# THE FEDERAL UNIVERSITY OF TECHNOLOGY, AKURE

## *Department of Physics*

# PHY 409 – Electronic Measurement and Instrumentation

**Course Code:** PHY 409
**Course Title:** Electronic Measurement and Instrumentation
No. of Units:
**Course Duration:** Three hours of theory for 15 weeks.
**Status:** Compulsory
**Course Email Address:** kdadedayo@futa.edu.ng
**Course Webpage:** http://www.fwt.futa.edu.ng/courseschedule.php?coursecode = PHY409
**Prerequisite:** PHY210

## COURSE INSTRUCTORS

**Dr. K. D. Adedayo**
*Room 12, Physics Building,*
*Dept. of Physics,*
*Federal University of Technology, Akure, Nigeria.*
***Phone:*** +2348039115200
***Email:*** kdadedayo@futa.edu.ng

## COURSE DESCRIPTION

This course is electronics based course dealing with measurements and instrumentation designed for students in Physics Electronics, Electrical and Electronics Engineering and allied disciplines. It is a theory course based on the use of electrical and electronics instruments for measurements. The course deals with topics such as Principle of measurements, Errors, Accuracy, Units of measurements and electrical standards, Q- meters, Watt-meters, Semiconductor device testers Counters, Digital voltmeters, X-Y recorders, Temperature controllers, Operational amplifiers, transducers, introduction to the design of electronic equipments for temperature measurement, resistance, liquid level, speed etc; use of 7106 and 7107 ICs for LED and LCD displays.

## COURSE OBJECTIVES

The objectives of this course are to:

- introduce students to the use of various electrical/electronic instruments, their construction, applications, principles of operation, standards and units of measurements; and
- provide students with opportunities to develop basic skills in the design of electronic equipments.

## COURSE LEARNING OUTCOMES / COMPETENCIES

Upon successful completion of this course, the student will be able to:
*(Knowledge based)*

- identify electronics/ electrical instruments, their use, peculiar errors associated with the instruments and how to minimise such errors
- explain the industrial and laboratory applications of such instruments,
- Service and maintain such instruments in case of damage or misuse,
- understand the basic design techniques of electronic equipment;

*(Skills)*

The students will

- use various laboratory instruments like cathode ray oscilloscope, function generators, dismantle and recouple serviceable parts of some other selected instruments without damaging them.
- be well grounded in their knowledge about various types of transducers, their applications and how they can be used for design purposes

## GRADING SYSTEM FOR THE COURSE

This course will be graded as follows:

| | |
|---|---|
| Class Attendance | 5% |
| Assignment(s) | 15% |
| Test(s) | 20% |
| Final Examination | 60% |
| **TOTAL** | **100%** |

## GENERAL INSTRUCTIONS

***Attendance:*** It is expected that every student will be in class for lectures and also participate in all practical exercises. Attendance records will be kept and used to determine each person's qualification to sit for the final examination. In case of illness or other unavoidable cause of absence, the student must communicate as soon as possible with any of the instructors, indicating the reason for the absence.

***Academic Integrity:*** Violations of academic integrity, including dishonesty in assignments, examinations, or other academic performances are prohibited. You are not allowed to make copies of another person's work and submit it as your own; that is plagiarism. All cases of

academic dishonesty will be reported to the University Management for appropriate sanctions in accordance with the guidelines for handling students' misconduct as spelt out in the Students' Handbook.

***Assignments and Group Work:*** Students are expected to submit assignments as scheduled. Failure to submit an assignment, as at when due, will earn you zero for that assignment. Only under extenuating circumstances, for which a student has notified any of the instructors in advance, will late submission of assignments be permitted.

***Code of Conduct in Lecture Rooms and Laboratories:*** Students should turn off their cell phones during lectures. Students are prohibited from engaging in other activities (such as texting, watching videos, *etc*.) during lectures. Food and drinks are not permitted in the lecture room.

## READING LIST


[1]Cooper W. D. And Helfrick A. D. (1988) *Electronic Instrumentation and Measurement Techniques*. Published by Prentice- Hall Inc., Englewood Cliffs, N.J., USA 463p

[2]Paul Horowitz and Winfield Hill (1995). *The Art of Electronics*. Published by Cambridge, Second edition.United Kingdom 1125p.

[3] Gupta B. R. (2003). *Electronics and Instrumentation*.Published by S. Chand and Company Ltd, New Delhi, India 520p.


***Legend***
1-Available in the university Library
2- Available in Departmental/School Libraries
3- Available as Personal Collection

# COURSE OUTLINE

| Week | Topic | Remarks |
|---|---|---|
| 1 | Introduction and Course Overview | During this first class, the general overview of the course, rules and regulations for successful achievement in the course will be emphasized. |
| 2 & 3 | Principles of measurements, Accuracy, Precision, Reproducibility/ Repeatability, Sensitivity, Resolution, Linearity, Types of error, Units of measurements, Electrical Standards. | Lectures will include measurement and error, significant figures, range of error, reduction of error, calibration of instrumentation, conversion of units, types of standards |
| 4 -6 | Electrical/ Electronic instruments, digital and analog instruments, essential features of indicating instruments, recording instruments, controlling instruments, ac and dc instruments. | Lectures will include studies on absolute instruments, secondary instruments and their classifications, deflecting device, controlling device, damping device, dc instruments, converting basic meter to dc ammeter, multirange dc voltmeter, multimeter, permanent magnet moving coil instrument, galvanometer etc |
| 7 & 8 | Construction, use and principle of operations of watt-meter, (induction and dynamometer watt-meter), watt-hour meter, single phase and three phase energy meter, Q- meter, electronic voltmeter, ac and dc voltmeter | Lectures will include studies on induction wattmeter, dynamometer, energy meters, connections of energy meter, q- meter: direct connection, series connection, parallel connection, error in q- meter, rms voltmeter, peak reading voltmeter, average reading voltmeter<br><br>MID-SEMESTER TEST |
| 9 & 10 | Construction, use and principle of operations of digital voltmeter, frequency counter, operational amplifier, X- Y recorder, temperature controllers. | Lectures will include studies on different types of digital voltmeter (DVM): ramp type DVM, integrating DVM, continuous – balance DVM, successful approximation DVM, different types of counter, operational amplifier, plotters, controllers. |

| | | |
|---|---|---|
| 11 & 12 | Transducers, Tachometers, Telemetry, Measurement and signal processing, Microprocessors | Lectures will include studies on types of transducers; applications of transducers, thermistors, resistance thermometer, strain gauge, thermocouple, selection of transducers, errors in transducers, types and applications of transducers |
| 13 & 14 | Microprocessors, introduction to the design of electronic equipments | Exploring on various applications, programming of microprocessors, introduction to the design of electronic equipments for measurement of liquid level, speed etc |
| 15 | REVISION | This is the week preceding the final examination. At this time, evaluation will be done to assess how far the students' expectations for the course have been met. |