![Ahmedabad University]

Course	ENR305 Sensors, Instruments and Experimentation	Semester	Monsoon Semester 2024
Faculty Name(s)	Ashok Ranade, Sanket Patel, Vinod Mall	Contact	ashok.ranade@ahduni.edu.in, sanket.patel@ahduni.edu.in, vinod.mall@ahduni.edu.in
School	SEAS	Credits	2
GER Category:		Teaching Pedagogy Enable:NO	P/NP Course: Can not be taken as P/NP

Schedule				
	Section 2	02:30 pm to 04:00 pm	Fri	01-08-24 to 26-11-24
		04:00 pm to 05:30 pm	Fri	01-08-24 to 26-11-24
		05:30 pm to 07:00 pm	Fri	01-08-24 to 26-11-24
	Section 1	03:00 pm to 04:00 pm	Fri	01-08-24 to 26-11-24
		04:00 pm to 05:30 pm	Fri	01-08-24 to 26-11-24
		05:30 pm to 07:00 pm	Fri	01-08-24 to 26-11-24
	Section 3	03:00 pm to 04:00 pm	Fri	01-08-24 to 26-11-24
		04:00 pm to 05:30 pm	Fri	01-08-24 to 26-11-24
		05:30 pm to 07:00 pm	Fri	01-08-24 to 26-11-24

Prerequisite	ENRNNN Electronics and Magnetic Circuits and Devices/ENR102 Electronics and Magnetic Circuits and Devices
Antirequisite	Not Applicable
Corequisite	Not Applicable
Course Description	Teaching scheme : 4 Hours of lab/week : Credits 2 Introduction to construction and characteristics of sensors. Experiments involving application of sensors for physical quantities like temperature, pressure, force, torque, strain, velocity, acceleration, linear and angular speed and displacement, volumetric and mass flow rates, illumination, and sound level etc. Introduction to calibration of sensors and data acquisition systems.

Course Objectives	To introduce students to (1) Sensors and their characteristics (2) Interfacing of sensors to computers for applications (3) Calibration of sensors and data acquisition systems
Learning Outcomes	At the end of the course students will be able to (1) State various specifications of sensors (10%) (2) Find polynomial equation between input and output , given the data set(5%) (3) Apply the concept of curve fitting and table look up to calibration in measurements(8%) (4) Apply the properties of resistors to measure many non electrical quantities like position, strain,Force, temperature.(15%) (5) Apply the properties of electromagnets to measure non electrical quantities .(6%) (6) Apply the properties of capacitance to measure non electrical quantities(5%) (7) Apply the concept of thermocouples to measure temperature.(8%) (8) Carry out simple designs of instrumentation amplifiers (5%) (9) Carry out the design of active filters(8%) (10) To design D to A and A to D converters (10%) (11) To state the requirements of data acquisition systems.(5%) (12) Work in a group and carry out a software or hardware project.(15 %)

Pedagogy	(1) Short lectures and simulations
	(2) Experiments involving use of instruments
	(3) Writing programs to interface sensors to computers
	(4) Project work
Expectation From Students	100 % Attendance
	Completing assignments in time
Assessment/Evaluation	- Mid-Semester Examination: - Written examination - 15% - End Semester Examination: - Written exam - 15% - Other Components: - Second Project - 30% - First Project - 40%
Attendance Policy	As per Ahmedabad University Policy.
Project / Assignment Details	Projects demonstrating use of sensors and computers for measurement and control
Course Material	
Additional Information	

Session Plan

NO.	TOPIC TITLE	TOPIC & SUBTOPIC DETAILS	READINGS,CASES,ETC.	ACTIVITIES	IMPORTANT DATES
1	Introduction	Sensor input output and curve fitting	Notes	Simulations	
2	Instrument designs	Standard errors	Notes	Problem solving	
3	Computer controlled systems	Computer board interfacing	Notes	Simulations andExperiments	
4	study of serial ports	Program to interface serial ports	Notes	Simulations	
5	ADC and PWM	Analog to Digital converter and Pulse width modulation	Notes	Experiments	
6	Control systems	Open loop and closed loop systems	Notes	Simulations	
7	Arduino board	Read and write functions	Notes	Experiments	
8	Project	Project Discussions		Group formation and discussions	
9	Sensors using electromagnetic effects	LVDT	Notes	Simulations	
10	Strain measurements	Bridge circuits	Notes	Problem solving	
11	Project	Project discussions		Project presentations	
12	Force sensing resistor	Construction and characteristics	Notes	Simulations	
13	Temperature sensors	RTDs and thermocouples	Notes	Problems	

14	Capacitive sensors	Flow measurement	Notes	Problems	
15	Displacement sensors	LVDT	Notes	Simulations	
16	Magnetic reluctance sensors	Frequency measurements	Notes	Problem solving	
17	Light measurements	Light units and sensors	Notes	Problems	
18	Sound measurements	Units and sensors	Notes	Problems	
19	Project	Design finalization and discussion		Testing	
20	Project	Project Discussions		Project presentations	