# PHY270 Electronics and Instrumentation

Gustavus Adolphus College Spring 2018

**Instructor:** Chuck Niederriter **Office:** Olin Hall 211, 933-7315

**Email:** [chuck@gustavus.edu](mailto:chuck@gustavus.edu) **Cell Phone:** 507-351-8647

**Textbooks:** *Electrical Engineering: Principles and Applications* (5th Edition),byAllan R. Hambley

Laboratory Manual (for PHY271, co-requisite lab course)

**References:** *Analog and Digital Electronics for Scientific Application,* by Dennis Barnaal, Breton Publishers, ©1982

*Digital Electronics: A Practical Approach,* by William Kleitz, Pearson, ©2008

**Course Policy and Evaluation**:

1. **Class Meetings and Reading Assignments**: The class will meet three days a week from 8:30-9:50 AM. These periods will be used for lecture, electronics studio and group activities, and exams. When reading assignments are made for a class session, the **reading is expected to be completed before coming to the class**.
2. **Studio Group Activities:** Students will work in assigned groups of three or four to build, test, and characterize electronic circuits in a cooperative-learning setting. A worksheet detailing the studio or group activity will be handed out in class, and each group will complete one worksheet and submit it for a group grade.
3. **Pre-studio, Online Quizzes:** Before each class period that involves a reading assignment from the textbook and/or a studio worksheet, each student is required to take an online quiz to demonstrate that he/she has read and obtained a basic understanding of the material in the textbook for the next lecture.

These quizzes will be conducted using the WebAssign program (accessible on the World Wide Web at www.webassign.net). The day’s reading quiz may be accessed at least 24 hours in advance, and **must be completed 15 minutes before class starts, i.e. at 8:15 am.**

1. **Homework**: Homework problems will be due approximately once per week, and are due at the beginning of class on the assigned date.
2. **Attendance**: Regular attendance at all class meetings is expected. Students will be held responsible for informing themselves of all announcements/assignments made in class.
3. **Exams :** There will be three, one-hour exams and a two-hour final exam (See calendar for schedule). Students must arrange **in advance** to take an exam at other than the scheduled time, and may do so **only** for a valid health or school‑related reason.
4. **Evaluation** : Homework 20%

Online Quizzes 10%

Group & Studio Worksheets 20%

Hour Exams 10% each

Final Exam 20%

Total 100%

Assignment of final letter grades will be based upon the following guidelines:

B+ = 86-90% C+ = 74-78% D+ = 62-66%

A = 94-100% B = 82-86% C = 70-74% D = 58-62%

A- = 90-94% B- = 78-82% C- = 66-70%

1. **Academic Honesty**: Having signed and agreed to abide by the College’s Honor Code, students thereby pledge that, in all academic exercises, examinations, papers, and reports, they shall submit their own work. Footnotes, or some other acceptable form of citation must accompany any use of another's words or ideas. In the context of this course, students are expected to collaborate and to discuss their out-of-class assignments. However, submitting under one’s own name work that is merely copied from another is a violation of the Honor Code. (The full text of the Gustavus Academic Honor Code Policy may be found at:

<https://gustavus.edu/general_catalog/current/acainfo>).

1. Disability Services: Gustavus Adolphus College is committed to ensuring the full participation of all students in its programs. If you have a documented disability (or you think you may have a disability of any nature) and, as a result, need reasonable academic accommodation to participate in class, take tests or benefit from the College’s services, then you should speak with the Disability Services Coordinator, for a confidential discussion of your needs and appropriate plans. Course requirements cannot be waived, but reasonable accommodations may be provided based on disability documentation and course outcomes. Accommodations cannot be made retroactively; therefore, to maximize your academic success at Gustavus, please contact Disability Services as early as possible. Disability Services [(https://gustavus.edu/advising/disability/](file:///C:\Users\mellema\Documents\Natural%20World\(https:\gustavus.edu\advising\disability\)) is located in the Advising and Counseling Center. Disability Services Coordinator Laurie Bickett (lbickett@gustavus.edu or x6286) can provide further information.
2. Help for Students Whose First Language is not English: Support for English Language Learners (ELL) and Multilingual students is available via the College's ELL Support staff person, Andrew Grace (agrace@gustavus.edu or x7395). He can meet individually with students to consult about academic tasks and to help students seek other means of support. The ELL Support person can also consult with faculty members who have ELL and multilingual students enrolled in their classes. The College’s ELL staff person can provide students with a letter to a professor that explains and supports academic accommodations (i.e. additional time on tests, additional revisions for papers). Professors make decisions based on those recommendations at their own discretion. In addition, ELL and multilingual students can seek help from peer tutors in the Writing Center.
3. **Incompletes** : A grade of incomplete will only be given for work not completed due to circumstances beyond the control of the student.

