CLASS SCHEDULE 2013 FALL

Class # **or Lab #**	Date	Important Concepts **(Section # in Text Reading, Lecture note)** **Examples/Lab Activities**	Problems Assigned, **due next class day: *by 5:00 pm***
1	Aug 26	Definition fluid; continuum hypothesis; fluid properties (Text 1.1 - 1.5, Lecture Ch.1) Example1: Density (1.39) Example2: Density	1.36 (γ,ρ,SG) 1.50 (ideal gas)
	27	No lab	
2	28	Viscosity, shear stress and rate of strain; compressibility; vapor pressure/cavitation; surface tension and capillary effects; flow classification (Text 1.6-1.11, Lecture Ch.1) Example1: Shear stress (1.74) Example2: Surface tension (1.127) Example3: Shear stress	1.81 (Shear stress) 1.129 (Surface tension)
	29	No lab	
3, L1	30	Fluid Mechanics: AFD, EFD, and CFD	
4	Sep. 2	Labor Day: No Class	2.9 (pressure variation) 2.23 (gases; standard atmosphere)
	3	No lab	
5, L2	4	Pressure definition, force, and transmission; absolute/gage/vacuum; pressure variation with elevation liquids/gases; pressure measurement (barometer, piezometer, manometers) (Text 2.1-2.7, Lecture Ch.2) Example1: Pressure variation (2.8) Example2: Manometer Example3: Hydraulic pressure	
	5	No lab	
6	6	Experimental Methodology and Uncertainty Assessment Procedures: EFD EFD Pre-test	2.40 (u-tube manometer) 2.54 (differential manometer)
	9	Hydrostatic forces on plane surfaces (Text 2.8-2.9, Lecture Ch.2) Example1: Differential manometer Concepts of EFD Lab 1	

L3	10	**EFD Lab1 (1)**	
7	11	Continued Example1: Plane surface (1) Example2: Plane surface (2)	2.87, 2.99 (plane surface)
L3	12	**EFD Lab1 (2)**	
8	13	Hydrostatic forces curved surfaces (horizontal and vertical components); buoyancy; hydrometer (Text 2.10-2.11, Lecture Ch.2) Example1: Curved surface (1) Example2: Curved surface (2) Example3: Curved surface (3) (2.116) Example4: Curved surface (4) (2.122)	2.117, 2.128 (curved surface)
9	16	Stability immersed and floating bodies (Text 2.11, Lecture Ch.2) Example1: Buoyancy (2.136) Example2: Stability (block) Example3: Stability (cylinder)	2.142, 2.143 (buoyancy)
L3	17	**EFD Lab1 (3)**	
10	18	Continued Example1: Stability Example2: Curved surface Rigid body translation and rotation (Text 2.12, Lecture Ch.2)	SP.1, SP.2 (stability)
L3	19	**EFD Lab1 (4)**	
11	20	Continued Example1: Translation (1) (2.150) Example2: Translation (2) Example3: Translation (3) Example4: Rotation (1) Example5: Rotation (2) Example6: Rotation (3) (2.157)	2.151 (translation) 2.163 (rotation)
12	23	Newton's 2nd Law for a Fluid, Steamline Coordinates, Bernoulli equation (Text 3.1-3.4, Lecture Ch.3) Example1: Bernoulli equation (along streamline) (3.2) Example2: Bernoulli equation (normal to streamline) (3.12) Example3: Bernoulli equation	3.8 (Euler Eq., along streamline) 3.14 (Euler Eq., normal to streamline)
L4	24	**EFD Lab2 (1)**	
13	25	Static Dynamic and total pressure, applications Bernoulli equation, Flow Rate (Text 3.5-3.6, Lecture Ch.3)	3.24 (Bernoulli equation, stagnation pressure) 3.51 (Bernoulli equation,

