DEPARTMENT OF INSTRUMENTATION AND CONTROL ENGINEERING

COURSE PLAN – PART I			
Name of the programme and specialization	**B. Tech , Instrumentation and Control Engineering** **(II Year, 3rd Semester)**		
Course Title	**Sensors and Transducers**		
Course Code	**IC PC13**	**No. of Credits**	**3**
Course Code of Pre-requisite subject(s)	**Nil**		
Session	**July 2023**	**Section**	**A**
Name of Faculty	**Dr. G. Uma**	**Department**	**ICE**
Official Email	**guma@nitt.edu**	**Telephone No.**	**0431-2503359**
Name of Course Coordinator(s)	**NA**		
Official E-mail		**Telephone No.**	-
Course Type (please tick appropriately)	√ **Core course**	☐ **Elective course**	

Syllabus (approved in BoS)

General concepts and terminology of measurement systems, transducer classification, general input-output configuration, static and dynamic characteristics of a measurement system, Statistical analysis of measurement data.

Resistive transducers: Potentiometers, metal and semiconductor strain gauges and signal conditioning circuits, strain gauge applications: Load and torque measurement.
Self and mutual inductive transducers- capacitive transducers, eddy current transducers, proximity sensors.

Piezoelectric transducers and their signal conditioning, Ultrasonic sensors, Seismic transducer and its dynamic response, seismic accelerometers, Force-Balance transducers: Theory-servo systems for measurement of non-electrical quantities.

Photoelectric transducers, Digital displacement sensors: Position Encoders, Variable frequency sensors, Tacho-generators and stroboscope, Hall effect sensors, Magnetostrictive transducers.

Introduction to semiconductor sensor, materials, scaling issues and basics of micro fabrication. Smart sensors. Introduction to flexible sensors and sensor fusion.

Reference Books :

1. John P. Bentley, Principles of Measurement Systems, Pearson Education, 4th Edition, 2005.
2. Doebelin E.0, Measurement Systems - Application and Design, McGraw-Hill, 4th Edition, 2004.
3. S.M. Sze, Semiconductor sensors, John Wiley & Sons Inc., 6th Edition, July 2017.
4. Murthy D. V. S, Transducers and Instrumentation, Prentice Hall, 2nd Edition, 2012
5. James W.Dally, Instrumentation for Engineering Measurements, Wiley, 2nd Edition, 2010
6. John G.Webster, Sensors and Signal Conditioning, Wiley Inter Science, 2nd Edition, 2008
7. Neubert H.K.P, Instrument Transducers - An Introduction to their Performance and Design, Oxford University Press, 2nd Edition, 1999.
8. Patranabis, Sensors and Transducers, Prentice Hall, 2nd Edition, 2010.
9. Waldemar Nawrocki, Measurement Systems and Sensors, Artech House, 2nd Edition, Jan 2016.

COURSE OBJECTIVES

1. To expose the students to various sensors and transducers for measuring mechanical quantities.
2. To make the students familiar with the specifications of sensors and transducers.
3. To teach the basic conditioning circuits for various sensors and transducers.
4. To introduce about advancements in sensor technology.

MAPPING OF COs with POs

Course Outcomes On completion of the course, the student will be able to,	**Programme Outcomes (PO)** (Enter Numbers only)
1. Classifies and explain any type of measurement systems and its input-output configuration	**1,9**
2. Predict the expected performance of various sensors.	**1,3,9**
3 Evaluate the performance of transducer by conducting suitable experiment and suggest methods to improve upon it.	**1,3,6,9**
4. Design signal conditioning circuit for various transducers.	**1,2,3,9**
5. Identify or choose a transducer for a specific measurement application.	**1,3,9,12**
6. Identify new methods for converting a physical variable into electrical quantity.	**1,3,9,12**

COURSE PLAN – PART II

COURSE OVERVIEW

The course consist of basic concepts of Measurement system, its characteristics and its design, with emphasis on different types of transducers and its conditioning circuits. Basic introduction to Microsensors,its fabrication and flexible sensors is also covered.

COURSE TEACHING AND LEARNING ACTIVITIES			
S.No.	**Week/Contact Hours**	**Topic**	**Mode of Delivery**
1	31.07.2023 to 18.08.2023	General concepts of design of measurement system and its characteristics	Chalk and Talk, PPT and discussion
2	21.08.2023 to 31.08.2023	Resistive transducer introduction, design of signal conditioning circuit and its application.	Chalk and Talk, PPT and discussion
3	01.09.2023 to13.09.2023	Self and mutual inductive transducers- capacitive transducers, eddy current transducers, proximity sensors.	Chalk and Talk, PPT and discussion.
4	14.09.2023 to 29.09.2023	Piezoelectric transducers and their signal conditioning, Ultrasonic sensors, Seismic transducer and its dynamic response, seismic accelerometers, Force-Balance transducers: Theory-servo systems for measurement of non-electrical quantities	Chalk and Talk, PPT and discussion.
5	02.10.2023 to 13.10.2023	Introduction to semiconductor sensor, materials, scaling issues and basics of micro fabrication. Smart sensors. Introduction to flexible sensors and sensor fusion	Chalk and Talk, PPT and discussion
6	17.10.2023 to 02.11.2023	Photoelectric transducers, Digital displacement sensors: Position Encoders, Variable frequency sensors, Tacho-generators and stroboscope, Hall effect sensors, Magnetostrictive transducers	Chalk and Talk, PPT and discussion

COURSE ASSESSMENT METHODS (shall range from 4 to 6)

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1.	Written Assessment I	1st week of Sep-2023	1hour	15%
2	Written Assessment II	1st week of Oct -2023	1 hour	15%
3	Assignment/Quiz/Open book test	Continuous Throughout the semester	NA	40%

4	Written Final Assessment *	2nd week of Nov 2023	3 hours	30%

***Mandatory; refer to guidelines on page 4**

COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)

Feedback from students will be obtained during the course Students' performance in test and their presentation during discussion will be used to assess the understanding level.

COURSE POLICY (including compensation assessment to be specified)

1. 75% of attendance is must, students not acquiring the required attendance will be assigned V grade.
2. Relative grading with passing minimum of 35 % or clustering will be followed, on seeing the overall performance of the students at the end of the semester.
3. For the students missing the assessment for medical reasons, one compensation assessment will be conducted one week before the final assessment for a weightage, equal to that of the missed assessment. But students are advised not to miss the assessments.
4. For the students not passing the course, supplementary examination will be given as per the regulations.
5. For academic dishonesty institute policy will be followed.

ADDITIONAL INFORMATION, IF ANY

NIL

FOR APPROVAL

Course Faculty _____ **CC- Chairperson** _____ **HOD** _____