Course Syllabus

020MEFGS2 Fluid Mechanics

1. **Course number and name:** 020MEFGS2 Fluid Mechanics
2. **Credits and contact hours:** 6 credits, 3x1:52.5 course hours
3. **Instructor's or course coordinator's name:** Sélim CATAFAGO (course coordinator and instructor) and Christiane ZOGHBI (instructor)
4. **Textbook and other supplemental material:**
    a. Class Notes by Sélim CATAFAGO
5. **Specific course information**
    a. **Catalog description:** Provides the fundamental elements for understanding incompressible fluid flow using mass, momentum and energy conservation principles. Resolution of the characteristic fluid flow equations through the application of analytical, numerical and analogous methods as well as reduced-model techniques. Provides basic preparations for hydraulic engineering applications and studies.
    b. **Prerequisites:** 020MAIGS1 Mathematical Techniques for Engineers.
    c. **Required/Elective/Selected Elective:** Required major course for Civil Engineering students.
6. **Specific goals for the course**
    a. **Specific outcomes of instruction:**
    By the end of the course, the students will:
        - understand the concepts of mass, momentum and energy conservation principles
        - know the methods and assumptions needed to describe quantitatively and analytically a fluid flow
        - be able to apply hydrostatic laws to calculate forces on surfaces
        - be able to use Bernoulli's equation to calculate pressures and velocities
        - be able to study an ideal fluid flow using potential flow theory
        - be introduced to the basics of numerical analysis and computational flow dynamics
        - know about dimensionless analysis and similitude
        - be familiar with the flow of real or viscous fluids
        - be able to identify different flow types and regimes
        - be familiar with fluid flow applications through laboratory experiments.
        - have basic scientific writing skills
    b. **KPIs addressed by the course:**

KPI	a1	b1	b2	b3	e3	g1
Covered	x	x	x	x	x	x
Assessed						
Give Feedback						

7. **Brief list of topics to be covered and approximate number of lectures:**
    1. Introduction (1 Lecture)
    2. Review of basic mathematical formulations (1 Lecture)
    3. Mass conservation and continuity equation (4 Lectures)
        i. Control volume approach
        ii. Differential form
    4. Conservation of linear momentum (6 Lectures)

    i. Control volume approach
    ii. Differential form and Navier-Stokes equations
5. Conservation of angular momentum (1 Lecture)
6. Conservation of energy (4 Lectures)
    i. Control volume approach
    ii. Differential form
7. Fluid statics (6 Lectures)
    i. Hydrostatic pressure
    ii. Forces on inclined and curves surfaces
    iii. Pressure distribution in rigid-body motion
    iv. Overview of atmospheric stability
8. Flow of an ideal or inviscid fluid (10 Lectures)
    i. Euler equations of motion
    ii. Bernoulli's equation
    iii. The stream function
    iv. Potential flow theory, complex analysis and conformal mapping
    v. Fluid flow dynamics
9. Dimensional analysis and similitude (4 Lectures)
    i. Principle of dimensional homogeneity
    ii. The Pi-theorem
    iii. Geometric and kinetic similitude
10. Flow of a real or viscous fluid (8 Lectures)
    i. Viscosity measurements and Couette experiment
    ii. Reynolds experiment and Reynolds number
    iii. Laminar flows and velocity profiles
11. Laboratory experiments (7.5 sessions)
    i. Forces on plates
    ii. Venturi meter and Bernoulli's equation
    iii. Flow through an orifice
    iv. Viscosity measurements
    v. Rheoelectric analogy