INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

FLUID MECHANICS AND HYDRAULIC MACHINES LABORATORY								
III Semester: ME								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
AMEE11	**Core**	0	0	2	1	40	60	100
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 36**				**Total Classes:36**		
Prerequisite: Engineering Workshop								

I. COURSE OVERVIEW:
This laboratory is intended to enhance the learning experience of the students with new tools, equipment, and techniques for creating physical objects and mechanisms with a variety of materials. Skills learned in the course enable analogous learning about the design process in manufacturing used in various industrial applications and empowers the students to apply modern concepts of manufacturing technologies.

II. COURSES OBJECTIVES:
The students will try to learn

I. The importance of fluid mechanics in day-to-day life and the study of fundamental fluid flow principles, properties of fluids, and flow measuring devices used in engineering applications.
II. The knowledge of energy, momentum, and continuity principles applied to fluid flow systems, and performance evaluation of hydraulic machines such as turbines and pumps under different operating conditions.
III. The design and operational features that influence fluid flow behavior and hydraulic machine performance, and the assessment of experimental results on real flow systems and hydraulic machinery.

III. COURSE OUTCOMES:
At the end of the course students should be able to:

CO1 Identify the fundamental properties of fluids and flow parameters using standard fluid flow measuring devices such as Venturimeter and Orifice meter.
CO2 Demonstrate the application of continuity, energy, and momentum principles through experimental verification of Bernoulli's theorem and flow through pipelines.
CO3 Determine friction factor and minor losses in pipe flow systems under various flow conditions.
CO4 Evaluate the performance characteristics of hydraulic machines including turbines and pumps by conducting efficiency and characteristic curve tests.
CO5 Analyze the influence of operating conditions and design parameters on the performance of hydraulic machines such as Pelton wheel, Francis turbine, Kaplan turbine, and centrifugal pumps.
CO6 Interpret experimental data and assess real-time fluid flow and hydraulic machine behavior with reference to industrial and power plant applications.

IV. COURSE CONTENT:

EXCERCISE-1: CALIBRATION AND PERFORMANCE OF VENTURIMETER
To determine the coefficient of discharge of a Venturimeter and verify Bernoulli's equation for fluid flow

EXCERCISE-2: CALIBRATION AND PERFORMANCE OF ORIFICE METER
To determine the coefficient of discharge of an orifice meter and study flow characteristics through a pipeline

EXCERCISE-3: DETERMINATION OF FRICTION FACTOR IN A PIPELINE
To determine the friction factor for flow through a given pipe and verify Darcy–Weisbach equation

EXCERCISE-4: LOSS OF HEAD DUE TO SUDDEN CONTRACTION
To determine the head loss due to sudden contraction in a pipeline and evaluate loss coefficients

EXCERCISE-5: VERIFICATION OF BERNOULLI'S THEOREM
To verify Bernoulli's theorem by measuring pressure head, velocity head, and total head along a flow system

EXCERCISE-6: IMPACT OF JET ON VANES
To determine the force exerted by a jet of water on stationary and moving vanes and verify momentum equation

EXCERCISE-7: PERFORMANCE TEST ON PELTON WHEEL
To conduct performance testing of a Pelton wheel and determine efficiency under different load conditions

EXCERCISE-8: PERFORMANCE TEST ON FRANCIS TURBINE
To determine overall efficiency and characteristic curves of a Francis turbine

EXCERCISE-9: PERFORMANCE TEST ON KAPLAN TURBINE
To evaluate performance characteristics and efficiency variation of a Kaplan turbine with load

EXCERCISE-10: PERFORMANCE TEST ON SINGLE STAGE CENTRIFUGAL PUMP
To determine discharge, head, efficiency, and characteristic curves of a single-stage centrifugal pump

EXCERCISE-11: PERFORMANCE TEST ON MULTI STAGE CENTRIFUGAL PUMP
To study performance characteristics and efficiency variation of a multi-stage centrifugal pump

EXCERCISE-12: PERFORMANCE TEST ON RECIPROCATING PUMP
To determine discharge, slip, and overall efficiency of a reciprocating pump

EXCERCISE-13: CHARACTERISTIC CURVES OF HYDRAULIC MACHINES
To plot and analyze characteristic curves of turbines and pumps based on experimental data.

EXCERCISE-14: STUDY OF FLOW MEASURING AND HYDRAULIC TEST RIGS
To study construction, working principles, and industrial applications of fluid flow and hydraulic machinery test rig

V. TEXT BOOKS:

1. Fox R.W., McDonald A.T. and Pritchard P.J., Introduction to Fluid Mechanics, John Wiley & Sons, 8th Edition, 2016.
2. Munson B.R., Young D.F., Okiishi T.H. and Huebsch W.W., Fundamentals of Fluid Mechanics, John Wiley & Sons, 7th Edition, 2013.

VI. REFERENCE BOOKS:

1. Raghunath H.M., Fluid Mechanics and Machinery, New Age International Publishers, 10th Edition, 2017.
2. Fox R.W. and McDonald A.T., Hydraulic Machinery, Pearson Education, Indian Edition, 2015.
3. Rajput R.K., Fluid Mechanics and Hydraulic Machines, S. Chand & Company Ltd., Revised Edition, 2018.
4. Dixon S.L. and Hall C.A., Fluid Mechanics and Thermodynamics of Turbomachinery, Butterworth-Heinemann, 7th Edition, 2014.

VII. ELECTRONICS RESOURCES:

1. https://nptel.ac.in/courses/112/105/112105218.
2. https://nptel.ac.in/courses/112/104/112104117
3. https://ocw.mit.edu/courses/2-005-thermal-fluids-engineering-i-fall-2013/.

VIII. MATERIALS ONLINE:

1. Course Outline Description
2. Laboratory Manual
3. Laboratory Exercises