PHY270 Electronics and Instrumentation

Gustavus Adolphus College Spring 2020

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Textbooks: *Electrical Engineering: Principles and Applications* (5th Edition), by Allan 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.**

4. **Homework**: Homework problems will be due approximately once per week, and are due at the beginning of class on the assigned date.

5. **Attendance**: Regular attendance at all class meetings is expected. Students will be held responsible for informing themselves of all announcements/assignments made in class.

6. **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.

7. **Office Hours, etc:** My scheduled office hours are 1st and 2nd hour on Tuesday and Thursdays. I will be available during these times for individual assistance and advising. I will also be available at other times by appointment. Call, email, or text. In general, if you want to stop in and you see me in the office, feel free to ask for help. If I can't help you then, I'll suggest some later time. Don't be afraid to ask for help.

8. **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%	

8. **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).

9. **Incompletes** : A grade of incomplete will only be given for work not completed due to circumstances beyond the control of the student.

10. **Accessibility Services:** Gustavus Adolphus College is committed to ensuring equitable and inclusive learning environments for all students. If you have a disability and anticipate or experience barriers to equal access, please speak with the accessibility resources staff about your needs. A disability may include mental health, attentional, learning, chronic health, sensory, physical, and/or short-term conditions. When appropriate, staff will guide students and professors in making accommodations to ensure equal access. Accommodations cannot be made retroactively; therefore, to maximize your academic success at Gustavus, please contact them as early as possible. Accessibility resources staff are located in the Center for Academic Resources and Enhancement (https://gustavus.edu/care/accessibility/) (x7227). Accessibility Resources Coordinator, Katy Clay, (clayk@gustavus.edu), can provide further information.

11. **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 (e.g., mental health, attentional, learning, chronic health, sensory, or physical) 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 Accessibility Resources staff 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 Accessibility Resources as early as possible. Accessibility Resources (https://gustavus.edu/care/accessibility/) is located in the Center for Academic Resources and Enhancement.

12. **Mental Wellbeing**: The Gustavus community is committed to and cares about all students. Strained relationships, increased anxiety, alcohol or drug problems, feeling down, difficulty concentrating, and/or lack of motivation may affect a student's academic performance or reduce a student's ability to participate in daily activities. If you or someone you know expresses such mental health concerns or experiences a stressful event that can create barriers to learning, Gustavus services are available to assist you. You can learn more about the broad range of confidential health services available on campus at https://gustavus.edu/counseling/and https://gustavus.edu/deanofstudents/services/.

13. **Title IX: Sexual Misconduct Prevention and Resources:** Gustavus Adolphus College recognizes the dignity of all individuals and promotes respect for all people. As such, we are committed to providing an environment free of all forms of discrimination including sexual and gender-based discrimination, harassment, and violence like sexual assault, intimate partner violence, and stalking. If you (or someone you know) has experienced or is experiencing these types of behaviors, know that you are not alone. Resources and support are available; you can learn more online at https://gustavus.edu/titleix/. Please know that if you choose to confide in me, I am mandated by the College to report to the Title IX Coordinator, because Gustavus and I want to be sure you are connected with all the support the College can offer. Although it is encouraged, you are not required to respond to outreach from the College if you do not want to. You may speak to someone confidentially by contacting the Sexual Assault Response Team (SART/CADA), Chaplains, Counseling Center, or Health Service staff; conversations with these individuals can be kept strictly confidential. SART/CADA can be reached 24 hours a day at 507-933-6868. You can also make a report yourself, including an anonymous report, through the form at https://gustavus.edu/titleix/.

14. **Classroom and Lab Environment/Ethos:** It is expected that all members of this classroom community will treat each other in a respectful and positive manner. This expectation is independent of your role associated with this course. Respectful treatment of others associated with this class is expected whether you are a student in the class, a TA for the class, a tutor for the class, or the professor for the class. Furthermore, should any problem / issue arise, it is expected that an attempt to resolve the situation will be made directly, calmly, respectfully, and professionally by the parties involved. If this fails to resolve the issue and the problematic behavior continues, or if the initial situation is deemed to be of a more serious nature, then the professor for the course should be contacted directly. Physics can, at times, be challenging for all of us. Please do your part in helping to create a positive environment where all members of this classroom community can do their best work.

