Centre for High Energy Physics
Faculty of Science
University of the Punjab, Lahore

Course Outline

Program	BSCP	Course Code	CPHY 342	Credit Hours	(2 + 1 lab)

Course Title	Electronics

Course Introduction

This course is designed to provide the concepts of Semiconductors and their applications. Analysis of basic simple circuits using Ohm's law, Kirchhoff's laws and network theorems
Diodes and Diode circuits: diode circuits and characteristics, model, and behavior in relation to the circuits and analysis. Bipolar Junction Transistors (BJT), the physical structure of the BJT, circuit representation, transistor biasing, and transistor ratings.
Field Effect Transistors and Circuits: MOSFET characteristics and model, biasing techniques, circuit symbol, analog MOSFET amplifier and Operational Amplifiers.

Learning Outcomes

The course will introduce basic principle of electronic circuits and electronics. Its objectives are as following.

1. Understanding basic principle of electric circuits and electronics.
2. Be able to solve relevant numerical problems.

Course Content

Week 1	• Semiconductors: Classification of conductor, semiconductors, and insulators by Energy Band Theory • Lab: Characteristics of a semiconductor Diode.
Week 2	• P-type & N-type semiconductorssuch as silicon (Si) or germanium (Ge) • Lab: To construct a power supply and study the rectified wave form, ripple factor and regulation (without regulator).
Week 3	• Doping, PN junction. Diode theory and Circuit • Lab: To construct a voltage-regulated power supply with Zener diode.
Week 4	• Characteristics of diode, Ideal Diode, Models of diode, • Lab: Characteristics of Transistors.
Week 5	• Surge current, The Zener diode • Lab: To construct a single stage CE transistor voltage amplifier and study gain, input impedance, output impedance,
Week 6	• Optoelectronic devices, The Schottky diode. • Lab: Half power points by sine/square wave testing and effect of bias on the output and measurement of distortion.
Week 7	• Bipolar Transistors: PNP and NPN transistors, Characteristics of transistors • Lab: To construct a source follower FET voltage amplifier
Week 8	• Model of transistor, Transistor biasing. Transistor as amplifier: Transistor as voltage, current and power amplifier.

	• Lab: Study its gain, input impedance, output impedance, half power points by sine/square wave testing.
Week 9	• Field-Effect transistors: The JFET, The biased JFET, Characteristics of JFET, FET circuits. Frequency effects: Frequency response of an amplifier, Miller's theorem, High Frequency FET analysis. • Lab: To construct an R-C oscillator and compare it with a standard frequency.
Week 10	• OP-AMP: OP-AMP theory, OP-AMP negative feedback, • Lab: To construct a Hartley or Colpitts oscillator and measure it frequency.
Week 11	• Linear OP-AMP circuits, Non- linear OP-AMP circuits. • Lab: To construct and study the wave forms at the base and collector of the transistors of a free running a multi-vibrator.
Week 12	• Applications of common diodes • Lab: To construct and study of the height, duration and time period of the output pulses in amono-stable and bi-stable multi-vibrator with reference to the input trigger.
Week 13	• Transformers and power supply, Half-wave rectifiers, • Lab: To construct from discrete components OR, AND, NOT and NAND circuits and verify their truth tables
Week 14	• Full-wave rectifiers, full-wave Bridge rectifiers, • Lab: NOR, exclusive OR circuits and verify their truth tables.
Week 15	• Wave shaping circuits using diode, • Lab: Study of wave shaping circuits of diode, integrators and differentiators.
Week 16	• Voltage multiplier circuits. • Lab: To construct the operational amplifier (741) by using discrete components and study its frequency response.

Textbooks and Reading Material

1. Electronic Principles (8thedition), Paul Malvino, McGraw-Hill International (2015)
2. Electronics Circuits and Systems, J.D. Ryder, *Englewood Cliffs* (1976)
3. Electronics Devices, T.L. Floyd, *Prentice-Hall* (1996)
4. Electronic Devices and Circuit Theory, Boylestad and Nashhelsky, *Prentice-Hall* (1997)

Teaching Learning Strategies

The instructor is required to make use of examples of the text books and The students are required to solve a large portion of related exercises/questions/problems of the main textbooks.

Assignments: Types and Number with Calendar

At least two assignments and two quizzes. A course project may also be assigned.

Assessment

Sr. No.	Elements	Weightage	Details
1.	Midterm Assessment	35%	Written Assessment at the mid-point of the semester.

2.	Formative Assessment	25%	Continuous assessment includes Classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical, reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written Examination at the end of the semester.At least fifty percent of the question paper would involve new problems related to the concepts learned in the course. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.