

# Physics 623 Syllabus

Spring 2020

Lectures in Chamberlin 2104 on Tuesdays and Thursdays from 1:00 – 2:15 pm

Labs in Chamberlin 4128 on Wed. 10:00 am – 1:00 pm and 3:00 pm – 6:00 pm

**Instructor:**

Dan McCammon

Office hours: 4:00-5:00 pm Mondays in 6207 Chamberlin

Phone: 262-5916; e-mail: [mccammon@physics.wisc.edu](mailto:mccammon@physics.wisc.edu)

Course homepage: <http://www.physics.wisc.edu/undergrads/courses/spring2020/623/>

**Text and References are on reserve in the Physics Library**

**Text: "The Art of Electronics" by Horowitz and Hill, Cambridge 3rd Ed.**

**Useful General References:**

"Introduction to Modern Electronics", C. Sprott (Wiley) [**Physics 321 Textbook**]

"All About Circuits" on-line open source text: <http://www.allaboutcircuits.com/textbook>

"Electronics with Discrete Components", E. J. Galvez (Wiley, 2013)

"Introductory Electronics for Scientists and Engineers", R.E.Simpson, (Allyn and Bacon) 2nd Ed.

"Electronics for the Physicist", C.F.G. Delaney (Ellis Horwood)

"Principles of Electronics", L.R. Fortney (Harcourt Brace Jovanovich)

"Basic Electronics for Scientists", James J. Brophy, (McGraw-Hill) 5th Ed.

**Evaluation:**

50% Laboratory (understanding, skills development, **notebook**)

50% Lecture: Exams (70%), homework (30%)

Please don't skip any labs. Makeups are freely given — if you miss a lab due to research activities or illness, please see the instructor as soon as possible. Be considerate of your lab partner and make arrangements ahead of time if possible.

The homework is assigned two ways. Each week for the laboratory, there is a worksheet that you should complete and turn in before starting the lab. Some weeks, this is extensive enough that it constitutes the 'homework' for that week. Other weeks, homework problems will be assigned on Thursday in class and due the following Thursday in class.

## Physics 623 Lectures and Labs — Spring 2020

| Week          | Date (TR)    | Lecture Topic                   | Lab (Wed) | Laboratory**         | Text references                 |
|---------------|--------------|---------------------------------|-----------|----------------------|---------------------------------|
| 1             | Jan. 21      | Linear Circuit Theory           | Jan. 22   | Introduction*        | Ch. 1                           |
|               | Jan. 23      | Transmission Lines & more LCT   |           |                      | Appndx “H”, handout             |
| 2             | Jan. 28      | Diodes and Transistors          | Jan. 29   | Transmission Lines*  | Ch. 1                           |
|               | Jan. 30      | Transistor Amplifier            |           |                      | Ch. 2                           |
| 3             | Feb. 4       | Difference Amplifier            | Feb. 5    | Transistor Amplifier | Ch. 2, Appx “F”, ”G”            |
|               | Feb. 6       | Negative Feedback               |           |                      | Ch. 4                           |
| 4             | Feb. 11      | Op-amps                         | Feb. 12   | Difference Amplifier | Ch. 4                           |
|               | Feb. 13      | <b>EXAM I</b>                   |           |                      |                                 |
| 5             | Feb. 18      | Op-amp circuits                 | Feb. 19   | Operational Amps     | Ch. 4                           |
|               | Feb. 20      | Fourier Transforms              |           |                      | F.T. ‘cheatsheet’ handout       |
| 6             | Feb. 25      | Noise                           | Feb. 26   | Operational Amps     | Ch. 8                           |
|               | Feb. 27      | Noise                           |           |                      | Ch. 8                           |
| 7             | Mar. 3       | Field Effect Transistors        | Mar. 4    | Johnson Noise        | Ch. 3, 8.14                     |
|               | Mar. 5       | Lock-in applications            |           |                      | Ch. 8.14                        |
| 8             | Mar. 10      | Oscillators & positive feedback | Mar. 11   | Phase Detector       | Ch. 7                           |
|               | Mar. 12      | Digital Logic                   |           |                      | Ch. 10                          |
| <b>Spring</b> | Mar. 17      | —                               | Mar. 18   | —                    | (see also 1 <sup>st</sup> three |
| <b>Break</b>  | Mar. 19      | —                               |           |                      | “Digital Circuits”              |
| 10            | Mar. 24      | Digital Circuits                | Mar. 25   | Oscillators          | handouts)                       |
|               | Mar. 26      | <b>EXAM II</b>                  |           |                      |                                 |
| 11            | Mar. 31      | Integrated Circuits             | Apr. 1    | Digital Circuits     | Ch. 13                          |
|               | Apr. 2       | Phase Locked Loops              |           |                      | Ch. 13.13                       |
| 12            | Apr. 7       | Circuit simulation              | Apr. 8    | Phase Locked Loops   | Multisim & LTSPICE handouts     |
|               | Apr. 9       | DACs and ADCs                   |           |                      | Ch 13.1-13.2.5; 13.7-13.8       |
| 13            | Apr. 14      | DACs and ADCs                   | Apr. 15   | Circuit Simulation   | Ch 13.7-13.8                    |
|               | Apr. 16      | FPGA                            |           |                      | Ch 11 & PLD handout             |
| 14            | Apr. 21      | FPGA                            | Apr. 22   | DAC & ADC            | Ch. 11.3.3-4; Altera handout    |
|               | Apr. 23      | Modulation and communication    |           |                      | 13.13.6.C-F                     |
| 15            | Apr. 28      | Digital computers               | Apr. 29   | FPGA I               | Ch. 14                          |
|               | Apr. 30      | Review                          |           |                      |                                 |
|               | <b>May 4</b> | <b>Final Exam: 7:45-9:45 AM</b> |           |                      |                                 |

\*Note Appendix “O” on oscilloscopes in Horowitz & Hill. Also scope tutorials and manuals on course website.

\*\*See Appendix “B” on how to draw schematics. Also the lab handouts.