Academic Course Description

SRM University
Faculty of Engineering and Technology
Department of Electronics and Communication Engineering

EC1105 Sensors and Transducers

Fifth Semester, 2016-17 (Odd Semester)

Course (catalog) description
This course imparts the students with the knowledge of fundamentals, classification and characterization of transducers. It also provides the knowledge of working of various types of transducers such as mechanical transducer, electromechanical transducer, thermal transducer, radiation transducer, magnetic transducer and electro analytical transducer. It also discusses the automation of these transducers in various applications.

Compulsory/Elective course: Elective for ECE students

Credit hours: 3 credits

Course coordinator(s): Ms. A. Ramya, Assistant Professor (O.G), Department of ECE

Instructor(s):

Consultations: Day 1-Day 5 (12.30 pm-1.20 pm)

Name of the Instructor	Class	Office location	Office phone	Email (domain: @ktr.srmuniv.ac.in)
Ms. A. Ramya	B 1	TP1006A	2061	ramya.a
Mr. M. Mohana Sundharam	B 2	TP1106A	2063	mohanasundharam.m

Relationship to other courses

Pre-requisites : PY1003 & EC1001

Assumed knowledge : Basic knowledge in material science and basic concepts of electronics

Following courses : Nil

Syllabus Contents

UNIT I- INTRODUCTION (9 hours)
Definition, classification, static and dynamic parameters, Characterization – Electrical, mechanical, thermal, optical,biological and chemical, Classification of errors – Error analysis, Static and dynamic characteristics of transducers,Performance measures of sensors.

UNIT II- MECHANICAL AND ELECTROMECHANICAL SENSORS (9 hours)
Resistive Potentiometer, strain gauge, Inductive sensors and transducer, capacitive sensors, ultrasonic sensors.

UNIT III- THERMAL AND RADIATION SENSOR (9 hours)

Thermal Sensors: Gas thermometric sensors, acoustic temperature sensors, magnetic thermometer, resistance change - type thermometric sensors, thermo emf sensors, junction semiconductor types, Thermal radiation sensors, spectroscopic thermometry

Radiation Sensors: Photo detectors, photovoltaic and photo junction cells, photo sensitive cell, photo FETs and other devices.

UNIT IV- MAGNETIC AND ELECTROANALYTICAL SENSOR (9 hours)

Magnetic Sensors: Force and displacement measurement, magneto resistive sensors, Hall Effect sensor, Inductance and eddy current sensors, Angular/rotary movement transducer, Electromagnetic flow meter, squid sensor.

Electro analytical Sensors: Electro chemical cell, cell potential, sensor electrodes, electro ceramics in gas media, chemFET.

UNIT V- SENSORS AND THEIR APPLICATIONS (9 hours)

Automobile sensor, Home appliance sensor, Aerospace sensors, sensors for manufacturing, medical diagnostic sensors, environmental monitoring.

Text books, References

- Patranabis D, "Sensor and Actuators", Prentice Hall of India (Pvt) Ltd., 2006.
- Ian Sinclair, "Sensor and Transducers", Elsevier India Pvt Ltd, 3rd Edtion, 2011.
- Sawhney.A.K, Puneeth sawhney, "A Course in Electrical and Electronic Measurements and Instrumentation", Dhanpat Rai Publications, 2012.
- Ernest O. Doeblin, "Measurement System, Application and Design", Tata McGraw Hill Publishing CompanyLtd., 5th Edition, 2008.

Computer usage: NIL

Class schedule: Four 50 minutes lecture sessions per week, for 12-13 weeks

Section	Schedule
X Batch	Day 3 - 3rd Hour
	Day 4 - 5th Hour
	Day 5 - 5th Hour
Y Batch	Day 3 - 7th Hour
	Day 4 - 5th Hour
	Day 5 - 5th Hour

Professional component

General	-	0%
Basic Sciences	-	0%
Engineering sciences & Technical arts	-	0%
Professional subject	-	100%

Broad area: Communication | Signal Processing | **Electronics** | VLSI | Embedded

Course objectives

The goals of the course is to ensure that the learners become familiar	**Correlates to Program Objective**		
	H	**M**	**L**
1. To study basic concepts of various sensors and transducers.	a	b	d
2. To develop knowledge in selection of suitable sensor based on requirement and application.	a,b	d	

