

## NUCL 35000: FLUID MECHANICS SYLLABUS and POLICIES

**Instructor:** Martin Bertodano, [bertodan@purdue.edu](mailto:bertodan@purdue.edu)

**Resources:** **BrightSpace** BoilerCast lectures, etc.  
**White, Fluid Mechanics, 9e with McGraw-Hill Connect key**

**Grading:** Exams: 70%  
Homework: 25%  
Attendance: 5%  
A+: 95-100, A: 90-94.9, A-: 85-89.9, B: 70-84.9, C: 55-69.9, D: 40-54.9, F: 0-39.9  
B, C, D, F are broken in plus-minus ranges of 5 points like A.

**Exams:** Two 1-1/2 hour evening online exams via **BrightSpace** and one 2 hour final (with bonus problem).

**Homework:** Homework assignments are listed in the schedule at the end of this document. They **MUST** be completed in **McGraw-Hill Connect** (best grade from several trials chosen). Due dates are listed with 10% daily penalty thereafter; lateness may be excused for acceptable reasons. *Homework handed outside of class will not be graded.* No homework are dropped in the final grade.

Be extremely critical of your own work!! You are responsible for making certain that your results are correct. You can achieve this by using the tests of “reasonableness”, checking by another method or against previous results, and/or consulting with other students, the grader, or the instructor.

When a homework dispute arises please discuss it with the grader first.

**Attendance:** TBA

**Emergencies:** In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor’s control. Relevant changes to this course will be posted onto the course website or can be obtained by contacting the instructors or TAs via email or phone. You are expected to read your @purdue.edu email on a frequent basis.

**Ethics:** The Brightspace template includes a link to Purdue’s Student Guide for Academic Integrity under University Policies. As a boilermaker pursuing academic excellence, I pledge to be honest and true in all that I do. Accountable together - we are Purdue.

*Exams:* Exams will be open book, open notes, but needed equations will be furnished. Completely independent work is required; copying is unacceptable and copied work will warrant an F for the course.

*Homework:* getting help from the instructor, grader or other students is encouraged BUT be careful not to lean heavily on others... make sure you understand concepts.

**Course Description:**

The first of an integrated two-course sequence introducing the concepts of nuclear reactor thermal transport and associated hydraulics with applications to design and safety. Control volume and macroscopic balances, dimensional analysis, and flow measurement. Fluid behavior, momentum transfer, and applications to reactor systems and design.

**Prerequisite:** NUCL 273      **Classification:** Required

**Learning Outcomes:**

- a. Understand basic fluid mechanics principle, practices, design and applications in different systems.
- b. Develop qualitative and quantitative analysis of engineering principles and their application to reactor fluid transport systems.
- c. Formulate and solve design problems through exercise in analysis and in a group design project
- d. Formulate and solve typical problems in fluid mechanics to reactors systems.
- e. Communicate on fluid flow systems as applied to nuclear power plants
- f. Understand overall impact of this discipline to society.

**Quarantine:** If you become quarantined or isolated at any point in time during the semester, in addition to support from the Protect Purdue Health Center, you will also have access to an Academic Case Manager who can provide you academic support during this time. Your Academic Case Manager can be reached at [acmq@purdue.edu](mailto:acmq@purdue.edu) and will provide you with general guidelines/resources around communicating with your instructors, be available for academic support, and offer suggestions for how to be successful when learning remotely. Importantly, if you find yourself too sick to progress in the course, notify your academic case manager and notify me via email or Brightspace. We will make arrangements based on your particular situation. The Office of the Dean of Students ([odos@purdue.edu](mailto:odos@purdue.edu)) is also available to support you should this situation occur.

**Protect Purdue:**      The [Protect Purdue Plan](#), which includes the [Protect Purdue Pledge](#), is campus policy and as such all members of the Purdue community must comply with the required health and safety guidelines. Required behaviors in this class include: staying home and contacting the Protect Purdue

Health Center (496-INFO) if you feel ill or know you have been exposed to the virus, wearing a mask [in classrooms and campus building](#), at all times (e.g., no eating/drinking in the classroom), disinfecting desk/workspace prior to and after use, maintaining proper social distancing with peers and instructors (including when entering/exiting classrooms), refraining from moving furniture, avoiding shared use of personal items, maintaining robust hygiene (e.g., handwashing, disposal of tissues) prior to, during and after class, and following all safety directions from the instructor.

Students who are not engaging in these behaviors (e.g., wearing a mask) will be offered the opportunity to comply. If non-compliance continues, possible results include instructors asking the student to leave class and instructors dismissing the whole class. Students who do not comply with the required health behaviors are violating the University Code of Conduct and will be reported to the Dean of Students Office with sanctions ranging from educational requirements to dismissal from the university.