February

Sun	*Mon*	*Tue*	*Wed*	*Thu*	*Fri*	*Sat*
			5	**6**	**7**	**8**
9	**10** Syllabus/ Introduction <u>Studio Exercise</u> Ohm's Law	**11**	**12** Hambley: 1.2-1.7;2.1-2.3 <u>Studio Exercise</u> Voltage Dividers	**13** Lab 1: Introduction to Test Equipment	**14** Hambley: 2.4-2.6 <u>Studio Exercise</u> Thevenin Equivalents	**15**
16	**17** Hambley: 5.1-5.2 <u>Studio Exercise</u> Sinusoidal Voltages I	**18**	**19** Hambley: 5.3-5.4; Appendix A <u>Group Exercise</u> Complex Impedance	**20** Lab 2: AC Circuits	**21** Hambley: 5.5-5.6 <u>Studio Exercise</u> Transfer Function	**22**
23	**24** Hambley: 6.1-6.3 <u>Studio Exercise</u> AC Impedances	**25**	**26** Hambley: 6.4-6.6 <u>Studio Exercise</u> Making Bode Plots	**27** Lab 3: Passive RC Filters	**28** Hambley: 6.7-6.9 <u>Studio Exercise</u> Black Boxes	**29**

2020

March

Sun	*Mon*	*Tue*	*Wed*	*Thu*	*Fri*	*Sat*
1	**2** Hambley: 10.1-10.2 <u>Studio Exercise</u> Diodes	**3**	**4** Hambley: 10.6 <u>Studio Exercise</u> Simple DC Power Supply	**5** Lab 4: Regulated DC Power Supplies	**6** Hambley: 10.3 & 10.7 <u>Studio Exercise</u> Zener Diodes	**7**
8	**9** Hambley: 11.1-11.2 <u>Studio Exercise</u> Op-Amp Voltage Follower	**10**	**11** Hambley: 14.1-14.3 <u>Studio Exercise</u> Op-Amp Inverting Amplifier	**12** Lab 5: Design and Construction of an Amplifier	**13** **Hour Exam #1 (Chapters 1, 2, 5, 6 and 10)**	**14**
15	**16** Hambley: 14.4 <u>Studio Exercise</u> Op-Amp Slew Rate	**17**	**18** Hambley: 14.5-14.7 <u>Studio Exercise</u> Op-Amps and Bandwidth	**19** Lab 6: Operational Amplifier Practicum	**20** Hambley: 14.8-14.10 <u>Studio Exercise</u> Integrators and Differentiators	**21**
22	**23** Barnaal: pp. A239-A241 <u>Studio Exercise</u> 741 Op-Amp as a Comparator	**24**	**25** Barnaal: pp. A242-A246 <u>Studio Exercise</u> LM311 Comparator and Schmitt Trigger	**26** Lab 7: Comparators and Schmitt Triggers	**27** Barnaal: A298-A299 <u>Studio Exercise</u> Introduction to Transistors	**28**

2020

April

Sun	*Mon*	*Tue*	*Wed*	*Thu*	*Fri*	*Sat*
29	**30** Hambley: 13.1-13.2 <u>Studio Exercise</u> Transistor Characteristics	**31**	**1** Hambley: 13.3-13.6 <u>Studio Exercise</u> Simplified Transistor Amplifier	**2** Lab 8: Transistors, Phototransistors and Relays	**3** Hambley: 7.1-7.2 <u>Studio Exercise</u> TTL Logic	**4**
5	**6** **No Class: Spring Break**	**7** **No Class: Spring Break**	**8** **No Class: Spring Break**	**9** **No Class: Spring Break**	**10** **No Class: Spring Break**	**11**
12	**13** **No Class: Spring Break**	**14**	**15** Hambley:7.3 <u>Studio Exercise</u> 7400 Series Chips Review for Exam 2	**16** Lab 9: Properties of Digital Logic Gates	**17** Review for Exam 2	**18**
19	**20** **Hour Exam #2 (Hambley: Chapters 11, 13 and 14 plus Barnaal supplemental material)**	**21**	**22** Hambley: 7.4-7.5 <u>Studio Exercise</u> Implementing Logic Circuits	**23** Lab 10: Introduction to Sequential Logic Circuits	**24** Hambley: 7.6 <u>Studio Exercise</u> Introduction to Sequential Logic	**25**

2020

May

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

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