1.	Title of the course	Flow Instability and Turbulence
2.	Course number	ME531L
3.	Structure of credits	3-0-0-3
4.	Offered to	PG
5.	New course/modification to	Modification To ME5038/21
6.	To be offered by	Department of Mechanical Engineering
7.	To take effect from	July 2022
8.	Prerequisite	CoT
9.	**Course Objective(s):** To introduce concepts related to stability of laminar flows and transition to turbulence, and to discuss the theory and modeling of fully turbulent flows	
10.	**Course Content:** Two-dimensional laminar boundary layers, Falkner-Skan wedge flows, free shear flows; Axisymmetric laminar boundary layers: introduction, equations, Mangler transformation; Three-dimensional laminar boundary layers: introduction, coordinate systems, secondary flow; Instability: introduction, linear stability theory, method of normal modes, the Benard problem, Kelvin-Helmholtz instability, locally parallel flows, Orr-Sommerfeld equation, Squire's theorem, transition to turbulence; Turbulence, introduction, the characteristics and features of turbulence, definitions, Reynolds decomposition, turbulent shear stress and the closure problem, turbulent kinetic energy, Kolmogorov's contributions, energy scales and the energy cascade; Turbulence models, turbulence modeling, wall treatment, examples; Turbulence flow solutions, turbulent channel flow, turbulent boundary layer, free shear flows.	
11.	**Textbook(s):** 1. Kundu P, Cohen I and Dowling D, *Fluid Mechanics*, 6th Edition, Elsevier Academic Press (2016). 2. Pope S B, *Turbulent Flows*, 1st Edition, Cambridge University Press (2000).	
12.	**Reference(s):** 1. Panton R L, *Incompressible Flow*, 4th Edition, Wiley (2013). 2. Tennekes H and Lumley J L, *A First Course in Turbulence*, 1st Edition, MIT Press (1972).	