

**Curriculum - Academic Year 2018-19**  
**Characteristics of the Course Units**

Name	Momentum transfer and fluid flow
ECTS credits	5
Year / Semester	I/1
Specific learning outcomes	<p><i>On successful completion of this module students should be able to:</i></p> <p>1 – Use Euler’s and Bernoulli’s equations and the conservation of mass to determine velocities, pressures</p> <p>2 – Understand principles of flow measurements</p> <p>3 – Determine flow rates, pressure changes, linear head losses and point head losses for viscous flows through pipes</p> <p>4 – differentiate between turbulent flow and laminar flow</p> <p>5 – Use Navier-Stokes equations and the conservation of mass to determine velocities and pressures for turbulent flow</p> <p>6 – Understand the concepts of viscous boundary layers</p>
Contents	<p><i>Mass Continuity Equation; Fundamental equation of dynamic of perfect fluid; Bernoulli’s Principle; Applications of the Bernoulli’s equation; Real fluid dynamics; Reynolds’ Experiment; Equation of Poiseuille; Linear head loss; Point head losses; Equations of Navier-Stockes of laminar flow; Exemples of applications of the equations of Navier-Stockes; The turbulence; Statistical treatment of the turbulence; Equations of Reynolds; Tensions of Reynolds; Mixinf length; Modélisation of the turbulence; Universal distribution; Theory of boundary layer; Thickness of the the boundary layer; Thickness of displacement; Thickness of momentum; Boundary layer equation on flate plane; turbulent boundary layer.</i></p>
Teaching and learning methods	
Teaching techniques	<p><i>Lectures,</i></p> <p><i>Practical classes,</i></p>
Assessment methods	<p><i>Written.</i></p> <p><i>A two mid-term written test and a final-term written test are foreseen.</i></p> <p><i>The first mid-term written test will be devoted to the assessment of the level of achievement of LOs 1, 2 and 3.</i></p> <p><i>The second mid-term written test will be devoted to the assessment of the level of achievement of LOs 4, 5 and 6.</i></p> <p><i>The final term written test will be devoted to the assessment of the level of achievement of LOs 1, 2, 3, 4, 5, and 6.</i></p>
Assessment criteria	<p><i>In the mid-term test students should demonstrate their ability to apply concepts of mass, momentum and energy conservation to flows, determine flow rates, pressure changes, linear head losses and point head losses for viscous flows through pipes</i></p> <p><i>In the second mid-term test students will be able to Use Navier-Stokes equations and the conservation of mass to determine velocities and pressures for turbulent flow, and to understand the concepts of viscous boundary layers</i></p>
Assessment metrics	<p><i>Attribution of a final grade</i></p>
Criteria of attribution of the final grade	<p><i>The grade goes from 1 (minimum) up to 20 (maximum). The minimum threshold to pass is 7. To pass the exam students should obtain the minimum evaluation in all the assessments.</i></p>

	<p><i>The final grade will be determined according to the following rules:</i></p> <ul style="list-style-type: none"><li>- <i>Mid-terms written test: 20%</i></li><li>- <i>Practical classes assessments: 30%</i></li><li>- <i>Final examination (including): 50%</i></li></ul>
Preparatory course units	
Didactic material	<i>Frank M. White "Fluid Mechanics"</i>