

## PHY 375

### (Electronics for Scientists)

<b><u>Instructor:</u></b>	Dr. Namrata Tripathi
<b><u>Office:</u></b>	301 B, Moulton Hall (MLT)
<b><u>Office hours:</u></b>	M-F 12 AM – 2:00 PM, or by appointment
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<b><u>Telephone:</u></b>	309-438-2026
<b><u>Class Meeting:</u></b>	Tuesday 9-10:50 AM in 309 MLT
<b><u>Lab Meeting:</u></b>	Thursday 9-11:50 AM in 217 MLT

**Course Description:** This course introduces students to analog and digital electronics. Topics covered include but are not limited to: DC and AC circuit analysis techniques including mesh and nodal analysis, and network theorems, filter circuits, diodes, transistors, operational amplifier and digital circuits. The course includes two hours of lecture on Tuesday and three hours of laboratory on Thursday.

**Textbook:** Principal of Electronics: Analog and Digital, Lloyd R. Fortney

**Student Learning Outcome:** On completion of the course, students will able to:

- 1- understand basic concepts of dc ac circuit behavior
- 2- understand the use of circuit analysis and theorems to solve complex circuit
- 3- understand the design and use of more complicated circuitry such as filters and circuits
- 4- Understand number systems and analyze basic digital circuits.
- 5- able to build circuits with transistors and diodes and understand their functionality as a part of the circuit.

### **Topics:**

Basic Concepts: Charge, Voltage, Power, Resistance, Capacitance, Inductance,  
DC Circuits: Independent and Dependent Sources, Kirchhoff's voltage and current Laws, Series and Parallel Combinations of Elements, Voltage Division and Current Division, Capacitor charging and discharging in RC ckt, Node, Mesh Analysis,  
DC circuit Analysis and Network theorems: Node and Mesh Analysis, Superposition, Source Transformation, Thevenin's Theorem, Norton's Theorem, Max Power Transfer Theorem,  
AC Circuits: Alternating Current and Voltage, Complex numbers, Phasor diagram, Reactance and Impedance, RC, RL, RLC and Filters Circuit Analysis, Bode plot  
Diodes and diode circuits: Basic Semiconductor Physics, PN junction Diode, characteristics, Simple diode circuits (Rectifiers, Clamp, Voltage Multiplier), Zener diodes, Zener diode as Voltage Regulator,

Transistors: Introduction, Transistor operation: PNP, NPN, Characteristics - CB, CE, CC, BJT Biasing – Introduction, DC load line & bias point, Field effect transistors, Working Principle, Static Characteristics of JFET,  
Operational Amplifiers: Ideal and Practical Op-Amp, Op-Amp characteristics, Modes of Operation, Op-Amp Applications  
Digital Circuits: Introduction to number systems, Logic gates, Boolean Algebra, Demorgan's Theorem, Logic Circuit Implementation of Boolean Expressions, half adder, full adder, Flip-flops, Counters  
Microprocessor: The Arduino

**Labs:** A weekly lab will be performed on Thursday. I will provide you with a handout and a brief overview of what is to be done in the week's lab. You will perform the experiment and will write a clear, concise report describing what you did, what you found, and your analysis of your results.

**Student Expectations:**

Attend class regularly

Complete homework assignment on time

Participate in class. Never allow anything to go by that you do not understand, ask question immediately.

Correct me if I make a mistake

**Homework:** Homework will be assigned each week (except exam days), with the homework due the next week. Homework will be graded and returned to you. Late assignment will not be accepted. The lowest 2 homework scores will be dropped

**Exams:** There will be two exams, tentatively scheduled on Thursday Feb 22<sup>nd</sup> and Apr 19<sup>th</sup> from 9: 11:50 AM. The format will be 40 questions in 3 hrs. Each exam will be a combination of multiple choice, true-false, short answer and problems which involve calculations and must be worked out in detail. Exam questions may be similar the homework questions or what was covered in class lecture. Exams will be closed book and notes. No smartphones or devices will be allowed during exams.

**Final Exam:** It will be of the same format as the in-class exams. The exam will cover all material presented in the course. The test will be close notes. Cheating will result in a zero grade for the exam. Final exam schedule will be announced later in the semester and can be found online

**Make-up of Exams:** Students will be allowed to make up a missed exam provided the student may provide a valid (to be determined by the instructor), verifiable, pre-approved (by instructor) reason for missing the exam. Students not meeting these criteria will receive a zero for the missed exam.

**Examinations and Grading:** The course grade will be based on the approximate weighting:

Class Response 10 %

Homework 25%

Laboratory: 20%

Exams: 20%

Final Exam: 25%

If you know you will be absent on exam day, please arrange in advance to take the Exams.

**Grading Scale:**

The grading scale is as follows:

90% and above A

80% - 89.9% B

70% - 79.9% C

60% - 69.9% D