# Subject Description Form

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| **Subject Code** | CSE20202 |
| **Subject Title** | Fluid Mechanics for Civil Engineering |
| **Credit Value** | 3 |
| **Level** | 2 |
| **Exclusion** | CSE202 Fluid Mechanics |
| **Objectives** | This subject aims to:<br>(1) familiarize students with the basic principles of fluid mechanics;<br>(2) enable students to acquire basic laboratory techniques of fluid mechanics; and<br>(3) To train students to apply the basic principles to explain fluid mechanics related phenomena and solve practical engineering problems. |
| **Intended Learning Outcomes** | Upon completion of the subject, students will be able to:<br><br>a. Master the fundamentals of fluid mechanics, i.e. the basic fluid properties, hydrostatics, conservations of mass, momentum and energy, and dimensional analysis;<br>b. Be competent to apply the laws of similitude and identify the important dimensionless parameters in designing fluid flow models to predict the performance of the prototype;<br>c. Be competent to apply the basic knowledge of vector algebra and calculus to solve the integral and differential forms of conservation of mass, momentum and energy equations in steady state situations;<br>d. Evaluate the correct application of basic fluid concepts to different situations critically and independently;<br>e. Be eager to participate in team discussions and ask questions for group work. |
| **Subject Synopsis/ Indicative Syllabus** | 1. Fundamental Concepts Relating to Fluids (3 weeks)<br>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, and state, units and dimensions, ideal fluid, viscosity, Newton's equations for viscous shear, real fluid.<br>2. Fluids at Rest (2 weeks)<br>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.<br>3. Types of Flow, Methods of Description (1 week)<br>Velocity fields. Streamlines, path lines, streak lines, streamtubes. Steady and unsteady, laminar and turbulent, uniform and non-uniform flows.<br>4. Conservation Principles and Derived Equations (5 weeks)<br>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 and propulsion, nozzles. Velocity and flow measurement: Pitot tube, current meter, anemometer, venturi meter, orifice meter, notches and weirs.<br><br>5. Similitude and Models (2 weeks) |

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<tr><td></td><td>Geometric, kinematic and dynamic similarity. Dimensional analysis, Rayleigh and Buckingham methods. Dimensionless parameters as force ratios. Basic introduction to CFD and hydraulic modelling.<br>6. <u>Laboratory Work</u><br>Hydrostatic force; V-notch; Venturi meter; and Jet impact.</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>(1) Basic principles of fluid mechanics will be discussed in lectures;<br>(2) Tutorials will be conducted mainly in the form of example class and problem-solving session to supplement understanding from lectures;<br>(3) Laboratory work will help student appreciate the limitations of physical principles and will provide the opportunities for familiarity with basic 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="5">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td></tr>
<tr><td>1. Homework, quizzes, laboratory reports and mid-term tests</td><td>30</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>2. Final Examination</td><td>70</td><td>√</td><td>√</td><td>√</td><td>√</td><td></td></tr>
<tr><td>Total</td><td>100 %</td><td colspan="5"></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.<br><br>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes: A student will demonstrate successful completion of all the outcomes by achieving a grade C or above on 1 mid-term test, 2 laboratory reports and a final examination.</td></tr>
<tr><td>Student Study Effort Expected</td><td>
<table>
<tr><td>Class contact:</td><td>Average hours per week</td></tr>
<tr><td>▪ Lectures / Tutorials / Laboratories</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 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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<tr><td>Reading List and References</td><td>(1) “Fluid Mechanic: Fundamentals and Applications”, 4th Edition, 2017 – Cengel, Y.A. and Cimbala, J.M., McGraw Hill.<br>(2) “Mechanics of Fluids”, 4th Edition, 2012 – Potter M.C., and Wiggert D.C., Cengage Learning.<br>(3) “Fluid boundaries”, Video Materials, 2014 – Mun, J.H., Haryanto, D.R., and Todorovic, V. South Korea: CinemaDAL<br>(4) “Engineering Mathematics”, 8th Edition, – Bird, J., Routledge, Taylor & Francis Group, New York</td></tr>
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