



FACULTY OF ENGINEERING & TECHNOLOGY

First Year Master of Engineering

Semester I

Course Code: 102430109

Course Title: Sensor Signal Processing

Type of Course: Program Elective II

Course Objectives: To study characteristics of various analog/Digital sensors. To learn signal conditioning techniques for nonlinear and noisy sensors. To study signal processing techniques

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
Lecture	Tutorials	Practicals		Internal		External		Total
				Theory	J/V/P*	Theory	J/V/P*	
3	0	2	4	30 / 15	20 / 10	70 / 35	30 / 15	150 / 75

* J: Jury; V: Viva; P: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	Introduction: Sensors and transducers. Understand characteristics of various sensors. Touch, position, displacement, proximity, velocity, motion, integrated circuit based temperature and vibration, humidity, moisture content, solar photovoltaic and accelerometer type of sensors, microphone array and image sensors.	10
2	Signal conditioning of sensor signals using analog circuits, understanding the need of and design of filters and pre-amplifiers, zero crossing detector and wave-shaping circuits. Design of PWM circuits.	10
3	Signal conditioning of sensor signal using digital circuits; understand the need of level shifter. Design of Schmitt trigger, counter and shifter circuits, Controller based interfacing system. System with on chip and on device sensors.	14
4	Case study of design of analog systems and digital systems for various sensors. Introduction to mix-mode controller and design.	08

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks						R: Remembering; U: Understanding; A: Application, N: Analyze; E: Evaluate; C: Create
R	U	A	N	E	C	
10%	40%	20%	10%	10%	10%	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.



Reference Books:

1	Industrial Instrumentation, Padmanabhan, Springer
2	Practical Signal Processing, Mark Owen, Cambridge Press
3	Wireless Sensor Network: Principles and Practice, Fei Hu, X. Cao

Course Outcomes (CO):

	Course Outcome Statements	%weightage
CO-1	Understand various sensors and their characteristics	10
CO-2	Experimentally obtain the characteristics of various sensors and transducers	15
CO-3	Define appropriate signal conditioning requirements	15
CO-4	Design analog system for interfacing with sensors	25
CO-5	Design digital systems for interfacing with sensors	25
CO-6	Understand benefit of system on chip architectures for various applications	10

List of Practical / Tutorials:

1	Design and Implementation of Op-Amp based signal conditioning circuits.
2	Obtaining characteristics of various sensors such as position, proximity, motion and accelerometer.
3	Obtaining characteristics of various environmental sensors such as temperature and humidity and moisture content.
4	Design of analog signal processing circuits using op-amp and specialized integrated circuits for sensors.
5	Design of digital signal processing circuits using various digital integrated circuits for sensors
6	Design of complete analog signal processing system for sensors.
7	Design of complete digital signal processing system for sensors
8	Low power controller based signal processing techniques for sensors
9	Mixed- mode controller based signal processing for sensors
10	A project based on topics learned during the course

Supplementary learning Material:

1	Sakshat Virtual Labs, IIT Guwahati
2	Virtual Labs, IITB

Curriculum Revision:

Version:	1
Drafted on (Month-Year):	Apr-20
Last Reviewed on (Month-Year):	Jul-20
Next Review on (Month-Year):	Apr-22