

## Course-Plan

School: **Engineering**

Department: **Mechanical Engineering**

Course Code: **ME 215**

Course Name: **Mechanical Measurements and Instrumentation**

Total Class Hours: **39**

*Instructors:* **Rakesh Bhadra**

### **1. Course Outline:**

Instrumentation is a science which deals with measurement and control. The knowledge of instrumentation and its practical applications is of vital importance in the modern competitive industrial environment. The most important factor in achieving quality and reliability in service of any product is its dimensional control. Due to rapid development in the field of measurements and industrial instrumentation, the student has to know the basic fundamentals, mechanisms and functioning of different instruments which must meet the stringent design requirement. Course deals with topics such as Principle of measurements, Errors, Accuracy, Units of measurements, Description of various types of sensors, transducers and measuring instruments.

### **2. Time plan for course and exams:**

<b>Topic</b>	<b>Content</b>	<b>Class Hours</b>
<b>Introduction to Metrology</b>	General concepts, Definition of different metrological terms	1
	Metrology and methods of measurement, Classification of standards	1
	Accuracy of Measurements, Precision, Accuracy, Sensitivity	1
	Calibration, Readability, Repeatability, Magnification	1
	Limits and Fits	1
	Tolerances	1
<b>Sessional Test I (25 Marks)</b>		
<b>Mechanical measurements</b>	Linear measurements	2
	Angular and Taper measurements	1
	Screw thread measurements, Gear measurements	1
	Circularity measurements	1
	Surface finish	1
	Straightness and flatness measurements	1
<b>Assessing Experimental Data</b>	Static performance characteristics	1
	Errors in measurements: Types and sources of errors	1
	Methods of elimination or reduction of error	1
	Sensitivity, linearity, resolution etc of instruments	1
	Uncertainty analysis	1

Mid-semester examination (40 Marks)		
<b>Statistical analysis of Experimental Data</b>	Gaussian distribution of error	2
	Least square method of fitting data	1
	Linear regression method	2
<b>Dynamic Performance Characteristics</b>	Zero, first and second order instruments	1
	Signal conditioners: bridge circuit	1
	Amplifiers, and filters	1
<b>Sensors and Transducers</b>	Definition and classification of transducers	1
	The Variable-Resistance Transducer	1
	The Differential Transformer	1
	Capacitive Transducers	1
	Piezoelectric Transducers	1
	Digital Displacement Transducers	1
Sessional Test II (25 Marks)		
<b>Measuring Instruments</b>	Description of instruments used for Displacement Measurements	1
	Pressure measuring instruments	1
	Force measuring instruments	1
	Acceleration measuring instruments	1
	Torque measuring instruments	1
	Flow measuring instruments	1
	Temperature measuring instruments	1
	Strain measuring instruments	1
End-semester examination (60 Marks)		

### 3. Course Outcomes (COs):

On the successful completion of the course, the student would be able to:

**CO1:** Gain knowledge of the basics of the science of measurement.

**CO2:** Have the knowledge of different categories of mechanical measurements.

**CO3:** Identify problems associated to measuring devices and measurements.

**CO4:** Apply their acquired knowledge to solve problems related to measurements and instrumentation.

**CO5:** Apply their learning and understanding in the design and working of measuring instruments according to need.

### 4. Study Materials:

*Text Books*

1. Jain, R.K. Engineering Metrology. Khanna Publishers, New Delhi, 21st edition, 2009.

2. Nakra, B.C. and Chaudhry, K.K. Instrumentation Measurement and Analysis. Tata McGraw Hill, New Delhi, 4th edition, 2016.

*Reference Books*

1. Beckwith, T.G. Marangoni, R.D. and Lienhard, J.H. Mechanical Measurements. Pearson Prentice Hall, 6th edition, 2007.

2. Holman, J.P. Experimental Methods for Engineers. Mc-Graw Hill, 8th edition, 2012.

3. Rajput, R.K. Mechanical Measurements and Instrumentation. S. K. Kataria and Sons, New Delhi, 2012.

**5. Evaluation Plan**

Test No.	Marks	Duration (minutes)
		-
Assignments (5 assignments)	50	
Mid-Semester Examination	40	90
End-Semester Examination	60	120
<b>Total</b>	<b>150</b>	

All the tests will be held as per the schedule notified by the Controller of Examinations, Tezpur University.

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