H: high correlation, M: medium correlation, L: low correlation

Teaching Plan

Session #	**Unit #**	**Topic**	**Text / Chapter**	**Problem Solving**	**Correlation of Topics with IOs**
UNIT I- INTRODUCTION (9 hours)					
1	1	Definition, classification	T[1]- Chapter 1 T[3]- Chapters 3,4 T[4]- Chapter 3	N	1
2	1	Static and dynamic parameters		Y	1
3	1	Characterization – Electrical, mechanical, thermal, optical, biological and chemical		N	1
4	1	Classification of errors – Error analysis		N	1
5-8	1	Static and dynamic characteristics of transducers		Y	1
9	1	Performance measures of sensors		N	
UNIT II-MECHANICAL AND ELECTROMECHANICAL SENSORS (9 hours)					
10	2	Resistive Potentiometer	T[1]- Chapter2 T[2]- Chapter 5 T[4]- Chapter 4	Y	1
11,12	2	Strain gauge		Y	1
13-15	2	Inductive sensors and transducer		Y	1
16-18	2	Capacitive sensors, Ultrasonic sensors		Y	1
UNIT III-THERMAL AND RADIATION SENSOR (9 hours)					
19	3	Gas thermometric sensors, acoustic temperature sensors	T[1]- Chapters 3,5 T[2]- Chapters 3,4 T[4]- Chapter 8	Y	1
20,21	3	magnetic thermometer, resistance change -type thermometric sensors		Y	1
22,23	3	Thermo emf sensors, Junction semiconductor types		N	1
24	3	Thermal radiation sensors,		N	1

Session #	Unit #	Topic	Text / Chapter	Problem Solving	Correlation of Topics with IOs
		Spectroscopic thermometry			
25,26	3	Photo detectors		N	1
27	3	Photovoltaic and photo junction cells, photo sensitive cell, photo FETs and other devices.		N	1
UNIT IV-MAGNETIC AND ELECTROANALYTICAL SENSOR (9 hours)					
28,29	4	Force and displacement measurement, magneto resistive sensors	T[1]- Chapter 4,6 T[2]- Chapter 6 T[3]- Chapter 5	N	1
30	4	Hall Effect sensor		Y	1
31,32	4	Inductance and eddy current sensors, Angular/rotary movement transducer, Electromagnetic flow meter, squid sensor		N	1
33	4	Electro chemical cell, cell potential		N	1
34,35	4	Sensor electrodes		N	1
36	4	Electro ceramics in gas media, chemFET		N	1
UNIT V-SENSORS AND THEIR APPLICATIONS (9 hours)					
37,38	5	Automobile sensor	T[1]- Chapter 9	N	2
39	5	Home appliance sensor		N	2
40,41	5	Aerospace sensors		N	2
42,43	5	Sensors for manufacturing		N	2
44	5	Medical diagnostic sensors		N	2
45	5	Environmental monitoring		N	2

Test Schedule

S. No.	Test	Portions	Date	Duration
1	Cycle Test-1	Session 1 to 9	TBA	1 Period
2	Cycle Test-2	Session 10 to 18	TBA	2 Periods
3	Model Test	Session 1 to 45	TBA	3 Hrs
4	End-Sem Exam	All sessions / units	TBA	3 Hrs

Evaluation Methods

Cycle Test – I	-	10%
Cycle Test – II	-	10%
Model Test	-	20%
Surprise Test	-	5%
Attendance	-	5%
Final exam	-	50%

Prepared by: Ms. A. Ramya, Assistant Professor (O.G), Department of ECE

Dated: 04-Jan-2016 **Revision No.:** 00 **Date of revision:** NA

Addendum

ABET Outcomes expected of graduates of B.Tech / ECE / program by the time that they graduate:

a. an ability to apply knowledge of mathematics, science, and engineering
b. an ability to design and conduct experiments, as well as to analyze and interpret data
c. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
d. an ability to function on multidisciplinary teams
e. an ability to identify, formulate, and solve engineering problems
f. an understanding of professional and ethical responsibility
g. an ability to communicate effectively
h. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
i. a recognition of the need for, and an ability to engage in life-long learning
j. a knowledge of contemporary issues
k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Program Educational Objectives

1. Graduates will perform as a successful professional engineer in related fields of Electronics and Communication Engineering.
2. Graduates will pursue higher education and/or engage themselves in continuous professional development to meet global standards.
3. Graduates will work as a team in diverse fields and gradually move into leadership positions.
4. Graduates will understand current professional issues, apply latest technologies and come out with innovative solutions for the betterment of the nation and society.

Name of the instructor	Class handling	Signature
Ms. A. Ramya	Batch 1	
Mr. M. Mohana Sundharam	Batch 2	

Course Co-ordinator	Academic Co-ordinator	Professor Incharge	HOD / ECE
(Ms. A. Ramya)	(Mrs. R.Manohari)	(Dr.Shanthi Prince)	(Dr. T.Ramarao)