

MWF 8:00–8:50 AM, RGAN 202  
M 1:00-1:50 PM, RGAN 202

**Instructor:** Prof. J. M. McDonough  
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Course website: <http://courses.engr.uky.edu/ME/me330>

**Prerequisites:** ME 220, MA 214; Engineering Standing.

**Course Description:** Physical properties of fluids and classification of fluid flows. Integral and differential forms of equations for mass conservation and momentum and energy balances; control volume analyses. Laminar and turbulent pipe and duct flows; analysis of fluid systems involving pumps and turbines.

**Text:** *Basic Fluid Mechanics* (2<sup>nd</sup> Ed.) by David C. Wilcox. Required.

### CONCEPTS AND TOPICS TO BE INTRODUCED:

Importance & applications of fluid mechanics	Momentum balance
Intuitive notions	Navier–Stokes equations
Continuum hypothesis	Dimensional analysis
Shear stress	Bernoulli’s equation
Rate of deformation	Energy equation
Viscosity	Boundary layers
Classification and visualization of flows	Laminar pipe flow
Eulerian & Lagrangian descriptions of flow	Turbulent pipe flow
Substantial derivative	Moody chart
Gauss & general transport theorems	Colebrook equation
Conservation of mass	Pumps & turbines

### EXPECTED OUTCOMES:

*Upon conclusion of the course, the student should be able to do the following:*

1. Define, discuss and/or apply all of the above concepts.
2. Express all parameters encompassed in these concepts in their appropriate dimensions.
3. Derive and apply appropriate integral and differential forms of conservation of mass and balance of momentum for fluid flow situations.
4. Perform dimensional analysis.
5. Apply the Poiseuille equation, friction factor *vs.* Reynolds number correlations and Moody chart for description of laminar and turbulent pipe flows.
6. Use the energy equation to predict pressure drop in pipes, across fittings and through pumps and turbines, including design and sizing applications.
7. Apply boundary layer concepts.
8. Generally, analyze physical flow situations and prescribe appropriate method(s) to obtain quantitative information for engineering use.

**Office Hours:** Office hours will be held at two specific times, one to be set by student input. The other of these periods will be in RGAN 202, M 1:00–1:50, and will be of the nature of a recitation. It is hoped that all students will attend this office hour most of the time, although this IS VOLUNTARY. Example problems will be discussed, and questions regarding lecture will be answered by Prof. McDonough. Practice quizzes will be given and subsequently discussed to aid students in their preparation for examinations.

**Homework:** Problem sets will be assigned approximately every week; one problem from each set will be graded in detail. Detailed solutions will be posted in the Engineering Library where students can assess correctness of their efforts. Overall performance on homework assignments will be used mainly as “extra credit” in determining course final letter grades in border-line cases.

**Examinations:** The examinations in ME 330–001 will consist of two (2) ONE HOUR evening midterms, and the usual two-hour final examination.

The *midterm* schedule is as follows:

Wednesday, Oct. 6, 2003	6:00 to 7:00 PM, CB 114
Wednesday, Nov. 17, 2003	6:00 to 7:00 PM, FB 200

Only those students with a regularly-scheduled *COURSE* conflict can have an evening exam rescheduled. The request for this must be submitted IN WRITING to Prof. McDonough at least TWO WEEKS in advance of the examination date(s). The examination(s) will then be rescheduled at a mutually agreeable time.

Students who fall ill, or who know in advance (but less than two weeks prior to the exam date) that they must miss an exam for a valid reason (e.g., family emergency), should notify Prof. McDonough by telephone (leave voice mail if necessary, or contact a ME Department secretary at 257-6336), or (preferably) by e-mail prior to the exam. Students missing an exam without a valid excuse will receive a grade of 0 for that exam.

The FINAL EXAM will take place on Monday, December 13, 2003 from 8:00 to 10:00 AM in RGAN 202.

All examinations will be considered comprehensive. Moreover, it must be made clear that this is NOT a “plug and chug” course. Emphasis will be placed on understanding the basic physics and mathematics associated with fluid mechanics, and the ability to translate this understanding into conceptual problem solving. This will be strongly reflected in the nature of written examinations (and to a lesser extent, homework assignments); as a consequence, calculators will not be needed, and their use will NOT be permitted during examinations.

### Grading:

Homework	5%
Two evening Midterm Exams @ 25%	50%
Final Exam	45%

Any (and hence, *every*) student attaining a 90%, or better, straight-curve score for the entire course is guaranteed a grade of **A**; a student achieving 33%, or less, is guaranteed a grade of **E**. In general, however, a curved grading scale will be used. (Specific details will be provided via example after the first midterm.) Thus, it is possible to earn an **A** grade with a total score below 90%, and conversely an **E** with a score above 33%. It is expected that the overall class GPA will be in the range 2.2 to 2.6, and this will have some influence on the setting of break points in the curve used

for final letter grade assignment.

**Copying, Cheating, etc.:** Penalties for cheating on examinations will be applied as published in the *Student Rights and Responsibilities Code* of the University. During examinations no student will be permitted to leave the examination room without explicit permission from the proctor. Any student requesting such permission will be required to submit their examination papers to the proctor for “safe keeping” during their absence from the examination room and may reclaim them upon their return. No additional time for completion of the examination will be allotted to any such student.