Course Outline

Code: ENG211  
Title: Fluid Mechanics and Hydraulics

School: Science & Engineering  
Teaching Session: Semester 1  
Year: 2019  
Course Coordinator: Dr Terry Lucke  Tel: 07 5456 5185  Email: tlucke@usc.edu.au  
Course Moderator: Dr Helen Fairweather

Please go to the USC website for up to date information on the teaching sessions and campuses where this course is usually offered.

1. What is this course about?
   1.1 Description  
   Fluid Mechanics and Hydraulics concerns the continuous deformation of gases and liquids under shear stress. First we establish the properties of fluids and introduce hydrostatic principles before delving into dynamics of flow for incompressible fluids (mainly) water. In Fluid Mechanics and Hydraulics you will learn how to formulate and solve fluid hydrostatics and pressure problems, analyse pipe flow situations using the Bernoulli equation, determine appropriate pump sizes for pipe systems, and analyse open channel flow situations using Manning's equation.

   1.2 Course topics  
   • Fluid Properties and Hydrostatics  
   • Static Pressure Forces  
   • Fluid Dynamics & Bernoulli Equation  
   • Flow Measurement  
   • Forces and Momentum of Moving Fluids  
   • Viscous Pipe Flows  
   • Pumps and Turbines  
   • Open Channel Hydraulics

2. What level is this course?  
200 level Developing - Applying broad and/or deep knowledge and skills to new contexts. May require pre-requisites and introductory level knowledge/skills. Normally undertaken in the 2nd or 3rd year of an undergraduate program

3. What is the unit value of this course?  
12 units
4. How does this course contribute to my learning?

<table>
<thead>
<tr>
<th>Specific Learning Outcomes</th>
<th>Assessment tasks</th>
<th>Graduate Qualities or Professional Standards mapping</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explain, describe and apply hydraulic theory and how fluid properties are used to predict hydraulic behaviour in fluids and pipe systems</td>
<td>Task 1 – Tutorial Solutions</td>
<td>Knowledgeable</td>
</tr>
<tr>
<td>Task 3 – Practical Report</td>
<td></td>
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<tr>
<td>Explain and describe how fluid shear stresses resist forces such as gravity and momentum</td>
<td>Task 1 – Tutorial Solutions</td>
<td>Creative and critical thinkers.</td>
</tr>
<tr>
<td>Task 3 – Practical Reports</td>
<td></td>
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</tr>
<tr>
<td>Interpret experimental and test results and present these in an appropriate engineering report format</td>
<td>Task 3 – Practical Reports</td>
<td>Creative and critical thinkers.</td>
</tr>
<tr>
<td>Collaborate with others in a team project environment to conduct engineering investigations and produce engineering reports</td>
<td>Task 1 – Tutorial Solutions Task 3 – Practical Reports</td>
<td>Engaged.</td>
</tr>
</tbody>
</table>

5. Am I eligible to enrol in this course?

Refer to the USC Glossary of terms for definitions of “pre-requisites, co-requisites and anti-requisites”.

5.1 Enrolment restrictions
Enrolled in Program SC383, SC384, SC410, SC411, SC425, SC430, AB101 or UU301 or XU301

5.2 Pre-requisites
ENG102 or CIV1501 (USQ equivalent course)

5.3 Co-requisites
Nil

5.4 Anti-requisites
ENV 2103 (USQ equivalent course)

5.5 Specific assumed prior knowledge and skills (where applicable)
Basic Y12 maths knowledge is assumed.

6. How am I going to be assessed?

6.1 Grading scale
Standard – High Distinction (HD), Distinction (DN), Credit (CR), Pass (PS), Fail (FL)
6.2 Assessment tasks

You will be introduced to an exciting and innovative teaching and learning style in this course. A new topic will be introduced each week before the allocated lecture time in a new "eLecture" format (narrated PowerPoint shows). The new eLecture format allows you to work through the material at your own pace, whenever you like, and as often as you like. You are required to work through each week's eLecture material and answer a number of preliminary online questions related to the eLecture before you attend each week's lecture. Answers to the eLecture questions are graded and form part of your assessment.

