

1.	Title of the course	Advanced Fluid Mechanics
2.	Course number	ME515L
3.	Structure of credits	3-0-0-3
4.	Offered to	PG
5.	New course/modification to	Modification To ME5104/9
6.	To be offered by	Department of Mechanical Engineering
7.	To take effect from	July 2022
8.	Prerequisite	Nil
9.	Course Objective(s): To provide a fundamental understanding of advanced topics in fluid mechanics; to discuss the modelling of fluid flow in detail for various situations of relevance; to provide training to students in applying the modelling techniques to various real-life and industrial flow phenomena.	
10.	Course Content: Introduction: vectors, tensors, notation; Kinematics: Lagrangian and Eulerian descriptions, streamlines, stress and strain, vorticity, circulation, stream function, cylindrical and polar coordinates; Conservation laws: equations for conservation of mass, momentum and energy, Bernoulli equation; Vorticity dynamics: Kelvin's circulation theorem, vorticity equation, interaction of vortices; Irrotational flow: complex variables, elementary flows, superposition, conformal mapping, numerical solutions, axisymmetric flows, 3-D flows; Laminar flow solutions: diffusion; exact analytical solutions, similarity solutions; Laminar boundary layers: introduction to the boundary layer approximation, flat plate, Blasius solution, Faulkner-Skan flow, separation, cylinders and spheres, free shear flows; Low Reynolds number flows: creeping flow, Stokes flow, lubrication theory.	
11.	Textbook(s): 1. Kundu P K, Cohen I M and Dowling D R, <i>Fluid Mechanics</i> , 5th Edition, Academic Press (2014). 2. White F M, <i>Viscous Fluid Flow</i> , 3rd Edition, McGraw Hill Education (2017).	
12.	Reference(s): 1. Batchelor G K, <i>An Introduction to Fluid Dynamics</i> , Cambridge University Press (2000). 2. Fox R W, McDonald A T and Pritchard P J, <i>Introduction to Fluid Mechanics</i> , 6th Edition, John Wiley & Sons, Inc. (2004). 3. Panton R L, <i>Incompressible Flow</i> , 4th Edition, Wiley (2013). 4. Schlichting H and Gersten K, <i>Boundary Layer Theory</i> , Springer (2000).	