

# COURSE OUTLINE

## Electronics I– Spring 2022

### PHYS-331

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### COURSE OBJECTIVES

This course develops a basic understanding of the fundamentals and principles of analog circuits and electronic devices. This understanding is a critical step towards being able to design new electronic circuits. Hence the course seeks to develop foundational concepts and skills, but does so through a series of application-oriented topics such as the design of DC power supplies and audio amplification and tone control. Important topics covered include: the key electrical variables and the application of fundamental circuit laws and theorems to DC and AC resistive circuits; power supply applications of diodes and switch-mode transistors; the operating principles of DC, induction; analysis of simple operational and single-MOSFET amplifiers; methods of systematic circuit analysis; and steady state sinusoidal analysis of RLC circuits. The course is designed to be such that successfully completing the course will provide the necessary foundation for more specialist learning in analog and radio frequency electronics and electrical power systems.

### LEARNING OUTCOMES

Through this course, the students will be able to:

- Acquire a basic knowledge in electronics devices and to design and conduct projects by these devices.
- Observe the amplitude and frequency responses of common amplification circuits.
- Design a system, component or process to meet desired needs using different techniques and skills.

### COURSE OUTLINES

Circuit analysis, Characteristics and applications of semiconductor devices and circuits, power supplies, special diodes, Bipolar junction transistors(BJT) with biasing analysis and frequency response, BJT models, Field effect transistors(FETs), signal analysis of BJTs and FETs, Power amplifiers, Feedback concepts and types, Oscillator circuits and applications, Multivibrators, Laboratory.

## **Prerequisites**

PHYS 221 (Electricity and magnetism)

## **Course Materials:**

[1] Thomas L. Floyd, Electronic devices; 7<sup>th</sup> edition

[2] B.L.Theraja, Basic electronics.

[3] Millman, Jacob, Halkias, Integrated Electronics: Analog, Digital Circuits and Systems, NY: McGraw-Hill, 1972.

[4] Fonstad, Clifton G., Microelectronic Devices and Circuits, Singapore: McGraw-Hill, 1994.

[5] Sze, S. M., Physics of semiconductor Devices, 2nd Ed., Singapore: Wiley, 1981.

## **Course grading:**

Your final grade will be based on the following:

Assignments + Quizzes + Class Participation	20%
Midterm Test	25%
Final Examination	25%
Laboratory Work	20%
Project	10%
	100%

**Assignments:** They will be problems assigned from textbook of Electronic devices by **Floyd**.

Assignment #	Chapter #
1	2-3
2	4-5
3	12-13
4	9-16

## Syllabus and Tentative schedule:

This page lists the assigned readings on selected topics [Week 1-12] from textbook of Electronic devices by **Floyd**.

WEEK #	TOPICS	LECTURE NOTES SECTIONS	QUIZ-ASSIGNMENTS
1	<b>Introduction:</b> Overview of electronic signal, Basics of semiconductors	Ch-1	
2	<b>Diodes:</b> Introduction to PN junction and junction diode, Ideal diode, diode models and its circuit analysis.	Ch-2	Assignment 1
3	<b>Diodes:</b> Application of diodes and special diodes.	Ch-3	Quiz 1
4	<b>Bipolar Junction Transistors (BJTS)</b> Physical structure and operation modes of BJTs, biasing the BJT, analysis of BJT circuits at DC and AC including its small signal model.	Ch-4	
5	<b>Bipolar Junction Transistors (BJTS)</b> Different configurations of BJT amplifiers, BJT as a switch.	Ch-5	
6	<b>BJT Amplifiers:</b> Frequency response of amplifiers	Ch-6	Assignment 2
7	<b>Field Effect Transistors (FETS):</b> Physical structure and operation modes of FETs, biasing the FET	Ch-7	Quiz 2
8	<b>Field Effect Transistors (FETS):</b> Analysis of FET circuits at DC and AC including its signal model, different configurations of FET amplifiers.	Ch-8	
9	<b>Operational Amplifiers:</b> Introduction basic properties of OpAmp and advantages of differential operation, inverting and non-inverting configuration of OpAmp.	Ch-12	
10	<b>Operational Amplifiers:</b> Typical circuit building blocks using OpAmp, Practical OpAmp and its effect of finite open-loop Gain and bandwidth, DC imperfections.	Ch-13	Assignment 3
11	<b>Power Amplifiers:</b> Introduction and classification	Ch-9	Quiz3
12	<b>Oscillators:</b> Feedback Oscillators Principle and circuits	Ch-16	
13	<b>Solid State Switching Circuits:</b> Electronic switches, Switching Transistors	Ch-18 [Theraja]	Assignment 4
14	<b>Multivibrators:</b> Types of Multivibrator and its applications	Ch-18 [Theraja]	Quiz 4