Subject Description Form

Subject Code	CSE29207
Subject Title	Introduction to Fluid Mechanics for EESD
Credit Value	3
Level	2
Exclusion	CSE207 Fluid Mechanics
Objectives	(1) To familiarize students with the basic principles of fluid mechanics; (2) To enable students to acquire basic laboratory techniques of fluid mechanics; and (3) To train students to apply the basic principles to solve practical problems.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. master the fundamentals of fluid mechanics, i.e. the basic fluid properties, hydrostatics, and conservations of mass, momentum and energy; b. apply competently the basic principles of fluid mechanics to the solution of practical civil and environmental engineering problems and to recognize the assumptions and limitations of the applications; c. acquire basic laboratory techniques to study fluid mechanics problems; d. appreciate the impact of engineering projects on the environment through a thorough understanding of the fundamental fluid mechanics principles; and e. evaluate the correct applications of basic fluid concepts to different situations critically and independently. f. recognize the need for, and to engage in life-long learning
Subject Synopsis/ Indicative Syllabus	1. <u>Fundamental Concepts Relating to Fluids</u> (2 weeks) The nature of the problem, including a brief outline of the history of the subject and some typical engineering problems. Definitions and properties, including density, specific volume, relative density, pressure, compressibility, bulk modulus, surface tension, capillarity, units and dimensions, ideal fluid, viscosity, Newton's equations for viscous shear, real fluid. 2. <u>Fluids at Rest</u> (3 weeks) Hydrostatic pressure distribution. Thrust on surface. Pressure measurement. Elementary treatment of the equilibrium of submerged and floating objects, and of liquid in containers subject to acceleration. 3. <u>Types of Flow, Methods of Description</u> (1 week) Velocity fields. Streamlines, path lines, streak lines, streamtubes. Steady and unsteady, laminar and turbulent, uniform and non-uniform flows. 4. <u>Conservation Principles and Derived Equations</u> (4 weeks) Control volumes and surfaces. Conservation of mass. Equation of continuity. The momentum principle. Steady flow energy equation. Euler's equation. Bernoulli's equation. Jet impact, jet propulsion, nozzles. Velocity & flow measurement: Pitot tube, current meter, anemometer, Venturi meter, orifice meter, notches and weirs.

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<tr><td></td><td>5. <u>Pipe Flow</u> (3 weeks)
Darcy equation, friction factor, effect of roughness. Pipes in parallel and in series. Minor losses. Pipe networks.

6. <u>Laboratory Work</u>
Hydrostatic force, Venturi meter, jet impact, pipe flow.</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>Basic principles of fluid mechanics will be discussed in lectures. Tutorials will be conducted mainly in the form of example class and problem-solving session related to topics covered in lectures. Laboratory work will introduce students to real situations, enable students to appreciate the limitations of derived theories and provide the opportunities to use flow-measuring instruments.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="6">Intended subject learning outcomes to be assessed</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td>f</td></tr>
<tr><td>1. Laboratory Report/Assignment/ Seminar Report</td><td>20</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>2. Mid-term Test</td><td>10</td><td>√</td><td>√</td><td></td><td>√</td><td>√</td><td></td></tr>
<tr><td>3. Examination</td><td>70</td><td>√</td><td>√</td><td></td><td>√</td><td>√</td><td></td></tr>
<tr><td>Total</td><td>100</td><td colspan="6"></td></tr>
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Students must attain at least grade D in both coursework and final examination (whenever applicable) in order to attain a passing grade in the overall result.

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:
Students are required to submit individual reports for the laboratory experiments, which will test the understanding of basic principles as well as the applications of different laboratory techniques. The mid-term test and examination will assess the competence of students in applying the basic principles to solve practical fluid mechanics problems, examples of which will be discussed in the tutorials. Students will also be provided with problems to be solved during private study to gauge their level of understanding and problem solving skills. To widen our students' exposure in their field of study, students are required to attend 1 seminar for submission of seminar report pertinent to this subject.</td></tr>
<tr><td>Student Study Effort Expected</td><td>
<table>
<tr><td></td><td>Average hours per week</td></tr>
<tr><td>Class contact:</td><td></td></tr>
<tr><td>▪ Lectures/ Tutorials/ Laboratory</td><td>3 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Reading and Study</td><td>3 Hrs.</td></tr>
<tr><td>▪ Completion of seminar report, assignments and laboratory reports</td><td>3 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>9 Hrs.</td></tr>
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Reading List and References	**Essential Textbooks** J.F. Douglas, J.M. Gasiorek, J.A. Swaffield and L.B. Jack, *Fluid Mechanics, 6th edition*, Prentice Hall, 2011. Y.A. Cengel and J.M. Cimbala, *Fluid Mechanics: Fundamentals and Applications*, 2nd edition in SI units, McGraw Hill, 2010. **Reference Textbooks** K.W. Chau, "Modelling for Coastal Hydraulics and Engineering", Taylor & Francis, UK, 2010, 240pp. **(**ISBN: 978-0-415-48254-7**).** K.W. Chau & C.L. Wu, "Hydrological Predictions: Using Data-Driven Models Coupled with Data Preprocessing Techniques," LAP LAMBERT Academic Publishing, Germany, 2010, 248pp. (ISBN: 978-3-8433-6446-1) K.W. Chau, "Knowledge-Based System for Analysis and Design of Liquid Retaining Structures," Nova Science Publishers, USA, 2011, 159p. (ISBN: 978-1-61209-550-9) C. Nalluri & R.E. Featherstone, "Nalluri & Featherstone's Civil Engineering Hydraulics: Essential Theory with Worked Examples", 5th Edition, Rev. by Martin Marriott, Wiley-Blackwell, 2009. E.J. Finnemore & J.B. Franzini, "Fluid Mechanics with Engineering Applications", 10th Edition, McGraw-