



# SARVAJANIK UNIVERSITY

## Sarvajani College of Engineering and Technology Bachelor of Technology



### Mechanical Engineering B. Tech. Semester IV

Course Name: Mechanical Measurement and Metrology

Course Code: BTME13405

Type of course : Professional Core Course (PCC)

Prerequisite : Nil

Rationale of course : The course is designed to study the Measurement and Metrology deals with the application of science in Mechanical Engineering. To provide knowledge on various Metrological equipment's available to measure the dimension of the components. It provides a means of assessing the suitability of measuring instruments, their calibration, and the quality control of manufactured products.

#### Teaching and Examination Scheme:

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	150
2	0	2	3	60	25	15	30	20	

**CA1:** Continuous Assessment (assignments/projects/open book tests/closed book tests **CA2:** Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems **TEE:** Term End Examination **TEP:** Term End Practical Exam (Performance and viva on practical skills learned in course) **CA3:** Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

#### Content:

Sr. No.	Content	Total Hrs	Module Weightage
1	<b>Basic Concept of Meteorology and Measurement:</b>  Definition, objectives and concept of metrology, need of inspection, significance of measurement, generalized measurement system, definitions and concept of calibration, Accuracy, precision and errors in measurement, Material Standard, Wavelength Standards, Subdivision of standards, Line and End standards, Classification of standards.	05	15%
2	<b>Linear and Angular Measurement and basic of Limits, Fits, Tolerance and Gauging:</b>  Linear measuring instruments: Vernier, micrometer, interval measurement, Slip gauges and classification, interferometry, optical flats, limit gauges, Comparators: Mechanical, pneumatic and electrical types, applications.	08	30%



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Sr. No.	Content	Total Hrs	Module Weightage
	Angular measurements: Sine bar, optical bevel protractor, angle Decker, Taper measurements. Definition of tolerance, Principle of interchangeability and selective assembly, concept of limits of size and tolerances, definition of fits, hole basis system, shaft basis system, geometric tolerance, Classification of gauges, brief concept of design of gauges (Taylor's principles), Gauge tolerance, Wear allowance on gauges.		
<b>3</b>	<b>Form Measurement:</b>  Principles and Methods of straightness, Flatness measurement, Thread measurement, gear measurement, surface finish measurement, Roundness measurement and their applications.	<b>06</b>	<b>20%</b>
<b>4</b>	<b>Advances in Metrology:</b>  Precision instruments based on laser-Principles- laser interferometer-application in linear, angular measurements and machine tool metrology, Coordinate measuring machine (CMM) - Constructional features, types, applications.	<b>05</b>	<b>15%</b>
<b>5</b>	<b>Flow, Pressure, and Temperature Measurement:</b>  Force, Torque, Power: mechanical, Pneumatic, Hydraulic and Electrical type, Flow measurement: Venturi meter, Orifice meter, rotameter, pitot tube, Temperature: bimetallic strip, thermocouples, electrical resistance thermometer, Reliability and Calibration, Readability and Reliability.	<b>06</b>	<b>20%</b>

### Percentage Distribution of Marks as per Revised Bloom's Taxonomy (Theory/Practical):

Percentage Distribution of Marks					
R Level	U Level	A Level	N Level	E Level	C Level
<b>25</b>	<b>30</b>	<b>20</b>	<b>20</b>	<b>5</b>	<b>0</b>

**Legends: R:** Remembrance, **U:** Understanding; **A:** Application, **N:** Analyse, **E:** Evaluate **C:** Create and above Levels

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.



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#### Reference/Text Books:

Sr. No.	Title of book /article	Author(s)	Publisher	Year of publication	Publication Edition
1.	Engineering Metrology and Measurements	Bentley	Pearson Education		
2.	Metrology and Measurement	Anand Bewoor & Vinay Kulkarni	McGraw-Hill	2017	--
3.	Mechanical Measurements and Instrumentations	R K Rajput	Kataria Publication	2013	
4.	Mechanical Measurement and Metrology	R K Jain	Khanna Publisher	2009	
5.	Engineering Metrology and Measurement	N V Raghavendra and Krishnamurthy	Oxford University Press	2013	

#### Course Outcomes (CO's):

Sr. No.	CO Statement After learning this subject, students will be able to	Marks % weightage
CO-1	Describe the concepts of measurements to apply in various metrological instruments.	20
CO-2	Outline the principles of linear and angular measurement tools used for industrial applications	20
CO-3	Apply concepts of metrology for gears, threads and surface finish.	20
CO-4	Utilize various precision machines working based on Laser technology and coordinate measuring methods.	20
CO-5	Measure mechanical quantities like Force, Temperature, Pressure, Velocity, Acceleration, Strain and Torque.	20

#### Mapping of CO's with Program Outcomes (PO's) and Program Specific Outcomes (PSO's):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO-1	3	2	2	1	1	1	1	1	2	2	1	2	3	2	1
CO-2	3	3	2	2	2	2	1	1	1	2	1	1	2	2	2
CO-3	3	3	2	1	1	1	1	1	2	3	1	2	3	2	2
CO-4	2	3	2	3	2	1	2	1	1	3	1	1	3	3	2
CO-5	2	2	1	2	2	1	1	1	2	1	1	2	3	2	2



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#### Rationale of Mapping - CO's with PO's and CO's with PSO's:

**CO-PO's:** According to the CO-PO mapping subject will develop basic engineering knowledge related to measurement, modern tool uses, problem analysis as well the skill of team work.

**CO-PSO's:** According to the CO-PSO mapping graduate will develop the skill to take accurate, précised and reliable measurement of products, and upgrade themselves for technical communication required on shop floor.

#### List of Experiments:

1. To determine the length, height and diameter of the given work piece using vernier caliper, vernier height gauge, and micrometer.
2. To determine the inner diameter of the given work piece by using micrometer and dial bore gauge.
3. To determine the chordal addendum and chordal thickness of the given spur gear by gear tooth vernier caliper.
4. To measure the angle of the given work piece by using venire bevel protractor and sine bar.
5. To measure the major and minor diameters, pitch diameter and pitch of a given threaded component using three wire methods.
6. Measurement of straightness of edges and flatness of surfaces.
7. To determine the flow, pressure and temperature parameters using precise equipment.
8. To study the Coordinate Measuring Machine.

#### Major Equipment:

1. Temperature and Pressure Measurements devices.
2. Stress, Strain and Force Measurements devices.
3. Surface Measurements devices.
4. Linear and Angular Measurements devices.
5. Gears and Screw Threads Measurements devices.

#### List of Open learning website:

<https://archive.nptel.ac.in/courses/112/104/112104250/>  
<https://archive.nptel.ac.in/courses/112/103/112103261/>  
<https://archive.nptel.ac.in/courses/112/107/112107242/>  
<http://elearning.vtu.ac.in/econtent/courses/web/CV/18CV32.html>

#### List of Open Source Software:

Nil