



# INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal - 500 043, Hyderabad, Telangana

## COURSE CONTENT

MECHANICS OF SOLIDS AND FLUIDS LABORATORY								
<b>III Semester: AE</b>								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AEEE05	Core	0	0	2	1	40	60	100
<b>Contact Classes: Nil</b>		<b>Tutorial Classes: Nil</b>		<b>Practical Classes: 36</b>		<b>Total Classes: 36</b>		
<b>Prerequisite: Mechanics of Solids and Fluid Dynamics</b>								

### I. COURSE OVERVIEW:

The Mechanics of Solids and Fluid Dynamics Laboratory offers students an integrated hands-on learning experience that builds a strong practical foundation in both material behavior and fluid flow. In this laboratory, students investigate the mechanical properties of engineering materials through experiments on impact, tensile and compressive strength, hardness, and ductility, supporting project work involving composites, ferrous, and non-ferrous alloys for selecting suitable materials in aero-structural applications. Simultaneously, the fluid dynamics component introduces fundamental concepts of fluid properties, fluid statics, and incompressible flow through experiments using standard flow-measurement devices, pumps, and turbines, enabling performance evaluation and understanding of flow behavior, fluid forces, and turbomachinery operation.

### II. COURSE OBJECTIVES:

**The students will try to learn:**

- I. The mechanics of materials and structural analysis through a series of experiments using appropriate codes and standards
- II. The behavior and failure modes using deflection of beams and columns for choosing the safety factor for engineering applications.
- III. Application of Bernoulli's theorem in measurement of rate of discharge in pumps.
- IV. The flow measurement and performance of pumps and turbines under various speeds.

### III. COURSE OUTCOMES:

**After successful completion of the course, students will be able to:**

- CO1 Compare the hardness of ferrous and non-ferrous materials using hardness testing machines for identifying suitable industrial applications.
- CO2 Choose the regions of elasticity and plasticity, stress-strain relationships using universal testing machine for determining the safety factor.
- CO3 Summarize performance of a material or product using torsion tests, when undergoes rotational motion when in service.
- CO4 Demonstrate the validation of Bernoulli's theorem for incompressible, steady, continuous flow in order for regulating discharges in pipes.
- CO5 Illustrate the critical Reynolds number using Reynolds apparatus for transition of laminar flow into turbulent flow.

#### **IV. COURSE CONTENT:**

##### **EXERCISE -1: BRINELL HARDNESS AND ROCKWELL HARDNESS TEST**

Determination of Brinell number of a given test specimen.

Determination of hardness of a material by measuring the depth of permanent indentation.

##### **EXERCISE-2: TENSION TEST**

To determine the behavior of mild steel and various materials under different loads.

- a) Tensile Strength
- b) Yield strength
- c) Elongation
- d) Young's modulus

##### **EXERCISE -3: TORSION TEST**

Determine of Modulus of rigidity of various specimens.

##### **EXERCISE -4: COMPRESSION TEST**

Determine the stress on material.

##### **EXERCISE -5: SPRING TEST**

Determine the stiffness of the spring and the Modulus of rigidity of wire material

##### **EXERCISE -6: DEFLECTION TEST FOR CANTILEVER and BEAM**

Determine the Young's modulus of the given material with the help of deflection of beam.

##### **EXERCISE -7: DEFLECTION TEST FOR SIMPLE SUPPORTED BEAM**

Determine the Young's modulus of the given material with the help of deflection of beam.

##### **EXERCISE -8: CHARPY AND IZOD IMPACT TEST**

Determination the toughness of the materials like steel, copper, brass and other alloys using Izod and Charpy test

##### **EXERCISE -9: IMPACT OF JET ON VANES**

Verify the momentum equation experimentally through impact of jet experiment and determine the coefficient of discharge

##### **EXERCISE -10: FLOW THROUGH NOTCHES**

Determine the coefficients of discharge of the rectangular, triangular and trapezoidal notches.

##### **EXERCISE -11: VERIFICATION OF BERNOULLI THEOREM**

Evaluate the different components of mechanical energy possessed by a fluid element at different sections of a converging-diverging duct and thus appreciate the limitations of Bernoulli's equation applied to incompressible flows.

##### **EXERCISE -12: RECIPROCATING PUMP**

Study the performance characteristics of a reciprocating pump

##### **EXERCISE -13: PELTON TURBINE**

Obtain the performance characteristics of a Pelton turbine.

##### **EXERCISE -14: CENTRIFUGAL PUMP**

Study the performance characteristics of a single stage centrifugal pump

#### **V. TEXT BOOKS:**

1. Gere, Timoshenko, "Mechanics of Materials", McGraw Hill, 3<sup>rd</sup> edition, 1993.

## **VI. REFERENCE BOOKS:**

1. R. S Kurmi, Gupta, “Strength of Materials”, S. Chand, 24<sup>th</sup> edition, 2005.
2. William Nash, “Strength of Materials”, Tata McGraw Hill, 4<sup>th</sup> edition, 2004.

## **VII. ELECTRONICS RESOURCES:**

1. <https://nptel.ac.in/courses/112107147/>
2. [https://vssut.ac.in/lecture\\_notes/lecture1423904647.pdf](https://vssut.ac.in/lecture_notes/lecture1423904647.pdf)
3. <https://web.mit.edu/emech/dontindex-build/>

## **VIII. MATERIALS ONLINE**

1. Course Outline Description
2. Lab manual