

San José State University
Department of Aviation & Technology
Tech 62, Analog Circuits, Fall 2017

Course and Contact Information

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|-------------------------|---|
| Instructor: | Dr. Ignatius Bezzam |
| Office Location: | IS134 |
| Telephone: | (408) 813 4716 |
| Email: | ibezam@scu.edu and CANVAS (preferred) |
| Office Hours: | TTh: 1600-1700 |
| Class Days/Time: | TTh: 1500-1550 |
| Classroom: | IS216 |
| Prerequisites: | TECH 060 and MATH 071 or MATH 030 |

Course Format:

The course relies on lecture materials presented in class and students are strongly encouraged to attend.

Faculty Web Page and MYSJSU Messaging

Course materials such as syllabus, handouts, notes, assignment instructions, etc. can be found on my faculty web page at <http://www.sjsu.edu/people/firstname.lastname> and/or on [Canvas Learning Management System course login website](#) at <http://sjsu.instructure.com>. You are responsible for regularly checking with the messaging system through [MySJSU](#) at <http://my.sjsu.edu> (or other communication system as indicated by the instructor) to learn of any updates

Course Description

Semiconductor theory; p-n junction, bipolar transistors, JFETs and MOSFETs, optoelectronic devices. Operational amplifiers and 555 timers. Device applications: comparators, signal generators, active filters, instrumentation amplifiers, voltage regulators and power supplies. Course Learning Outcomes (CLO)

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

1. Describe the fundamentals of semiconductor diodes, transistors, op-amps, timers, and oscillators.
2. Build, identify, and analyze diode circuits, transistor circuits, op-amp circuits, active filters, and oscillators.
3. Design or modify fundamental electronic circuits to meet certain requirements

Required Texts/Readings

Textbook

Floyd, Thomas L. (2012). Electronic Devices. Conventional Current Version. 10th Ed. Upper Saddle River, NJ: Prentice Hall. ISBN-13: 978-0-13-441454-6.

You may obtain an electronic version at:

<http://www.mypersonstore.com/bookstore/electronic-devices-conventional-current-version-subscription-9780134414546?xid=PS&D>

Other Readings

Instructor lecture notes and datasheets.

For LTspice Exercises, download from the Link:

[https://media.pearsoncmg.com/ph/chet/careersresources/resourcessite/products/series.html#series,series=Electronics and Electricity Technology](https://media.pearsoncmg.com/ph/chet/careersresources/resourcessite/products/series.html#series,series=Electronics%20and%20Electricity%20Technology)

Course Requirements and Assignments

Class Participation

Students working in groups of 2-3 will solve Problems Sets (assigned problems from each chapter) posted on Canvas (<https://sjsu.instructure.com>). Click on the **Modules** tab. You need to include the question and the answer. The answers should be easy to follow. The whole class will check/discuss if the answers are correct before submitting them. This group discussion will reinforce and/or enhance your analog circuits' knowledge.

When the Group has determined that their answers are correct then each Group will submit their answers via Canvas (<https://sjsu.instructure.com>). **One report per group.** Click on the **Assignments** tab for submission. **Only the students whose names are indicated on the group report will get the credit.**

Class Participation contributes to CLOs 2 and 3, learning the fundamental concepts of analog circuits, developing teamwork skills and discussing the course material. Class Participation must be submitted by the due date indicated on the green sheet and has a weight of 10% of the final grade. Your online inputs in the class will be used to assess objectively your class participation. Classes missed without approved reason and not made up will deduct from this score.

Lab experiments

You will complete lab assignments individually using the SPICE software. In addition, you will hardware 4 lab experiments and will compare the measurements obtained using real instruments with the ones obtained using SPICE. The written reports will be submitted one week after the date of the assigned lab. Lab experiments contribute to CLOs 2, 4 and 5, reinforcing the course material and developing teamwork skills.

Lab experiments have a weight of 0.30% of the final grade.

Tests

You will take weekly take-home quizzes, two midterms and the final exam. Tests will start and end at the scheduled time. These tests contribute to CLOs 1, 2 and 3 as well as reinforcing the learning of the fundamental concepts of analog circuits. The weight of the tests for the final grade is 20% for the weekly quizzes, 20% for midterms and 20% for the final exam.

