Intermediate Fluid Dynamics (ME EN 5700/6700)
Course Schedule, Fall 2018

Week	Class	Day	Date	Lecture Topics	Textbook	Homework Due	Projects*
1	1	M	20-Aug	Welcome; Definition of Fluid; Viscosity; Continuum Hypothesis; Transport Phenomena	1.1-1.10		
	2	W	22-Aug	Lagrangian vs. Eulerian; Material Derivative	3.1-3.2		
	3	F	24-Aug	Streamlines; Streaklines; Pathlines [Material Deriv]	3.3		
2	4	M	27-Aug	Material Line Stretching; Strain Rate Tens [Streamlines]	3.4	HW 0	
	5	W	29-Aug	Introduction to Index Notation	Handout; 2.1-2.11		
	6	F	31-Aug	Vorticity and Circulation, Relative Motion Near a Point [Material line stretching; strain rate] (Lecture M. Moody)	3.4		
3		M	3-Sep	Labor Day			
	7	W	5-Sep	Parallel and Vortex Flows from a Kinematic Perspective [Math operators and Vorticity]	3.5	HW 1	
	8	F	7-Sep	Classification of 1-, 2-,3-D Flows; Streamfunction [Motion at a Point, Parallel and Vortex Flows from a Kinematic Per	3.5 (4.3)		
4	9	M	10-Sep	Intro to Conservation Laws in Eulerian Framework; Reynolds Transport Theorem	4.1		
	10	W	12-Sep	Conservation of Mass; External Forces; Stresses [Not Stresses]	4.2		Lab (BLD 60)*
	11	F	14-Sep	Conservation of Momentum; Boundary Conditions [Stresses NOT BCs]	4.4		
5	12	M	17-Sep	Constitutive Law for Newtonian Fluid	4.5		
	13	W	19-Sep	Navier-Stokes Equation [Constitutive Law for Newtonian]	4.6	HW 2	
	14	F	21-Sep	Exact Solutions of the Navier-Stokes Equation: Couette Flow [Navier-Stokes Equations]	8		
6	15	M	24-Sep	Exact Solutions of the Navier-Stokes Equation: Poiseuille Flow [Couette Flow]	8		
	16	W	26-Sep	Mechanical Energy Equation [Poiseuille Flow]			Experiment Results Due
	17	F	28-Sep	First Law of Thermodynamics: Thermal Energy Equation [Poiseuille Flow]	4.8		
7	18	M	1-Oct	Applications of the 1st law [Poiseulli Flow, Mechanical Energy Equation]	4.8		PIV Lab (Bld 60)*
		W	3-Oct	Review for Midterm Exam		HW3	
		F	5-Oct	**Midterm Exam**			
		M	8-Oct	Fall Break			
		W	10-Oct				
		F	12-Oct				
8	19	M	15-Oct	Nondimensional Parameters from Governing Equations	4.11		
	20	W	17-Oct	Significance of Parameters; Scale Analysis	Handout	HW 4	
	21	F	19-Oct	Introduction to Dynamic Similarity	Handout		
9	22	M	22-Oct	Incomplete Similarity; Buckingham's Pi Theorem	Handout		PIV Lab Results Due
	23	W	24-Oct	Model Testing Example	Handout		
	24	F	26-Oct	Boundary Layer Approximation and Governing Equations	9.1		
10	25	M	29-Oct	Boundary Layer Approximations (cont.)	9.2		
	26	W	31-Oct	Boundary Layer Thickness; Momentum Thickness; Skin Friction	9.2	HW 5	
	27	F	2-Nov	Blasius Solution of Flow Along a Flat Plate	9.3		
11	28	M	5-Nov	Euler's Equations and Inviscid Flow	Handout		
	29	W	7-Nov	Falkner-Skan Solution for Laminar Boundary Layers with Non-zero Pressure Gradient	9.4		
	30	F	9-Nov	Falkner-Skan Solution for Laminar Boundary Layers with Non-zero Pressure Gradient	9.4		
12	31	M	12-Nov	Effect of Pressure Gradient; Separation	9.7		YouTube Experiment (in Fluids Lab)
	32	W	14-Nov	Effect of Boundary Layer on Flow Around Circular Cylinders and Spheres	9.8	HW 6	
	33	F	16-Nov	Vorticity Profile in the Boundary Layer			
13	34	M	19-Nov	Vorticity Flux at Solid Surface; Kelvin's Circulation Theorem	5.4		YouTube Experiment (in Fluids Lab)
	35	W	21-Nov	Extra day (TBD)			
		F	23-Nov	Thanksgiving Holiday			
14	36	M	26-Nov	Vorticity Transport Equation	5.5		
	37	W	28-Nov	Intro to Turbulence; Time Averages; Correlations	12.1-12.4		
	38	F	30-Nov	Averaged Equations of Motion	12.5-12.6		
15	39	M	3-Dec	Kinetic Energy Budget of Turbulent Flow	12.7		
	40	W	5-Dec	Turbulence in Wall-Bounded Flows; Inertial Subrange; Eddy Viscosity Model	12.9	HW 7	
		F	7-Dec	Reading Day no class			
16		M	10-Dec				YouTube Video Due
		T	11-Dec	**Comprehensive Final Exam** (1:00 - 3:00 pm, WEB L126)			

* Experimental and numerical laboratories will be performed outside of the regular lecture period. Sign up sheets will be availabe. Note exact timing TBD after coordination with 3700/3650