FLUID MECHANICS & ENERGY TRANSPORT

BIEN 301

Outline and Summary: A systematic account of a number of topics commonly discussed under physiological and biological fluid dynamics: basic equations of motion for both viscous and inviscid fluids. This course is meant to serve as a broad overview of fluid dynamics, and relate each topic to the field of biomedical engineering and biofluids. Individual projects and group projects will strengthen the synthesis of these topics into systematic problem solving skills related to fluid dynamics and energy transport, with specific applications in biofluids.

Prerequisite: ENGR 222, BIEN 202, BISC 227, and MATH 244

Text: *Fluid Mechanics*, *Fifth Edition,* Frank M. White, McGraw Hill, 2003.
ISBN: 0-07-240217-2

Classes: 2 lectures TR: 8:00-9:50. Location: BH 328

Instructor: Mr. Juan M. Lopez, E.I.T.

Office hours and location:
Office hours: 10:00-1:30 TR, or by appointment.
Contact information: jml039@latech.edu
Office location: Nethken 115

Grading:
Final grade based on:

Quizzes and Attendance	5%,
Individual Project	7.5%
Group Project	7.5%
Homework	20%
Exam1	20%
Exam 2	20%
Final Exam	20%
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Total:	100% (5% extra credit max)

Grading Scale: A =100-90%, B =89-80%, C =79-70%, D =69-60%, F =below 60%.

Disabilities and Accomodations: Students needing testing or classroom accommodations based on a disability are encouraged to discuss those needs with me as soon as possible.

NOTES:

- All assignments (i.e. homework and examinations) must be the independent work of each student or assigned group. 20% of the full points will be deducted each day for assignments turned in after the due date.
- The instructor will check the attendance daily. Only one unexcused absence will be permitted. After the unexcused absence, missing the roll call will deduct 1% off the final grade.
- Only university acceptable excuses will be accepted for giving back the points deducted due to late homework/report submissions and/or absence of lectures/labs.

Misconduct/Academic Honor Code: Academic misconduct is governed by university regulations published each year in the university bulletin. Academic misconduct at the University is determined by the faculty member under whom such misconduct occurs. The penalty for cheating and other forms of misconduct is also determined by the faculty member. The penalty may be an "F" in the course. Review the Louisiana Tech Honor Code for full details. (www.latech.edu/tech/students/honor-code.pdf). "**In accordance with the Academic Honor Code, students pledge the following: Being a student of higher standards, I pledge to embody the principles of academic integrity."**

Homework, Projects, and Extra Credit

HOMEWORK:

Homework will be assigned during each class, due the next class period. The homework will consist of a mixture of the Comprehensive Problems and the Fundamentals of Engineering problems.

Homework assignments will be worth 20 points each, evenly distributed among the problems. Partial credit will only be given if all work is shown properly. ***Students are strongly encouraged to generate electronic versions of their homework assignments***, as homework that is sloppy, messy, or otherwise illegible to the grader will ***NOT*** be given credit. When you enter the workforce, reports will ***ALL*** be electronic, so this is a great time to start that habit. A word document template will be provided on Blackboard that can be used to fill out homework assignments and/or reports.

For all assigned problems, you are to provide a short description, idea, or example from the real world as to where the theory involved in this problem would be applicable to biofluids and biomedical problems, specifically.

All solutions shall follow the guidelines in White Section 1.13, Problem-Solving Techniques. Failure to provide a detailed Problem Diagram, Assumptions, or a re-writing of what is being sought by the problem will be an automatic deduction of 5 points each. The use of computational solution methods to complement the work as necessary is encouraged.

EXTRA CREDIT – will be offered in the form of additional problems and special projects, at the instructor's discretion.

PROJECTS:
There are two types of projects in this class, Individual and Group Projects.

INDIVIDUAL PROJECTS:

As the name implies, individual projects will be performed by individuals in class. On the first day of class, a signup sheet will be circulated for students to sign up for either a written project or an in-class presentation. The order in which individuals will present will be randomly determined once the list has been generated. If the required number of presenters does not sign up, they will be ASSIGNED.

The project will involve setting up and solving a homework assignment NOT assigned for the current week of assignments. The full solution methodology will be followed, as described in White Section 1.13.

Grading: The class will evaluate your presentation for Technical Content, Clarity, Professionalism, and Relevance of Link to Biofluids. Their combined average grade will provide 25% of the grade for the project. The same grading criteria will be followed by the instructor, and will be worth 60% of the grade for the project. Finally, 15% will be assigned relative to how well the student stayed within the designated time limit and answered questions.

Time limit will be 8 minutes: 5 minutes for presentation and 3 minutes for questions and answers. The presentations are encouraged to be in PowerPoint, but the presenter will be left to their discretion as how to best present the work. All presentation materials will be submitted for grading.

All individual projects which were not presented to the class will require a final report at the end of the quarter in the format of the Blackboard template along with a Power Point presentation based on the work. The presentation should be about 8 minutes long.

GROUP PROJECTS:

Group projects will be like the individual projects, but will require the submission of BOTH an analytical and a computational solution to the problem. The problem will be complex enough to warrant this level of detail and analysis. An example of an industry product or known NEED that would employ the results of such a calculation will be included, along with a discussion of how this work relates to the biomedical need.

The group will submit both a report in the format presented by the template on Blackboard and a PowerPoint presentation that would present the work in approximately 12-15 minutes. The material can be from any section of the book except for the introductory Chapter 1.

Tentative Lecture Schedule on TR (subject to change as necessary)

No#	Date	Course Description	Items Due
1	11/30	Overall introduction and Examination of background	
2	12/05	Chapter 1 Introduction, Definition of Fluids, Vectors, and Dimensions	HW1
3	12/07	Chapter 1 Flow Analysis Techniques, Flow Patterns, Viscosity	HW2 Presentation 1
4	12/12	Chapter 2 Pressure Distribution – Definitions, Hydrostatic Forces, and Pressure Measurement	HW3 Presentation 2 Group Project Proposals Individual Project Proposals
5	12/14	Chapter 2 Pressure Distribution – Buoyancy, Rigid Body Motion Group Project Proposal Approval	HW4 Presentation 3
6	12/19	Exam 1 – Chapter 1 and Chapter 2	--
7	01/4	Chapter 3 Basic Laws – Transport Theorem, Conservation of Mass	HW5 Presentation 4
8	01/9	Chapter 3 Conservation of Energy	HW6 Presentation 5
9	01/11	Chapter 3 Bernoulli's Equation	HW7 Presentation 6
10	01/16	Chapter 4 Differential Fluid Flow	HW8 Presentation 7
11	01/18	Chapter 4 The Stream Function	HW9 Presentation 8
12	01/23	Exam 2 – Chapter 3 and Chapter 4	--
13	01/25	Chapter 6 Viscous Flow in Ducts, Introduction	HW10 Presentation 9
14	01/30	Chapter 6 Network Flow	HW11 Presentation 10
15	02/01	Chapter 7 Flow Past Immersed Bodies	HW12 Missed Present.
16	02/06	Chapter 8 Potential Flow	HW13 Missed Present.
17	02/08	No Class – HW14 on Non-Dim Assigned On Blackboard	Group Reports Individual Reports
18	02/13	Chapter 9 Compressible Flow	HW14
19	02/15	Chapter 9 Compressible Flow	HW15
20	02/22	Chapter 9 Compressible Flow and Review for Final Exam	HW16
21	02/27	Final Exam	