Weekly Take-home Quizzes

You will download the weekly take-home Quizzes posted on Canvas (<https://sjsu.instructure.com>). Click on the **Modules** tab. **You can work in groups but each student must submit his/her own quiz** via Canvas (<https://sjsu.instructure.com>) on or before the due date. Click on the **Assignments** tab.

Final Examination or Evaluation

Final Exam will be taken Thursday, 2017 December 14, 1445-1700.

Grading Information

Weekly online Quizzes, midterms and final exam will be graded based on the followed process and accurate answers. Class Participation will be evaluated based on the followed process and percent of accurate responses

provided. Lab experiments grade will be determined on the percent of lab assignments completed on or before the due date.

Determination of Grades

Grades will be determined based on your performance in Lab experiments, Class Participation, Weekly Quizzes, Midterms and Final Exam. The final grade for the course will be based on the following items and weights:

- | | |
|-------------------------------|-----|
| 1. Lab experiments | 30% |
| 2. Class participation online | 10% |
| 3. Weekly Quizzes & Problems | 20% |
| 4. Midterms (2x10%) | 20% |
| 5. Final Exam | 20% |

There will be no curving of grades. Final grades will be assigned as follows:

| | | |
|----------|----------|----------|
| A >94 | A- 90-93 | |
| B+ 85-89 | B 80-84 | B- 76-79 |
| C+ 72-75 | C 69-71 | C- 65-68 |
| D+ 62-64 | D 59-61 | D- 56-58 |
| F <55 | | |

Commented [P1]: This grading scale seems too low. F less than 55%.

Classroom Protocol

1. You are expected to attend all meetings for the course as you are responsible for material discussed therein, and active participation is frequently essential to ensure maximum benefit to all class members. Attendance is fundamental to course objectives; for example, you may be required to interact with others in the class.
2. Download (DO NOT print) read and bring softcopies of the assigned Chapter handout 2017 posted on Canvas (<https://sjsu.instructure.com>). Click on the **Modules** tab.
3. You will study the assigned chapter/material before coming to lecture by watching the assigned videos, reading the textbook and reviewing the PowerPoint presentation posted on Canvas (<https://sjsu.instructure.com>). Click on the **Modules** tab.
4. After reviewing the chapter materials you will answer the Problem Sets (assigned problems at the end of the chapter) posted on Canvas (<https://sjsu.instructure.com>). Click on the **Modules** tab.
5. Instructor will explain key points and answer questions from students. Instructor may add related material to enrich the course content.
6. Instructor will become more as a facilitator of learning. This means that the instructor will provide as much individual or group assistance as needed.
7. Students should work and learn in teams. This is very important to be successful in the real world.

University Policies

Per University Policy S16-9, university-wide policy information relevant to all courses, such as academic integrity, accommodations, etc. will be available on Office of Graduate and Undergraduate Programs' Syllabus Information web page at <http://www.sjsu.edu/gup/syllabusinfo/>

Tech 62 Analog Circuits, Fall 2017 Course Schedule

The schedule is subject to change with one week notice on CANVAS and email.

Course Schedule

| Week | Date | Topics, Readings, Assignments, Deadlines |
|------|------------|--|
| 1 | Aug 24 | <p>Introduction/Orientation/Greensheet Email Proof of completion of course prereq (Tech 60 or equivalent and MATH 71 or MATH 30) by 8/29 Download (DO NOT print) read and bring softcopies of Chapters 1 & 2 handout 2017 from Canvas. Modules tab. Read Ch1: Introduction to Electronics/ Ch 2: Diodes Watch video: http://www.youtube.com/watch?v=IA6V205VMYy Read 1-4: The PN junction Read 2-1: Diode Operation Read 2-3: Diode Models LOAD LTSPICE: Set up for LAB Prepare in advance for the next session: Download (DO NOT print) read and bring softcopies of Chapter 4 handout 2017 from Canvas. Modules tab. Watch video: http://www.youtube.com/watch?v=-td7YT-Pums&feature=related Read Chapter 4: 4-1: BJT Structure 4-2: Basic BJT Operation 4-3: BJT Characteristics And Parameters Answer Problems Set 1</p> |
| 2 | Aug 29, 31 | <p>Discuss Chapter 4 Email Proof of completion of course prereq (Tech 60 or equivalent and MATH 71 or MATH 30) by 8/29 4-4: The BJT As An Amplifier 4-5: The BJT As A Switch Prepare Quiz Set1 • Submit Weekly Quiz 1 via Canvas when available Attempt Assignment Set 1 Due by 11:00 pm on 9/1! Prepare in advance for the next session: Chapter 4-5 handout 2017 from Canvas or email. Watch video: https://www.youtube.com/watch?v=WLYc6oD2BYA Read: 5-1: The DC Operating Point 5-2: Voltage Divider Bias 5-3: Emitter, Base, Emitter-Feedback And Collector-Feedback Biasing Finish Assignment Set 1</p> |
| 3 | Sep 5, 7 | <p>Discuss Chapter 5 Finish Problems Set 2 Submit Problems Set 1 via Canvas. Click on the Assignments tab. Due by 11:00 pm on 9/13! Group submission. Only the indicated students will get the credit. Submit Weekly Quiz 2 via Canvas. Click on the Assignments tab. Due by 11:00 pm on 9/13! Individual submission Prepare in advance for the next session:</p> |