Any student who has substantial reason to believe that another person in a campus room (e.g., classroom) is threatening the safety of others by not complying (e.g., not wearing a mask) may leave the room without consequence. The student is encouraged to report the behavior to and discuss next steps with their instructor. Students also have the option of reporting the behavior to the [Office of the Student Rights and Responsibilities](#). See also [Purdue University Bill of Student Rights](#).

**Accessibility:** Purdue University strives to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, you are welcome to let me know so that we can discuss options. You are also encouraged to contact the Disability Resource Center at: [drc@purdue.edu](mailto:drc@purdue.edu) or by phone: 765-494-1247. More details are available on our course Brightspace under Accessibility Information.

**Nondiscrimination Statement:**

Purdue University is committed to maintaining a community which recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her own potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life. More details are available on our course Brightspace table of contents, under University Policies.

**Mental Health:** If you find yourself beginning to feel some stress, anxiety and/or feeling slightly overwhelmed, try [WellTrack](#). Sign in and find information and tools at your fingertips, available to you at any time. **If you need support**

**and information about options and resources**, please contact or see the [Office of the Dean of Students](#). Call 765-494-1747. Hours of operation are M-F, 8 am- 5 pm. **If you find yourself struggling to find a healthy balance between academics, social life, stress**, etc. sign up for free one-on-one virtual or in-person sessions with a [Purdue Wellness Coach at RecWell](#). Student coaches can help you navigate through barriers and challenges toward your goals throughout the semester. Sign up is completely free and can be done on BoilerConnect. If you have any questions, please contact Purdue Wellness at [evans240@purdue.edu](mailto:evans240@purdue.edu). **If you're struggling and need mental health services**: Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of mental health support, services are available. For help, such individuals should contact [Counseling and Psychological Services \(CAPS\)](#) at 765-494-6995 during and after hours, on weekends and holidays, or by going to the CAPS office of the second floor of the Purdue University Student Health Center (PUSH) during business hours.

**Schedule:** Next page.

Class	Date	Text sections	Remarks	HW due
1	23-Aug		Introduction to Fluid Dynamics	
2	25-Aug	1-1 to 1-6	Introduction	
3	27-Aug		Fundamental concepts	
4	30-Aug	1-7 to 1-11	Fluid motion, viscosity	Set 1
5	1-Sep	2-1 to 2-4	Hydrostatics and manometry	
6	3-Sep	2.5 to 2-10	Force on submerged surfaces	
7	8-Sep	3-1 to 3-2	Basic laws for a system	Set 2
8	10-Sep	3-3	Conservation of mass	
9	13-Sep	3-4	Momentum equation for inertial control volume	Set 3
10	15-Sep	3-5 to 3-6	Rectilinear acceleration case and angular momentum	
11	17-Sep	3-7	Control volume energy balance	
12	20-Sep	4-1 to 4-2	Differential mass conservation	Set 4
13	22-Sep	4-3	Differential momentum conservation	
14	24-Sep	4-6	Boundary conditions	
15	27-Sep	4-7 to 4-9	Euler's equations	Set 5
16	29-Sep		Review	
17	1-Oct		<b>Exam 1</b>	
18	4-Oct	4-10	Viscosity	Set 6
19	6-Oct	5-1 to 5-3	Dimensional analysis	
20	8-Oct	5-4	Non-dimensional equations	
21	13-Oct	5-5	Flow similarity and scaling	Set 7
22	15-Oct	6-1 to 6-3	Internal laminar flow	
23	18-Oct	6-4	Laminar pipe flow	Set 8
24	20-Oct	6-5 to 6-6	Turbulent flow	
25	22-Oct		Turbulent flow	
26	25-Oct	6-7 to 6-8	Solution of pipe flow problem	Set 9
27	27-Oct		Review	
28	29-Oct		<b>Exam 2</b>	
29	1-Nov	6-9	Minor losses	Set 10
30	3-Nov	6-12	Flow measurement	
31	5-Nov	7-1 to 7-2	Fluid drag	
32	8-Nov	7-3 to 7-4	Boundary layer introduction	Set 11
33	10-Nov	9-1 to 9-2	Review of thermodynamics and propagation of sound waves	
34	12-Nov	9-3 to 9-4	Isentropic flow	
35	15-Nov		Isentropic flow	Set 12
36	17-Nov	9-5 to 9-6	Shock waves	
37	19-Nov	9-7	Flow with friction	
38	22-Nov		Introduction to two-phase flow (1)	Set 13
39	29-Nov		Introduction to two-phase flow (2)	
42	1-Dec		Introduction to two-phase flow (3)	
43	3-Dec		Introduction to two-phase flow (4)	
44	6-Dec		Introduction to two-phase flow (5)	
45	8-Dec		Review	
46	10-Dec		Review	