Course code	Course Name	L-T-P-Credits	Year of Introduction
IC201	**BASIC INSTRUMENTATION ENGINEERING AND TRANSDUCERS**	**3-1-0-4**	**2016**

Prerequisite: Nil

Course Objectives

1. To develop a strong base in the fundamental philosophies of instrumentation engineering.
2. To learn the static and dynamic characteristics of the measuring instruments.
3. To familiarize with a variety of transducers, which are very vital in instrumentation systems.

Syllabus

Functional elements of measurement system. Classification of instruments. Input output configuration of measuring instruments and measurement systems. Measurement system performance. Static characteristics. Errors. Working principle, construction and application of different types of transducers.

Expected Outcome

Upon completion of this course, students will be able

1. To describe functional elements of any measurement system and to list static and dynamic characteristics of the measuring instruments.
2. To compute different types of errors that can occur during the measurement and to use the methods to correct the measurement errors.
3. To use different types of transducers for various industrial purposes.

Text Book:

1. Ernest.O Doeblin, Measurement systems: Application and design, McGraw- Hill

References:

1. A.K Sawhney, A course in Mechanical Measurement and Instrumentation, Dhanpat Rai & Co.
2. C.S. Rangan, G.R. Sarma, V.S.V. Mani, Instrumentation Devices & Systems, Tata McGraw-Hill publishing company Ltd. (III Module).
3. DVS Murthy, Transducers and Instrumentation, PHI

Course Plan			
Module	**Contents**	**Hours**	**Sem. Exam Marks**
I	Introduction to Instruments and their representations.	5	15%

	Typical applications of Instruments systems. Functional elements of a measurement system and examples. Basic description of the functional elements of the instruments.		
	Classification of instruments: Deflection and null type, manually operated and automatic type, analogue and digital types, self generating and power operated types, contacting and non-contacting types, dumb and intelligent types.	3	
II	Standards and calibration. Input output configuration of measuring instruments and measurement systems.	5	**15%**
	Desired inputs, interfering inputs, modifying inputs, methods of correction for interfering and modifying inputs.	5	
FIRST INTERNAL EXAM			
III	Measurement System performance. Static calibration, static characteristics. Errors in measurements, true value, static error, static correction. Scale range and span. Error calibration curve, reproducibility and drift, repeatability, noise, signal to noise ratio, sources of noise, Johnson noise, power spectrum density, noise. Accuracy and precision, static sensitivity, linearity, hysteresis, threshold, dead time. Dead zone, resolution or discrimination.	5	**15%**
	Loading effects. Input and output impedances. Input impedances, input admittance, output impedances, output admittance. Loading effects due to shunt connected instruments. Loading effects due to series connected instruments.	5	
IV	Limiting errors (Guarantee errors). Relative (fractional), limiting error. Combination of quantities with limiting errors. Known errors, types of errors, gross errors, systematic errors, instrumental errors, environmental errors, observational errors. Random (residual) errors.	5	**15%**
	Dynamic response. Dynamic characteristics of measurement systems. (Mention only the definition of characteristics. No need to study the various inputs and the corresponding dynamic responses of the system.	4	
SECOND INTERNAL EXAM			
V	Definition of Transducers. Role of Transducers in Instrumentation. Classification of Transducers, analogue and digital, active and passive, primary and secondary transducers.	3	**20%**
	Principles of variable resistance Transducers, Potentiometers, Strain gauges, Temperature	3	

	compensation of Strain gauges.		
	Piezo electric Transducers, Materials and properties, modes of deformation. Hall effect Transducers.	3	
VI	Principle, type and construction of variable inductive transducers, different types of self and mutual inductance transducers, LVDT and RVDT. *Uses, advantages and disadvantages of inductive Transducers.*	4	**20%**
	Principle, types and construction of different types of variable capacitance Transducers. *Uses, advantages and disadvantages of capacitive Transducers*.	3	
	Optical Transducers, digital Transducers, magneto elastic Transducers.	3	
END SEMESTER EXAM			

QUESTION PAPER PATTERN:

Maximum Marks :   100   Exam Duration: 3 Hours

Part A

Answer any two out of three questions from Module 1 and 2 together. Each question carries 15 marks and can have not more than four sub divisions.   (15 x 2 = 30 marks)

Part B

Answer any two out of three questions from Module 3 and 4 together. Each question carries 15 marks and can have not more than four sub divisions.   (15 x 2 = 30 marks)

Part C

Answer any two out of three questions from Module 5 and 6 together. Each question carries 20 marks and can have not more than four sub divisions.   (20 x 2 = 40 marks)

                    Total 100 Marks

Note: Each part shall have questions uniformly covering both the modules in it.