

## MECHANICS LABORATORY

**Mechanics** is the branch of science that deals with the motion of bodies either at rest or in motion under the action of forces. Experiments of Mechanics laboratory provide the foundation for Newton's Laws of Motion and Special theory of Relativity. The lab is equipped with state of the art facilities for the under-graduate students. The aim of this lab is to build an understanding about various instruments such as vernier Calliper, Screw Gauge, Travelling Microscope, Sextant, Bar Pendulum, Katers Pendulum etc. and to develop skill to measure the related physical quantities. In order to understand the basic concepts in Mechanics some measuring instruments have been also augmented in the lab like Function Generators, Dual Trace Cathode Ray Oscilloscopes, Multimeters etc.

The students perform various experiments for the measurement of length using vernier Calliper, Screw Gauge, Travelling Microscope; to determine height of a building using Sextant; moment of Inertia of a flywheel; Modulus of Rigidity of a wire using Maxwell needle; elastic constant of a wire using Searls method; value of acceleration due to gravity ( $g$ ) using bar pendulum and Katers pendulum etc. Students also perform experiments to study random errors in observations.

Our mission is to develop innovative and simple instructional material to drive the concepts into the minds of students and infuse scientific temper in the student and guide them towards research in this field.

### EQUIPMENT

1	Vernier Calliper
2	Screw Gauge
3	Travelling Microscope
4	Telescope
5	Bar Pendulum
6	Katers Pendulum
7	Torsional pendulum
8	Compound Pendulum
9	Maxwell Needle
10	Spring Constant
11	Sextant and Stand
12	Spherometer
13	Spring Balance
14	Potentiometer
15	Poisson Ratio
16	Tuning forks
17	Fly Wheel
18	Sonometer
19	Ballistic Galvanometer
20	Tangent Galvanometer

21	Youngs Modulus

Details of some of the instruments are as below:

1. **Vernier callipers** are measuring tools made up of steel that is used for accurately measuring linear dimensions. It is also used to measure the inner and outer dimensions of objects and thickness of objects of different shapes.
2. **A screw gauge** is an instrument that is used for measuring the diameter of thin wires and also the gauge can be used for measuring the thickness of thin metal sheets. Screw gauge has the smallest least count therefore it can be used to measure small measurements.
3. **A travelling microscope** is an instrument for measuring length with a resolution typically of the order of 0.01mm. It is also used to measure very short distances precisely, for example the diameter of a capillary tube.
4. The **sextant** is an instrument used to measure angles and hence height of buildings. It adheres to the principle of double reflection hence it can measure angles up to 120 degrees.
5. The **flywheel** consists of a heavy circular disc/massive wheel fitted with a strong axle projecting on either side. The axle is mounted on ball bearings on two fixed supports. There is a small peg on the axle. One end of a cord is loosely looped around the peg and its other end carries the weight-hanger. Our Students perform this experiment to determine the moment of inertia of a flywheel.
6. **Maxwell's needle** apparatus is used to determine the modulus of rigidity ( $\eta$ ) of the material of a wire of uniform cylindrical cross section. Modulus of Rigidity is the coefficient of elasticity of wire for a shearing force. In simple words, rigidity modulus of a metal wire is a measurement of the capability of a material to resist deformation when external tangential force is applied to the metal wire.
7. A **bar pendulum** is the simplest form of compound pendulum. It is in the form of a rectangular bar with holes drilled along its length at equal separation. The bar pendulum consists of a metallic bar of about one meter long. A series of circular

holes each of approximately 5 mm in diameter are made along the length of the bar. It is used to find the value of acceleration due to gravity ( $g$ ). .

8. A **Kater pendulum** is a compound pendulum with adjustable knife edges placed respectively at the center of suspension and near the center of oscillation. It is used to determine acceleration of gravity by means of the period of oscillation.
9. A **spherometer** is a device used primarily for measuring the curvature of objects such as lenses and curved mirrors. It consists of three legs positioned in an equilateral triangle. A centre probe is raised or lowered by means of a micrometer drive.
10. A **spring balance** measures the weight of an object by opposing the force of gravity acting with the force of an extended spring.
11. A **ballistic galvanometer** is a type of sensitive galvanometer; commonly a mirror galvanometer. Unlike a current-measuring galvanometer, the moving part has a large moment of inertia, thus giving it a long oscillation period. It is really an integrator measuring the quantity of charge discharged through it.
12. In **Searls method**, the length  $L$  of the wire is determined by a scale, diameter  $d$  of the wire is measured by a screw gauge, length  $l$  of the wire is determined by a Micrometer or Vernier scale, and  $F$  is indicated by external force. This method is used to determine the elastic constants of a wire.