		Example1: Bernoulli equation (Q) Example2: Bernoulli equation (static and total pressure) (3.52) Example3: Bernoulli equation Concepts of EFD Lab 2 & CFD Lab 1	Q)
L4	26	**EFD Lab2 (2)**	
14	27	Limitations Bernoulli equation (Text 3.7-3.9, Lecture Ch.3) Example1: Bernoulli equation (along streamline) Example2: Bernoulli equation (circular disk) (3.107) Example3: Bernoulli equation (channel flow) (3.113) Fluid kinematics, velocity, acceleration (Text 4.1 - 4.2, Lecture Ch.4)	3.109 (Bernoulli equation, nozzle) 3.121 (Bernoulli equation, channel flow)
15	30	Continued, fluid kinematics, velocity, acceleration Example: Velocity (4.4)	4.7, 4.10 (velocity)
L4	Oct. 1	**EFD Lab2 (3)**	
16	2	Flow classification Example1: Acceleration (1) (4.21) Example2: Acceleration (2) Example3: Acceleration (3)	~~4.31~~, 4.32, 4.36 (acceleration)
L4	3	**EFD Lab2 (4)**	**Report of EFD Lab1 (performed on Sep. 10 and 12) Due: 5:00 p.m.**
17	4	Review 1	
18	7	**EXAM 1**	
	8	No lab	
19, L5	9	Introduction to Computational Fluid Dynamics CFD Pre-test	
	10	No lab	**Report of EFD Lab1 (performed on Sep. 17 and 19) Due: 5:00 p.m.**
20	11	Control volume approach and RTT (Text 4.3-4.5, Lecture Ch.4)	4.72 (RTT) 5.13 (continuity)

		Example1: RTT (1) (4.73) Control Volume Analysis, continuity equation (Text 5.1, Lecture Ch.5) Example1: Continuity (5.3) Example2: Continuity Example3: Continuity	
21	14	Continued, continuity equation Example1: Steady flow continuity (5.23) Example2: Unsteady flow continuity (5.27) Example3: Falling cylinder Example4: Momentum, Bend Example5: Momentum Example6: Continuity	~~5.25~~ 5.15 (steady flow continuity) 5.28 (unsteady flow continuity)
L6	15	**CFD PreLab1 (1)**	
22	16	Momentum Equation (Text 5.2, Lecture Ch.5) Example: Momentum, jet (5.41)	~~5.48~~ 5.38 (momentum, nozzle) 5.49 (momentum, jet)
L6	17	**CFD PreLab1 (2)**	**Report of EFD Lab2 (performed on Sep. 24 and 26) Due: 5:00 p.m.**
23	18	Continued Example2: Momentum, nozzle (5.47) Example3: Momentum, vane (5.74) Example4: Drag on a body (5.69) Example5: Moving vane Energy equation (Text 5.3-5.5, Lecture Ch.5) Example: Head loss (5.103)	~~5.38 (momentum, nozzle)~~ 5.66 (momentum, vane) 5.83 (moving CV)
24	21	Concept of Hydraulic and Energy Grade Lines (HGL/EGL: Bernoulli equation) Example1: EGL/HGL (3.123) Example2: Energy, pump (5.116) Example3: Energy, turbine (5.115)	5.105, ~~5.106~~ (head loss) 3.124 (EGL/HGL)
L7	22	**CFD Lab1 (1)**	
25	23	Application of the Energy, Momentum, and Continuity Equations in Combination Example1: Energy + momentum (1) Example2: Energy + momentum (2) Example3: Sluice gate	5.117 (energy, turbine) 5.118 (energy, pump)
L7	24	**CFD Lab1 (2)**	**Report of EFD Lab2**

			(performed on Oct. 1 and 3) Due: 5:00 p.m.
26	25	Differential Analysis, relative motion, vorticity, continuity, and stream function (Text 6.1-6.2, Lecture Ch.6)	~~5.129~~ 5.131, 5.132 (energy + momentum)
27	28	Continued Example1: Vorticity (6.4) Example2: Continuity (6.13) Momentum equation and differential analysis of fluid flow (Text 6.3, 6.8-6.11, Lecture Ch.6)	6.9 (dilatation, rotation, vorticity, rate of angular deformation) 6.18 (irrotational and mass conservation)
L8	29	**EFD Lab3 (1)**	
28	30	Continued Example1: Exact solutions of NS (Couette flow) (6.92) Example2: Exact solution of NS (flow between fixed plates) (6.89) Concepts of EFD Lab 3 & CFD Lab 2	6.17 (stream function) ~~6.88 (flow between fixed plates)~~ 6.94 (Couette flow)
L8	31	**EFD Lab3 (2)**	**CFD Lab1 Report Due: 5:00 p.m.**
29	Nov. 1	Continued Example1: Exact solutions of NS (Poiseuille flow) (6.102) Example2: Exact solutions of NS (concentric cylinders) (6.109) Example3: Pipe flow (6.89_5e) Example4: Pipe flow (6.92_5e) Dimensional homogeneity; dimensional analysis; Pi theorem; Important non-dimensional parameters (Text 7.1-7.7, Lecture Ch.7)	6.103 (pipe flow) 6.107 (pipe flow) ~~6.113 (concentric cylinders)~~
30	4	Continued Example1: Exact solutions for NS Example2: Exact solutions for NS Example3: Exact solutions for NS	7.12, 7.22 (Pi parameters)
L8	5	**EFD Lab3 (3)**	
31	6	Continued Example1: Pi parameters (1) (7.9) Example2: Pi parameters (2) (7.13)	
L8	7	**EFD Lab3 (4)**	

