

Course Description

Description: Credits 1. Applies the knowledge gained in theoretical electronics courses to the analysis, design, construction and testing of circuits that are found in industrial and commercial electronic systems. Emphasizes the development of skills in (a) circuit design (b) computer simulation, (c) circuit wiring, (d) maintenance of experimental record, (e) writing of technical reports and (f) oral communications via presentations.

Textbook: None.

Reference Books: D.A. Neamen, *Electronic Circuit Analysis and Design*, 4th Edition, McGraw-Hill, 2010.
J. Millman, A. Grabel, *Microelectronics* McGraw-Hill, 1987.
M. Kaufman, A.H. Seidman, *Handbook of Electronics Calculations*, McGraw-Hill, 1979.
U. Tietze, Ch. Schenk, *Advanced Electronic Circuits*, Springer, 1978.
H. Taub, D. Schilling, *Digital Integrated Electronics*, McGraw-Hill, 1977.
J. Engelbert, T. Nguyen, C. Thurston, *User's Manual: B² Spice A/D Version 4*, Beige Bag Software, 2002.

Instructor: Professor P.B. Kosel, Rhodes Hall 837

Prerequisites: EECE2070, EECE2070L **Co-requisites:** EECE3071.

Organization

1. Students work in groups of **TWO**. Groups of **more than two are disallowed**. Students can elect to work alone.
2. Each group performs the **Fundamentals lab** and **ONLY three of the projects** during the semester. The **lab technician will assign the projects with modified goals** to minimize duplication. Two projects will run concurrently with (nearly) **equal numbers of groups on each**.
3. The **Fundamentals Lab** is done by every group during the first week to review electronics lab methods (analysis, design, simulation, measurement, etc) and report writing skills.
4. All project work conducted in the laboratory must be **recorded in a BOUND LOGBOOK** (a standard science record book is preferred) kept by each student. **Pads and loose-leaf pages do not qualify** as logbooks. **No-logbook results in zero points** towards the logbook grade (see below).
5. Each session spent in the laboratory **MUST** be recorded (**with dates, information and DATA**) in the logbook.
6. Each project runs **only THREE weeks** and the **final circuit MUST BE DEMONSTRATED** to the instructor, TA or lab technician. The logbook **WILL BE SIGNED when the demonstration is successful** and a **grade entered into the logbook** [A=good, B=fair, C=poor determined by the quality of the demonstration and the recorded data].
7. A logbook must be turned in to the instructor for grading during the **last week of the semester**. **No logbook scores a zero** for the logbook grade.
8. A project **report is submitted for grading by EACH student within 3 days after conclusion** of a project session.
9. **Reports are the INDEPENDENT work of each student and are organized** according to the specifications below.
10. Groups are required to spend **at least 3.5 HOURS per week on their projects in the designated laboratory**.
11. Short presentation on the projects will be given during the first 15-20 minutes of the first 2 meetings of each session.
12. No assignments or written exams are given.
13. Grades for the course are based on the **basics lab & project reports, oral presentations and logbook**.
14. Students **provide their own hand tools** such as pliers and cutters.
15. **Soldering irons will be provided**.
16. 'All-solder' construction is encouraged but students must provide their own PC boards.

Report

1. Each report contains no **more than 10 written pages** and **no more than 10 pages of Figures**.
2. A report is acceptable for grading **ONLY IF** it is: (a) **TYPED**, (b) **NEAT**, (c) **BOUND** in a soft cover, and (d) has a **TITLE page with project title, NAMES of author and team member, beginning date, and hand-in date**. Reports not meeting these requirements will be returned without grading.
3. **Late reports are heavily penalized:** 100% (20% per day-late) is taken off for a one week (5 day) late report.
4. Each report must have the following sections (clearly labeled) (a template is provided):

OBJECTIVE: this is provided in the handout.

PRINCIPLES OF OPERATION: a short qualitative description (one page) of the circuit's operation.

THEORY: contains **circuit analyses, derivations of equations, MATLAB calculations and plots.**

Equivalent circuits should be used and **values of the key circuit parameters** (ex. frequency of oscillation, gain, bandwidth, etc) calculated.

DESIGN and SIMULATION: Calculations of **all passive circuit components** such as biasing resistors, coupling and bypass capacitors, and inductances should be shown. All the calculated component values should be **tabulated** and the **SPICE input files and simulation results** shown. All DC bias conditions (that is, node voltages) on the final designed circuits must be shown.

DEVICE CHARACTERISTICS: contains **I-V plots** from transistor **curve tracer**, **resonance response plots** from inductor and capacitor measurements and a **tabulation** of all measured device values (includes **transistor parameters** and **resistor, capacitor and inductor values**).

TEST RESULTS: contains results from **all circuit measurements** including DC bias conditions, oscilloscope plots, input/output impedance measurements, corner frequencies, Excel plots, etc. **SPICE simulations of all final circuits** using real device values and models are included and must be **compared with simulations obtained in the design and simulation section**. A **thorough discussion** of the results is required. **All plots and tables must be labeled and properly dimensioned.**

CONCLUSION: includes a **statement of whether all circuit specifications were met** and a **discussion of how the theory, experiment and simulations compared** (with summary table and plots). **Explanations** of variations should be given and **reasons given when project goals are not achieved.**

5. Excess computer outputs and data can be submitted with the final reports as **attachments in an appendix.**

Fundamentals Lab: Common emitter BJT amplifiers

Projects	Session 1:	A-Large-signal amplifier	B-Multistage tuned amplifier
	Session 2:	A-Emitter-coupled oscillator	B-Power converter
	Session 3:	A-Phase-locked loop	B-Gyrator

Oral Presentations: Each student will be scheduled to give a 10 minute oral presentation on each project with no more than 6 Powerpoint slides during the week immediately following the conclusion of a project session. The oral presentation should be a **technically informative presentation with the following three sections** Principles and Theory, Design and Verification, and Experimental Results and Conclusion. **Title, author and objective statement should appear on the first page and a list of used references** should be given on an addendum page. **Due to the short duration limited questions will be asked and a grade will be determined by the instructor strictly on the basis of the presentation. A copy of the powerpoint slides must be submitted to the instructor. Particular attention must be paid to the proper use of technical terminology and expression, theoretical understanding and technical accuracy. A good presentation requires a well thought out preparation and an oral test run in front of your partner.**

Lab Rules

A. General:

1. No eating, drinking or smoking in the laboratory.
2. Keep workbench clean and tidy.
3. Last person out of the laboratory must turn off lights and lock the door.
4. Make certain all equipment is turned off when leaving.

B. Equipment:

1. Don't borrow equipment from any other laboratory.
2. Don't remove any equipment from the electronics laboratory.
3. Don't block vent holes in any equipment.
4. Use equipment with care, especially the knobs on small instruments.
5. Don't remove probes from oscilloscopes unless you have the lab technician's permission.
6. Don't remove scope probe ends.
7. **Return resistors, capacitors and inductors to their proper bins in the cabinets** and not the floor.

ABET category content as estimated by faculty member who prepared this course description:

Engineering science: 0% Engineering design: 1 credits or 100%

Grading: Basics Lab 5% **Project reports (3)** 60% **Logbook** 5% **Oral presentations** 30%

Teaching Assist.: Yes **Labs: Wed:** 3.35-6.55 pm, **Thu:** 12.30-3.20 & 3.30-6.55 pm, **Loc:** RH 806