

# **BEME505T: MECHANICAL MEASUREMENT & METROLOGY (Theory)**

**CREDITS: 04**

**Teaching Scheme**  
Lectures: 3 Hours/Week  
Tutorial: 1 Hour/Week

**Examination Scheme**  
Duration of Paper: 03 Hours  
University Assessment: 80 Marks  
College Assessment: 20 Marks

**Course Objectives and Expected Outcomes:** This course is designed to study various measurement systems and their significance along with the characteristics and order of the instruments. At the end of this course, students will be able to understand various instruments for the measurement of different parameters, tolerances, advanced concepts involved in measuring technology (Measurements) & use of precision measuring instruments. Students will appreciate the importance of accuracy and its effects on results and its uncertainty.

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## **UNIT – I**

**[ 8 Hrs.]**

Purpose, structure and elements of measuring system. Static characteristics of measurement system, elements including systematic, statistical characteristics, generalized model of system elements and calibration. Error measurement, error probability density function, error reduction. Introduction to dynamic characteristics of measurement system. Introduction to noise in measurement system.

## **UNIT – II**

**[ 8 Hrs.]**

Classification, Principle, Sensing elements, Signal conditioning elements, Construction, Range and working of instruments for measurement of Linear and Angular Displacement, Speed, Load, Strain, Force, Torque and Power. (Analytical treatment not included)

## **UNIT – III**

**[ 8 Hrs.]**

Classification, Principle, Sensing elements, Signal conditioning elements, Construction, Range and working of instruments for measurement of Pressure, Vacuum, Sound, Light and Temperature. (Analytical treatment not included)

## **UNIT – IV**

**[ 8 Hrs.]**

Standards of Measurement, Line, End and Wavelength standard. Working standards, Requirement of interchangeability, Allowance and Tolerance, Selective assembly. Measurement of Straightness and Flatness. Instruments for Linear and Angular Measurement. (Vernier, Angle gauge, Sine bar, Level indicator, Clinometers and Taper gauge)

## **UNIT – V**

**[ 8 Hrs.]**

Limits and Fits, Tolerance analysis of Limits and Fits, Types of limit gauges, Types of fit, Shaft and Hole basis system, Design of Limit gauge and Process planning sheet (Numerical treatment is expected).

## **UNIT – VI**

**[ 8 Hrs.]**

Comparators: Mechanical, Optical, Electrical, Electronic, Pneumatic.  
Study and use of Optical profile projectors, Tool maker's microscope and Autocollimator.  
Measurement of Screw thread and Gear tooth.

### **LIST OF TUTORIALS:**

- 1) Study of Linear and Angular measurement instrument.
- 2) Study of various types of Comparators.
- 3) Preparation of Process Planning sheet.

### **TEXT BOOKS:**

1. Mechanical Measurement and Control, D.S. Kumar, Metropolitan Book Co.
2. Instrumentation Measurement and Analysis, B.C. Nakra, K.K. Choudhary, TMH
3. Measurement Systems, Ernest O. Doebelin, Dhanesh N. Manik, TMH
4. Mechanical Measurement, Thomas G. Beckwith, Pearson
5. Metrology and Measurement, Anand K. Bewoor, Vinay A. Kulkarni, TMH
6. Metrology, R. K. Jain, Khanna Publishers.
7. A Textbook of Engineering Metrology, I. C. Gupta, Dhanpat Rai & Sons Publication.

### **REFERENCE BOOKS:**

1. Principles of Measurement Systems, John P. Bentley, Pearson