Traditional lecture sessions will be replaced with "workshops" (2 hours/week) where you will participate in class activities and discussions around applying the theory you learnt in the eLecture. The workshop sessions will be used to further reinforce and expand the on the knowledge that you gained by working through the eLecture before the workshop. You will use your internet enabled device (iPhone, tablets, laptops, etc) to answer online workshop problems. You will do this using classroom response system (CRS) software, however, this will be explained in detail before semester starts. Your answers to the workshop questions will not be graded, however, they will provide you with immediate feedback on your general understanding of each week's topic. It is highly recommended that you attend and participate in all workshops (and answer all eLecture, workshop and tutorial questions). A 1-hour tutorial will directly follow the 2-hour workshop each week. You can use these tutorial sessions to ask for further clarification on any issues that you had with that week's material or to ask any other questions.

You will be required to answer a final set of online weekly tutorial questions after each week's workshop. You can use the tutorial session to work together on these weekly quiz questions if you like. However, attendance at the tutorials is not mandatory. The weekly eLecture and tutorial questions will be graded and will contribute to up to 30% of your final mark. Students must also complete 4 laboratory practicals and submit individual reports for each. The practicals are designed as hands-on demonstrations of some of the fundamental fluid mechanics concepts and theory learned in the course. The format of the 4 reports must follow the guidelines provided in the course.

<table>
<thead>
<tr>
<th>Task No.</th>
<th>Assessment Tasks</th>
<th>Individual or Group</th>
<th>Weighting</th>
<th>What is the duration / length?</th>
<th>When should I submit?</th>
<th>Where should I submit it?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Assorted weekly quiz questions based on course material (best 10 results counted)</td>
<td>Individual</td>
<td>30% (10 x 3%)</td>
<td>Responses to weekly eLecture workshop and tutorial quiz questions</td>
<td>Weeks 1 - 13</td>
<td>Online, through CRS Website</td>
</tr>
<tr>
<td>2</td>
<td>Workshop Design Projects and Reports (4)</td>
<td>Group activities- individual reports</td>
<td>20% (4 x 5%)</td>
<td>Project output and associated report (max 250 words + appropriate diagrams)</td>
<td>At next practical class (or 2 weeks later)</td>
<td>Hardcopy Reports to lecturer in class</td>
</tr>
<tr>
<td>3</td>
<td>Mini-exams (2)</td>
<td>Individual</td>
<td>50% (2 x 25%)</td>
<td>2 hrs</td>
<td>Weeks 6 and 13</td>
<td>In Class</td>
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<td></td>
<td></td>
<td></td>
<td>100%</td>
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</table>
Assessment Task 1: Answer weekly eLecture, workshop CRS and tutorial questions (10 x 3% = 30% Total)

**Goal:**
Using classroom response systems (CRS) increases student engagement and improves student learning outcomes. Working through the content in the eLectures, participation in the weekly workshops using the CRS and answering weekly quizzes will reinforce your learning and provide you with immediate feedback on your understanding.

**Product:**
Individual and group responses to weekly eLecture, workshop and tutorial questions using CRS software.

**Format:**
This assessment task calls for both individual and groupwork participation. Weekly eLecture and tutorial quiz questions will be answered individually by all students outside of class and will be graded for assessment. Workshop questions will be answered both individually and in groups, in class, however, the workshop questions will not be graded as these questions provide an opportunity for formative self-assessment.

**Criteria:**
Assessment Criteria:  
- Correctness of your responses to the various weekly eLecture and tutorial questions  
- Your individual responses to the questions are anonymous to other students and are only available to the lecturer  
- Your answers to the quiz questions will demonstrate your understanding of the lecture materials and will identify areas for further study.