32	8	Review 2	
33	11	**EXAM 2**	
L9	12	**CFD PreLab2 (1)**	
34	13	Similarity and model testing (Text 7.8-7.11, Lecture Ch.7) Example1: Re similarity (1) (7.49) Example2: Fr similarity (1) (7.44) Example3: Re similarity (2) Example4: Fr similarity (2) EFD Lab3 concepts: drag calculation Viscous Flow in Pipes, entrance and developing flow, laminar flow, friction factor (Text 8.1-8.2, Lecture Ch.8) Example: Laminar pipe flow	7.50 (Re similarity) 7.59 (Fr similarity) 8.17 (laminar)
L9	14	**CFD PreLab2 (2)**	**Report of EFD Lab3 (performed on Oct. 29 and Oct. 31) Due: 5:00 p.m.**
35	15	Turbulent flow (Text 8.3, Lecture Ch.8) Example: Turbulent pipe flow (8.29)	8.19 (laminar) 8.27, 8.30 (turbulent)
36	18	Roughness, application pipe systems (Text 8.4-8.7, Lecture Ch.8) Example1: Friction factor Example2: Head loss (8.53) Example3: Friction factor Example4: Head loss (8.47)	~~8.41~~ 8.51 (head loss) ~~8.42 (f)~~ 8.46 (pressure drop)
L10	19	**CFD Lab2 (1)**	
37	20	Continued, Example1: Head loss (8.49) Example2: Flow rate Example3: Pipe diameter (1) Example4: Pipe diameter (2) Example5: Pipe diameter (3) (8.103)	8.94 (flow rate) 8.102 (pipe diameter)
L10	21	**CFD Lab2 (2)**	**Report of EFD Lab3 (performed on Nov. 5 and 7) Due: 5:00 p.m.**

38	22	Minor losses, Example1: Minor losses (1) Example2: Minor losses (2) Example3: Minor losses (3) Example4: Minor losses (4) (8.79) Example5: Minor losses (5) (8.61) Example6: Minor losses (6) (8.96)	~~8.54~~, 8.78, 8.73 (minor losses)
	25		
	26		
	27	Thanksgiving Recess	
	28		
	29		
39	Dec. 2	Flow over immersed bodies, lift and drag, boundary layer theory (Text 9.1-9.2, Lecture Ch.9) Example1: Laminar BL (1) Example2: Laminar BL (2) Summary of EFD and CFD study for the flow around Clark-Y airfoil	~~9.19~~, ~~9.13~~, 9.20, 9.21 (laminar BL)
	3	No lab	
40	4	Laminar boundary layer, continued Example1: Laminar BL drag (9.46) Example2: Transitional BL drag (9.26)	9.45 (laminar drag) 9.50 (transitional drag)
	5	No lab	**CFD Lab2 Report Due: 5:00 p.m.**
41	6	Turbulent boundary layer Example: Turbulent BL velocity profile	SP.4, SP.5 (turbulent flat plate drag)
42	9	Bluff body drag and lift (Text 9.3-9.5, Lecture Ch.9) Example1: Turbulent BL drag (1) Example2: Turbulent BL drag (2) Example3: Stokes flow Example4: Drag (1) (9.54) Example5: Drag (2) (9.84)	9.74, 9.78 (drag)
	10	No lab	
43	11	Review3	9.103, 9.104 (lift)
	12	No lab	

44	13	Post-test, Post-survey	
		Final Exam : TBD	