| Week | Date | Topics, Readings, Assignments, Deadlines |
|------|----------------|---|
| | | <p>Download (DO NOT print) read and bring softcopies of Chapter 6 handout 2017 from Canvas. Modules tab.</p> <p>Read 6-1: Amplifier Operation</p> <p>Watch video: http://www.youtube.com/watch?v=-LPALAwcYkg</p> <p>Read 6-2: Transistor AC Models</p> <p>Watch</p> <p>video: https://www.youtube.com/watch?v=Pkjn18Ekjic</p> <p>Read 6-3: The Common-Emitter Amplifier</p> <p>Read 6-4: The Common-Collector Amplifier</p> <p>Answer Problems Set 3</p> |
| 4,5 | Sep 12, 14, 19 | <p>Discuss Chapter 6</p> <p>Finish Problems Set 3</p> <p>Submit Problems Set 2 via Canvas. Click on the Assignments tab. <i>Due by 11:00 pm on 9/22! Group submission. Only the indicated students will get the credit.</i></p> <p>Submit Weekly Quiz 3 via Canvas. Click on the Assignments tab. <i>Due by 11:00 pm on 9/22! Individual submission</i></p> <p>Read and bring Chapter 6 handout 2017 from Canvas. Modules tab.</p> <p>Read in advance for the next session:</p> <p>6-5: The Common-Base Amplifier</p> <p>6-6: Multistage Amplifiers</p> <p>Answer Problems Set 4</p> |
| 5,6 | Sep 21, 26 | <p>Discuss Chapter 6</p> <p>Finish Problems Set 4</p> <p>Submit Problems Set 3 via Canvas, Click on the Assignments tab. <i>Due by 11:00 pm on 9/29! Group submission. Only the indicated students will get the credit.</i></p> <p>Submit Weekly Quiz 4 via Canvas.) Click on the Assignments tab. <i>Due by 11:00 pm on 9/29! Individual submission</i></p> <p>Prepare in advance for the next session:</p> <p>Download (DO NOT print) read and bring softcopies of Chapter 8 handout 2017 from Canvas. Modules tab.</p> <p>Read 8-1: The JFET</p> <p>Watch video: http://www.youtube.com/watch?v=BzsXNhgVC0</p> <p>Read 8-2: JFET Characteristic and Parameters</p> <p>Read 8-3: JFET Biasing</p> <p>Read 8-4: The Ohmic Region</p> <p>Answer Problems Set 5</p> |
| 6,7 | Sep 28, Oct 3 | <p>Discuss Chapter 8</p> <p>Finish Problems Set 5</p> <p>Submit Problems Set 4 via Canvas. Click on the Assignments tab. <i>Due by 11:00 pm on 10/6! Group submission. Only the indicated students will get the credit.</i></p> <p>Submit Weekly Quiz 5 via Canvas. Click on the Assignments tab. <i>Due by 11:00 pm on 10/6! Individual submission</i></p> <p>Prepare for Midterm 1</p> <p>You can use schematic diagrams and equations only. No text is allowed such as If resistor shorts it is 0, etc.</p> |