**Generic skill assessed** | **Skill assessment level**
--- | ---
Problem solving | Developing

**Engineers Australia Stage 1 Competencies**

1.3. In-depth understanding of specialist bodies of knowledge within the engineering discipline.
2.1. Application of established engineering methods to complex engineering problem solving.
2.2. Fluent application of engineering techniques, tools and resources

Assessment Task 2: Laboratory Practicals and Reports - (4 x 5% = 20% Total)

**Goal:**
The four laboratory practicals and design projects are designed as hands-on activities that demonstrate the theory presented in the course material to help you to gain a deep understanding of the underlying fluid mechanics principles.

**Product:**

**Format:**
(You MUST wear covered shoes in the laboratory – thongs etc are not allowed!)
The four practicals (5% each) will be completed by small groups of students. However, the reports are to be submitted individually by all students. Reports should NOT be longer than 5 pages (see Report Writing Guidelines in Practical folder on Portal). Report writing is a very important skill for engineering graduates to have and producing these reports will help you hone these skills.

**Criteria:**
Assessment Criteria:
- Degree to which the report adheres to the specified structure;
- Completeness of all components of the report within specified word count;
- Completeness and accuracy of data; and
- Depth of discussion and reflection on the project.

**Generic skill assessed** | **Skill assessment level**
--- | ---
Applying technologies | Developing
Communication | Developing

**Engineers Australia Stage 1 Competencies**

2.1. Application of established engineering methods to complex engineering problem solving.
2.2. Fluent application of engineering techniques, tools and resources.
3.2. Effective oral and written communication in professional and lay domains.
3.4. Professional use and management of information
Assessment Task 3: Two Mini-exams – 2 hrs (2 x 25% = 50% of final grade)

<table>
<thead>
<tr>
<th>Goal:</th>
<th>The two mini-exams will allow you to demonstrate your understanding of the theory learnt during the course and your ability to use the theory to solve Fluid Mechanics problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product:</td>
<td>Solutions to mini-exam questions</td>
</tr>
<tr>
<td>Format:</td>
<td>The first mini-exam will take place in the Week 6 workshop session. This mini-exam will assess the content of lectures covered in Weeks 1-5. The second mini-exam will take place in the Week 13 workshop session. This mini-exam will assess the content of lectures covered in Weeks 6-12. You will be required to solve a number of typical Fluid Mechanics problems similar to those given in the eLectures, workshops and tutorial questions throughout the semester. Your exam solutions will be used to evaluate your understanding of the total course material. The duration of the two mini-exams will be 2 hours each (closed book, programmable calculators are NOT permitted to be used but a formula sheet will be provided).</td>
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</table>

<table>
<thead>
<tr>
<th>Criteria:</th>
<th>Assessment Criteria:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Correct answers to the problems</td>
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<td></td>
<td>Use of correct methodology</td>
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<td></td>
<td>Demonstrated understanding through use of correct formulae</td>
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<td></td>
<td>Inclusion of all workings showing a logical sequence to the problem solution</td>
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</table>

<table>
<thead>
<tr>
<th>Generic skill assessed</th>
<th>Skill assessment level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem solving</td>
<td>Developing</td>
</tr>
</tbody>
</table>

**Engineers Australia Stage 1 Competencies**

1.3. In-depth understanding of specialist bodies of knowledge within the engineering discipline.
2.1. Application of established engineering methods to complex engineering problem solving.
2.2. Fluent application of engineering techniques, tools and resources.

