verilog.pdf

https://ece-classes.usc.edu/ee254/Verilog/EE254L_RTL_coding_style_verilog.pdf

ee254_divider_simple.zip

https://ece-classes.usc.edu/ee254/Verilog/ee254_divider_simple.zip

Lab #1 min/max finder lab (Verilog) (Due: [calendar](#))

Note: The .zip files will be available for download **in the second week of classes.**

.pdf of the assignment (both in Color and Black_n_White):

[http://www-classes.usc.edu/engr/ee-](http://www-classes.usc.edu/engr/ee-s/457/ee457_lab_manual_FI2010/min_max/ee457_min_max_finder_lab.pdf)

[s/457/ee457_lab_manual_FI2010/min_max/ee457_min_max_finder_lab.pdf](http://www-classes.usc.edu/engr/ee-s/457/ee457_lab_manual_FI2010/min_max/ee457_min_max_finder_lab.pdf)

[http://www-classes.usc.edu/engr/ee-](http://www-classes.usc.edu/engr/ee-s/457/ee457_lab_manual_FI2010/min_max/ee457_min_max_finder_lab_Black_n_White.pdf)

[s/457/ee457_lab_manual_FI2010/min_max/ee457_min_max_finder_lab_Black_n_White.pdf](http://www-classes.usc.edu/engr/ee-s/457/ee457_lab_manual_FI2010/min_max/ee457_min_max_finder_lab_Black_n_White.pdf)

Six of the figures in landscape mode for online reading (both in Color and Black_n_White):

[http://www-classes.usc.edu/engr/ee-](http://www-classes.usc.edu/engr/ee-s/457/ee457_lab_manual_FI2010/min_max/ee457_min_max_finder_lab_figures.pdf)

[s/457/ee457_lab_manual_FI2010/min_max/ee457_min_max_finder_lab_figures.pdf](http://www-classes.usc.edu/engr/ee-s/457/ee457_lab_manual_FI2010/min_max/ee457_min_max_finder_lab_figures.pdf)

[http://www-classes.usc.edu/engr/ee-](http://www-classes.usc.edu/engr/ee-s/457/ee457_lab_manual_FI2010/min_max/ee457_min_max_finder_lab_figures_Black_n_White.pdf)

[s/457/ee457_lab_manual_FI2010/min_max/ee457_min_max_finder_lab_figures_Black_n_White.pdf](http://www-classes.usc.edu/engr/ee-s/457/ee457_lab_manual_FI2010/min_max/ee457_min_max_finder_lab_figures_Black_n_White.pdf)

Slides (pdf) file used in class lecture

[http://www-classes.usc.edu/engr/ee-](http://www-classes.usc.edu/engr/ee-s/457/ee457_lab_manual_FI2010/min_max/ee457x8_min_max_finder.pdf)

[s/457/ee457_lab_manual_FI2010/min_max/ee457x8_min_max_finder.pdf](http://www-classes.usc.edu/engr/ee-s/457/ee457_lab_manual_FI2010/min_max/ee457x8_min_max_finder.pdf)

Short video and slides explaining part 3 (the four methods M1, M2, M3, and M4)

Note: The Part 3 Method M2 and M4 are cancelled for submission.

[http://www-classes.usc.edu/engr/ee-](http://www-classes.usc.edu/engr/ee-s/457/ee457_lab_manual_FI2010/min_max/min_max_Improved_testbench_part3.pdf)

[s/457/ee457_lab_manual_FI2010/min_max/min_max_Improved_testbench_part3.pdf](http://www-classes.usc.edu/engr/ee-s/457/ee457_lab_manual_FI2010/min_max/min_max_Improved_testbench_part3.pdf)

[http://www-classes.usc.edu/engr/ee-](http://www-classes.usc.edu/engr/ee-s/457/ee457_lab_manual_FI2010/min_max/min_max_Improved_testbench_part3.avi)

[s/457/ee457_lab_manual_FI2010/min_max/min_max_Improved_testbench_part3.avi](http://www-classes.usc.edu/engr/ee-s/457/ee457_lab_manual_FI2010/min_max/min_max_Improved_testbench_part3.avi)

Verilog files for downloading and completing (will be available **after the 1st week of classes**):

Part 1:

http://www-classes.usc.edu/engr/ee-s/457/ee457_lab_manual_FI2010/min_max/min_max_finder_part1.zip

Part 2:

http://www-classes.usc.edu/engr/ee-s/457/ee457_lab_manual_FI2010/min_max/min_max_finder_part2.zip

Part 3 Method 1:

http://www-classes.usc.edu/engr/ee-s/457/ee457_lab_manual_FI2010/min_max/min_max_finder_part3_M1.zip

Part 3 Method 2: **cancelled**

~~http://www-classes.usc.edu/engr/ee-s/457/ee457_lab_manual_FI2010/min_max/min_max_finder_part3_M2.zip~~

Part 3 Method 3:

http://www-classes.usc.edu/engr/ee-s/457/ee457_lab_manual_FI2010/min_max/min_max_finder_part3_M3.zip

Part 3 Method 4: **cancelled**

~~http://www-classes.usc.edu/engr/ee-s/457/ee457_lab_manual_FI2010/min_max/min_max_finder_part3_M4.zip~~

It will be great if you can complete state diagrams on paper for the four parts of Lab 1 (min/max finder) (the first 4 pages of the [pdf](#)) before the start of the semester!