| Week | Date | Topics, Readings, Assignments, Deadlines |
|----------|---------------------|--|
| 7 | Oct 5 | Review Q & A |
| 8 | Oct 10 | <p>Midterm 1</p> <p><i>Prepare in advance for the next session:</i></p> <p>Download (DO NOT print) read and bring softcopies of Chapter 9 handout 2017 from Canvas. Modules tab.</p> <p>Read 9-1: The Common-Source Amplifier</p> <p>Read 9-2: The Common-Drain Amplifier</p> <p>Read 9-3: The Common-Gate Amplifier</p> <p>Answer Problems Set 6</p> |
| 9,10 | Oct 12, 17 | <p>Discuss Chapter 10</p> <p>Finish Problems Set 7</p> <p>Submit Problems Set 6 via Canvas. Click on the Assignments tab. <i>Due by 11:00 pm on 11/1! Group submission. Only the indicated students will get the credit.</i></p> <p>Submit Weekly Quiz 7 via Canvas. Click on the Assignments tab. <i>Due by 11:00 pm on 11/1! Individual submission</i></p> <p>Download (DO NOT print) read and bring softcopies of Chapter 12 handout 2017 from Canvas. Modules tab..</p> <p><i>Prepare in advance for the next session:</i></p> <p>Watch video: http://www.youtube.com/watch?v=TQB1VILBgJE</p> <p>Read 12-4: Op-Amps with Negative Feedback</p> <p>Read 12-5: Effects of Negative Feedback on Op-Amp Impedance</p> <p>Read 12-7: Open-Loop Response</p> <p>Read 12-8: Closed-Loop Response</p> <p>Answer Problems Set 8</p> |
| 10,11 | Oct 19, 24 | <p>Discuss Chapter 12</p> <p>Finish Problems Set 8</p> <p>Submit Problems Set 7 via Canvas. Click on the Assignments tab. <i>Due by 11:00 pm on 11/8! Group submission. Only the indicated students will get the credit.</i></p> <p>Submit Weekly Quiz 8 via Canvas. Click on the Assignments tab. <i>Due by 11:00 pm on 11/8! Individual submission</i></p> <p>Download (DO NOT print) read and bring softcopies of Chapters 13 & 16 handout 2017 from Canvas. Modules tab..</p> <p><i>Prepare in advance for the next session:</i></p> <p>Watch video: http://www.youtube.com/watch?v=nG8gA_kAp-Y</p> <p>Read 13-1: Comparators</p> <p>Read 13-2: Summing Amplifiers</p> <p>Read 13-3: Integrators and Differentiators</p> <p>Read 16-2: Feedback Oscillator Principles and Oscillator types</p> <p>Answer Problems Set 9</p> |
| 11,12,13 | Oct 26, Nov 2, 7, 9 | <p>Discuss Chapters 13 & 16</p> <p>Finish Problems Set 9</p> <p>Submit Problems Set 8 via Canvas. Click on the Assignments tab. <i>Due by 11:00 pm on 11/22! Group submission. Only the indicated students will get the credit.</i></p> |

| Week | Date | Topics, Readings, Assignments, Deadlines |
|-------------------|------------------------------|---|
| | | <p>Submit Weekly Quiz 9 via Canvas. Click on the Assignments tab. <i>Due by 11:00 pm on 11/22! Individual submission</i></p> <p><i>Prepare in advance for the next session:</i></p> <p>Watch video: http://www.youtube.com/watch?v=yj4uVVV5Nsg</p> <p>Read 2-4: Half-Wave Rectifiers</p> <p>Read 2-5: Full-Wave Rectifiers</p> <p>Answer Problems Set 10</p> |
| 14 | Nov14 | <p>Review Q & A</p> <p>Finish Problems Set 10</p> <p>Submit Problems Set 9 via Canvas. Click on the Assignments tab. <i>Due by 11:00 pm on 11/29! Group submission. Only the indicated students will get the credit.</i></p> <p>Submit Weekly Quiz 10 via Canvas. Click on the Assignments tab. <i>Due by 11:00 pm on 11/29! Individual submission</i></p> <p>Prepare for Midterm 2</p> |
| 14 | Nov 16 | <p>Midterm 2</p> <p><i>Prepare in advance for the next session:</i></p> <p>Download (DO NOT print) read and bring softcopies of Chapter 3 handout 2017 from Canvas. Modules tab</p> <p>Read 2-6: Power Supply Filters and Regulators</p> <p>Read Ch3: Special-Purpose Diodes</p> <p>Watch video: http://www.youtube.com/watch?v=jG2YAfTWxvc</p> <p>Read 3-1: The Zener Diode</p> <p>Read 3-2: Zener Diode Application</p> <p>Answer Problems Set 11</p> |
| 15 | Nov 21 | Thanking Chapters 1 – 16 Learnings |
| 16 | Nov 28, 30 | <p>Discuss Chapter 3 and others</p> <p>Finish Problems Set 11</p> |
| 17 | Dec 5, 7 | <p>Review All material</p> <p>Submit Problems Set 10 via Canvas. Click on the Assignments tab. <i>Due by 11:00 pm on 12/13! Group submission. Only the indicated students will get the credit.</i></p> <p>Submit Problems Set 11 via Canvas. Click on the Assignments tab. <i>Due by 11:00 pm on 12/13! Group submission. Only the indicated students will get the credit.</i></p> <p>Prepare for FINAL</p> |
| Final Exam | Thursday, 2017 Dec14, | Venue TBD 14:45-17:00. |

