ME 520 Fluid Mechanics **(3-0-0-6)**

Introduction: Review of tensor algebra; continuum hypothesis; Eulerian and Lagrangian viewpoints; Reynolds transport theorem.
Conservation laws: Mass conservation; Momentum conservation, strain rate tensor, vorticity transport equation; Conservation of angular momentum.
Approximate solutions for incompressible flow: Plane Poiseuille flow, linear and rotational Couette flow, Stoke's oscillating plate.
Potential flows: Stream function, velocity potentials, Kelvin's circulation theorem, principle of superposition, Magnus effect, lift and drag on two-dimensional shapes.
Boundary Layer Theory: Derivation of boundary layer equation, order-of-magnitude analysis, flow over flat plate, Blausius equation, Falker-Skan equation, momentum integral method, separation of boundary layers.
Introduction to turbulence: Physical and mathematical description of turbulence, Reynolds equation of turbulent motion, Turbulence modeling.
Introduction to compressible flows: Isentropic flow, flow with area change.

References

1. P. Kundu, I. Cohen and D. Dowling, Fluid Mechanics, Elsevier, 6th Edition, 2015.
2. R.L. Panton, Incompressible Flow, Wiley, 4th Edition, 2013.
3. G.K. Batchelor, An Introduction to Fluid Dynamics, Cambridge University Press, 2000.
4. J.D. Anderson Jr., Fundamentals of Aerodynamics, McGraw Hill, 5th Edition, 2010.
5. F.M. White, Viscous Fluid Flow, McGraw-Hill Education, 3rd Edition, 2017.
6. H. Schlichting, K. Gersten, Boundary Layer Theory, Springer-Verlag Berlin Heidelberg, 9th Edition, 2017.