V Semester		
Sensors & Applications (Elective-B)		
Course Code:16G5B08		**CIE Marks: 100**
Credits: L:T:P:S:4:0:0:0		**SEE Marks: 100**
Hours:43		**SEE Duration(Theory): 3 Hrs**

Course Learning Objectives: The students will be able to	
1	Impart the principles and working modes of various types of Resistive, Inductive, Capacitive, Piezoelectric and Special transducers.
2	Give an idea about the applications of various transducers and selection criteria of a transducer for a particular application.
3	Give an insight into the static and dynamic characteristics of different orders of instruments.
4	Describe different data conversion techniques and their applications.

UNIT-I	
Introduction: Definition of a transducer, Block Diagram, Active and Passive Transducers, Advantages of Electrical transducers. **Resistive Transducers:** Potentiometers: Characteristics, Loading effect, and problems. **Strain gauge:** Theory, Types, applications and problems. **Thermistor, RTD:** Theory, Applications and Problems.	**09 Hrs**
UNIT-II	
Thermocouple: Measurement of thermocouple output, compensating circuits, lead compensation, advantages and disadvantages of thermocouple. **LVDT:** Characteristics, Practical applications and problems. **Capacitive Transducers:** Capacitive transducers using change in area of plates, distance between plates and change of dielectric constants, Applications of Capacitive Transducers and problems.	**10 Hrs**
UNIT-III	
Piezo-electric Transducers: Principles of operation, expression for output voltage, Piezo-electric materials, equivalent circuit, loading effect, and Problems. **Special Transducers:** Hall effect transducers, Thin film sensors, and smart transducers: Principles and applications, Introduction to MEMS Sensors and Nano Sensors, Schematic of the design of sensor, applications.	**10 Hrs**
UNIT-IV	
Chemical sensors: pH value sensor, dissolved oxygen sensor, oxidation-reduction potential sensor. **Light sensors**: Photo resistor, Photodiode, Phototransistor, Photocell, Photo-FET, Photocell, Charge coupled device. **Tactile sensors:** Construction and operation, types.	**08 Hrs**
UNIT-V	
Data Converters: Introduction to Data Acquisition System, types of DAC, Binary Weighted DAC, R-2R ladder DAC, DAC-0800, Types of ADC, Single Slope ADC and Dual-slope integrated type ADC, Flash ADC, 8-bit ADC-0808, Programmable Gain Amplifier.	**06 Hrs**

Course Outcomes: After completing the course, the students will be able to	
1	Remember and understand the basic principles of transducers and smart sensors.
2	Apply the knowledge of transducers and sensors to comprehend digital instrumentation systems.
3	Analyze and evaluate the performance of different sensors for various applications.
4	Design and create a system using appropriate sensors for a particular application

Reference Books	
1	A.K. Sawhney "Electrical and Electronic Measurements and Instrumentation", Dhanpat Rai and Sons, 18th Edition, 2008, ISBN 81-7700-016-0.
2	Clarence W.de Silva, "Sensor systems: Fundamentals and applications" CRC Press, 2016 Edition, ISBN 9781498716246.
3	D.V.S. Murthy "Transducers and Instrumentation", PHI Publication, 2nd Edition 2008, ISBN 978-81-203-3569-1.
4	Arun K. Ghosh, "Introduction to Measurement and Instrumentation", PHI 3rd Edition, 2009, ISBN: 978-81-203-3858-6.

Continuous Internal Evaluation (CIE) (Theory – 100 Marks)	
Evaluation method	Marks
Quiz -1	10
Test -1	50
Quiz -2	10
Test -2	50
Quiz -3	10
Test -3	50
Assignment	10
Final Evaluation Quiz 10+10+10; Test 50+50+50=150 Reduced to 60; Assignment 10	**100**

Semester End Evaluation Theory (100)	
Part- –A Objective type questions	**20**
Part –B There should be 5 questions from 5 units. Each question should be for maximum of 16 Marks. The **UNIT-1**, **UNIT-4** and **UNIT-5** should not have any choice. The **UNIT-2 and UNIT-3** should have an internal choice. Both the questions should be of the same complexity in terms of COs and Bloom's taxonomy level.	**80**
Total	**100**

	What		To whom	Frequency of conduction	Max Marks	Evidence	Contribution to Course Outcome		
Direct Assessment Methods	CIE	Quiz	Students	Three	30	Answer Scripts	80%	100%	90%
		Test		Three	60/50				
		Assignment		2 phases	10	Reports			
	SEE	Semester End Examination		End of every semester Consisting of Part-A and Part-B	100	Answer Scripts	20%		
Indirect Assessment Methods	Course End Survey		Students	End of course		Questionnaire Based on COs	10%		

Note: The faculty teaching the course may adapt additional methods for evaluation within the total maximum marks.

CO-PO MAPPING												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO2	**2**	**3**	**-**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	**1**	**2**	**2**	**-**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**2**
CO4	**-**	**-**	**-**	**-**	**1**	**1**	**-**	**-**	**-**	**3**	**-**	**1**

Course - PO Mapping												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
Course	**2**	**2**	**1**	**-**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**1**

Low-1 Medium-2 High-3