SAN JOSE STATE UNIVERSITY
Department of Aviation & Technology

Tech 62 Labs @ IS117
Fall 2017
Section M 9:00– 11:15
Section F 9:00 – 11:15

Dr. Ignatius Bezzam
TAs: ali.saeidiashtiyani@sjsu, melody.teoh@sjsu.edu
Office Hour: MF 1100:12
by Appointment in Lab

| Your Week Friday/Monday (dates subject to revision) | Lab Experiments |
|--|--|
| 1 (Aug 25/28) | Hands On, Lab Safety and Rules by TAs. SPICE Introduction. |
| 1&2 (Sep 1&8 / Sep 11&18) | SPICE Bipolar Transistor characteristics. Refer Experiment #11 |
| 1&2 (Sep 1&8 / Sep 11&18) | SPICE Collector-feedback biased BJT. Refer Experiment #16 |
| 2&3 (Sep 8 &15 / Sep 18 & 25) | #1 Hardwired lab Experiment Collector-feedback biased BJT (2N3904 or equivalent) BONUS: Bipolar Transistor characteristics |
| 3&4 (Sep 15&22/ Sep 25&Oct 2) | SPICE Voltage Divider Biased BJT. Refer Experiment #13 |
| 4&5 (Sep 22&29 / Oct 2 & 9) | #2 Hardwired Lab Experiment Voltage Divider Biased BJT |
| 6 (Oct 6/Oct 16) | SPICE Small-signal common-emitter amplifier. Refer Experiment #17 |
| 6&7 (Oct 6&13/ Oct 16&23) | #3 Hardwired Lab Experiment Small-signal common-emitter amplifier |
| 8 (Oct 20 / Oct 30) | SPICE JFET Small-signal common-source amplifier. Refer Experiment #27 |
| 8&9 (Oct 20&27 / Oct 30&Nov 6) | SPICE OPAMP Inverting voltage amplifier. Refer Experiment #32 SPICE OPAMP Non Inverting voltage amplifier. Refer Experiment #31 |
| 10 (Nov 3 / Nov 13) | catch up - 11/10/2017 Veterans Day – Campus Closed |
| 10&11 (Nov 3&17 / Nov 13&20) | #4 Hardwired Lab Experiment Inverting Voltage Amplifier |
| 12 (Nov 22-24) | Thanksgiving Holidays – Campus Closed |
| 13/12 (Nov 30/Nov 20 & 27) | SPICE Op-amp Integrator and Differentiator. Refer Experiment #35. |
| 14/13 (Dec 8 / Dec 4) | Catch up BONUS: Hardwire Op-amp Integrator or Differentiator |

Notes:

1. Each student will perform all lab experiments using SPICE: Simulation Program with Integrated Circuit Emphasis (LTspice/Multisim software).
2. Each student will submit an online lab report a week after the lab is completed.
3. Students working in groups of 2-3 members will hardwire four lab experiments. The measurements obtained in these hardwired lab experiments will be compared with the ones obtained using SPICE.
4. While one batch of students work at the Computer Area other half will work on the instrument test benches area. Simulation and Hardwiring may be repeated in any order.
5. Each group will submit a report online of each hardwired lab within week after the lab is completed.
6. Experiment is complete when Report is complete and accepted. If you have finished the Lab data collection you may spend the rest of the time in Lab to complete the report and submit online.