2018

February

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| --- | --- | --- | --- | --- | --- | --- |
| Sun | Mon | Tue | Wed | Thu | Fri | Sat |
|  |  |  | 7 | 8 | 9 | 10 |
| 11 | 12  Syllabus/  Introduction  Studio Exercise  Ohm’s Law | 13 | 14  Hambley:  1.2-1.7;2.1-2.3  Studio Exercise  Voltage Dividers | 15  Lab 1:  Introduction to Test Equipment | 16  Hambley:  2.4-2.6  Studio Exercise  Thevenin Equivalents | 17 |
| 18 | 19  Hambley:  5.1-5.2  Studio Exercise  Sinusoidal Voltages I | 20 | 21  Hambley:  5.3-5.4; Appendix A  Group Exercise  Complex Impedance | 22  Lab 2:  AC Circuits | 23  Hambley:  5.5-5.6  Studio Exercise  Transfer Function | 24 |
| 25 | 26  Hambley:  6.1-6.3  Studio Exercise  AC Impedances | 27 | 28  Hambley:  6.4-6.6  Studio Exercise  Making Bode Plots | 1  Lab 3:  Passive RC Filters | 2  Hambley:  6.7-6.9  Studio Exercise  Black Boxes | 3 |

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| Sun | Mon | Tue | Wed | Thu | Fri | Sat |
| 4 | 5  Hambley:  10.1-10.2  Studio Exercise  Diodes | 6 | 7  Hambley:  10.6  Studio Exercise  Simple DC Power Supply | 8  Lab 4:  Regulated DC Power Supplies | 9  Hambley:  10.3 & 10.7  Studio Exercise  Zener Diodes | 10 |
| 11 | 12  Hambley:  11.1-11.2  Studio Exercise  Op-Amp Voltage Follower | 13 | 14  Hambley:  14.1-14.3  Studio Exercise  Op-Amp Inverting Amplifier | 15  Lab 5:  Design and Construction of an Amplifier | 16  **Hour Exam #1**  **(Chapters 1, 2, 5, 6 and 10)** | 17 |
| 18 | 19  Hambley:  14.4  Studio Exercise  Op-Amp Slew Rate | 20 | 21  Hambley:  14.5-14.7  Studio Exercise  Op-Amps and Bandwidth | 22  Lab 6:  Operational Amplifier Practicum | 23  Hambley:  14.8-14.10  Studio Exercise  Integrators and Differentiators | 24 |
| 25 | 26  Barnaal:  pp. A239-A241  Studio Exercise  741 Op-Amp as a Comparator | 27 | 28  Barnaal:  pp. A242-A246  Studio Exercise  LM311 Comparator and Schmitt Trigger | 29  Lab 7:  Comparators and Schmitt Triggers | 30 | 31 |

2018

March

2018

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| Sun | Mon | Tue | Wed | Thu | Fri | Sat |
| 1 | 2  **No Class:**  **Spring Break** | 3  **No Class:**  **Spring Break** | 4  **No Class:**  **Spring Break** | 5  **No Class:**  **Spring Break** | 6  **No Class:**  **Spring Break** | 7 |
| 8 | 9  Barnaal:  A298-A299  Studio Exercise  Introduction to Transistors | 10 | 11  Hambley:  13.1-13.2  Studio Exercise  Transistor Characteristics | 12  Lab 8:  Transistors, Phototransistors and Relays | 13  Hambley:  13.3-13.6  Studio Exercise  Simplified Transistor Amplifier | 14 |
| 15 | 16  Hambley:  7.1-7.2  Studio Exercise  TTL Logic | 17 | 18  Hambley:  7.3  Studio Exercise  7400 Series Chips | 19  Lab 9:  Properties of Digital Logic Gates | 20  Review for Exam 2 | 21 |
| 22 | 23  **Hour Exam #2**  **(Hambley: Chapters 11, 13 and 14 plus Barnaal supplemental material)** | 24 | 25  Hambley:  7.4-7.5  Studio Exercise  Implementing Logic Circuits | 26  Lab 10: Introduction to  Sequential Logic Circuits | 27  Hambley:  7.6  Studio Exercise  Introduction to Sequential Logic | 28 |

April

2018

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| Sun | Mon | Tue | Wed | Thu | Fri | Sat |
| 29 | 30  Hambley:  7.6  Studio Exercise  Flip-Flops | 1 | 2  (Mayday)  Barnaal:  pp. D113-D123  Studio Exercise  Building Counters | 3  Lab 11:  Introduction to Soldering and Build Your Own Arduino | 4  Barnaal:  pp. A253-A256  Studio Exercise  JK Flip Flop | 5 |
| 6 | 7  Barnaal:  pp. A257-A259  Studio Exercise  555 One Shot | 8 | 9  Kleitz:  Section 12-8  Studio Exercise  Binary Counter Chip | 10  Final Lab  Project | 11  Kleitz:  Section 12-6  Studio Exercise  Decimal Counter | 12 |
| 13 | 14  Kleitz:  Sections 15-1 through 15-4  Studio Exercise  Digital to Analog Converter | 15 | 16  Kleitz:  Sections 15-7 through 15-9  Studio Exercise  Analog to Digital Converter | 17  Final  Lab  Project | 18  Data Acquisition  Studio Exercise  Computer Sound Card & LabJack Data Acquisition | 19 |
| 20 | 21  **Hour Exam #3**  **(Hambley: Chapter 7 plus Barnaal and Kleitz supplemental material)** | 22 | 23  Final Exam Review | 24  **No Class:**  **Reading Day** | 25  **Final Exam:**  **May 25, 2018 1:00-3:00 PM** | 26 |
| 27 | 28 | 29  **Alternate Final Exam: May 29, 2018**  **1:00-3:00 PM** | 30 | 31 | 1 | 2 |

May