Faculty of Engineering & Technology
Master of Technology (M. Tech)
(W. E. F.: 2023-24)

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Name of Faculty	:	Faculty of Engineering & Technology
Name of Program	:	Master of Technology (M. Tech)
Course Code	:	2MTE02
Course Title	:	Advanced Fluid Mechanics
Type of Course	:	PC
Year of Introduction	:	2023-24

Prerequisite	:	Fundamentals about fluid properties
Course Objective	:	To enable students to learn advanced principles of fluid mechanics for wide application to engineering projects
Course Outcomes	:	At the end of this course, students will be able to:
	CO1	Apply the fundamentals of kinematics and conservation laws of fluid flow systems.
	CO2	Apply the principles of high and low Reynolds number flows to fluid flow systems.
	CO3	Review the concepts of boundary layer and flow in transition and apply the fundamentals of turbulent flow to various fluid flow systems.
	CO4	Apply the principles of one dimensional isentropic flow to variable area duct and analyze the principles of normal shock formation and its effects
	CO5	Apply the principles of compressible flow to constant area duct subjected to friction or heat transfer.

Teaching and Examination Scheme

Teaching Scheme (Contact Hours)			Credits	Examination Marks				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	SEE	CIA	SEE	CIA	
03	00	02	04	70	30	30	20	150

Legends: ***L****-Lecture;* ***T****–Tutorial/Teacher Guided Theory Practice;* ***P*** *– Practical,* ***C*** *– Credit,* ***SEE*** *– Semester End Examination,* ***CIA*** *- Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.))*

Course Content

Unit No.	Topics	Teaching Hours	Weightage
1	Unit 1: Reviews of basic laws Reviews of basic laws, concept of continuum, fluid flow in Integral & differential form Ideal fluid flow: Introduction,	5	5%

	Elementary flows in a 2-D plane, Flow nets, superposition of Elementary flows		
2	Unit 2: Kinematics of Fluid Description of properties in a moving fluid, Local and material derivatives, Control mass and control volume analysis, Reynolds Transport theorem and its application.	8	15%
3	Unit 3: Viscous Incompressible Flows Introduction, Equations of motion, N-S equations and its application. Boundary Layer Theory: Prandtl's boundary layer equations, Flat plate boundary layer, approximate solution – Integral method, Laminar and turbulent boundary layer, Separation, Lift and Drag.	9	20%
4	Unit 4: Fundamental of Compressible flows Introduction, Thermodynamic relations of perfect gases, Speed of sound, pressure wave propagation, Stagnation and Sonic properties, Shocks.	10	30%
5	Unit 5: Hydraulic machines Theory and design of hydro-turbines and centrifugal pumps, their proto-type testing.	10	30%

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

Suggested List of Experiments/Tutorials

Sr. No.	Name of Experiment/Tutorial	Teaching Hours
1	To study the effect of angle of attack on Lift and Drag force	02
2	To study the loss of energy in wake region behind various models (car, jeep, bus etc.) in the wind tunnel	02
3	To draw profile of NACA Aero foils	02
4	To Investigate on Recent development and advances in rarefied gas dynamics	02
5	To visualize and plot the pattern of flow around an object in a fluid stream using Hale-Shaw apparatus	02
6	To develop temperature distribution in thermal boundary layer for the flow over a flat plate	02
7	To draw profile of NACA Aero foils	02
8	To develop a Gas Table (Isentropic flow, Normal shocks, Fanno flow, Rayleigh flow) for different γ values.	02
9	A case study: Performance of real nozzle	02

Major Equipment/ Instruments and Software Required

Sr. No.	Name of Major Equipment/ Instruments and Software
1	Flow measuring devices and arrangements, Reynolds' apparatus,
2	Metacentric height apparatus
3	Impact of jet apparatus

Suggested Learning Websites

Sr. No.	Name of Website
1	https://nptel.ac.in

Reference Books

Sr. No.	Name of Reference Books
1	F M White, Fluid Mechanics, McGraw Hill Publishing Co. Ltd.
2	F M White, Viscous Fluid Flow, McGraw Hill Publishing Co. Ltd.
3	Yunus Cengel and John Cimbala, Fluid Mechanics, McGraw Hill Publishing Co. Ltd.
4	H Schlichting, Boundary Layer Theory, McGraw Hill Publishing Co. Ltd.