7. What are the course activities?

7.1 Directed study hours

13 x weekly eLectures (completed online at home before each week’s face-to-face workshop)
13 x 2hr Workshops (bring fully-charged internet-enabled device eg iPhone, tablets, laptops, etc with you)
13 x 1 hr Tutorial sessions directly after workshops
4 x 2hr Laboratory Practicals (no thongs permitted)

7.2 Teaching semester/session(s) offered

Sippy Downs: Semester 1

7.3 Course content

<table>
<thead>
<tr>
<th>Teaching Week / Module</th>
<th>What key concepts/content will I learn?</th>
<th>What activities will I engage in to learn the concepts/content?</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Directed Study Activities (in addition to the weekly lecture and tutorial)</td>
</tr>
<tr>
<td>Week 1</td>
<td>Fluid Properties and Hydrostatics</td>
<td>Weekly e-lecture, workshop, tutorial</td>
</tr>
<tr>
<td>Week 2</td>
<td>Buoyancy and Stability</td>
<td>Weekly e-lecture, workshop, tutorial</td>
</tr>
<tr>
<td>Week 3</td>
<td>Static Pressure Forces</td>
<td>Weekly e-lecture, workshop, tutorial &amp; Practical 1a</td>
</tr>
<tr>
<td>Week 4</td>
<td>Fluid Dynamics and Continuity</td>
<td>Weekly e-lecture, workshop, tutorial &amp; Practical 1b</td>
</tr>
<tr>
<td>Week 5</td>
<td>Fluid Forces and Momentum</td>
<td>Weekly e-lecture, tutorial &amp; Practical 2a</td>
</tr>
<tr>
<td>Week 6</td>
<td>Mini-exam 1 (2hrs -25%) based on material from weeks 1-5</td>
<td>Weekly e-lecture, workshop, tutorial &amp; Practical 2b</td>
</tr>
<tr>
<td>Week 7</td>
<td>Bernoulli Equation &amp; Viscous Pipe Flows</td>
<td>Weekly e-lecture, workshop, tutorial &amp; Practical 3a</td>
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<td></td>
<td></td>
<td>Mid-semester teaching break</td>
</tr>
<tr>
<td>Week 8</td>
<td>More Pipe Flows</td>
<td>Weekly e-lecture, workshop, tutorial &amp; Practical 3b</td>
</tr>
</tbody>
</table>
8. What resources do I need to undertake this course?

Please note that course information, including specific information of recommended readings, learning activities, resources, weekly readings, etc. are available on the course Blackboard site. Please log in as soon as possible.

8.1 Prescribed text(s)

No textbook prescribed. Course notes will be supplied for this course.

Students are advised to refer to the many high quality Fluid Mechanics textbooks in the USC and other libraries when needing further clarification on included topics.

8.2 Specific requirements

Fully enclosed shoes must be worn in the engineering laboratory (i.e. no thongs or sandals). If you do not have the correct shoes you will not be allowed to do the practical. You must also undertake the laboratory induction before you can undertake any practical.

9. Risk management

Health and safety risks for this course have been assessed as low.

It is your responsibility as a student to review course material, search online, discuss with lecturers and peers, and understand the health and safety risks associated with your specific course of study. It is also your responsibility to familiarise yourself with the University’s general health and safety principles by reviewing the online Health Safety and Wellbeing training module for students, and following the instructions of the University staff.

10. What administrative information is relevant to this course?

10.1 Assessment: Academic Integrity

Academic integrity is the ethical standard of university participation. It ensures that students graduate as a result of proving they are competent in their discipline. This is integral in maintaining the value of academic qualifications. Each industry has expectations and standards of the skills and knowledge within that discipline and these are reflected in assessment.

Academic integrity means that you do not engage in any activity that is considered to be academic fraud; including plagiarism, collusion or outsourcing any part of any assessment item to any other person. You are expected to be honest and ethical by completing all work yourself and indicating in your work which ideas and information were developed by you and which were taken from others. You cannot provide your assessment work to others. You are also expected to provide evidence of wide and critical reading, usually by using appropriate academic references.

In order to minimise incidents of academic fraud, this course may require that some of its assessment tasks, when submitted to Blackboard, are electronically checked through SafeAssign. This software allows for text comparisons to be made between your submitted assessment item and all other work that SafeAssign has access to.
10.2 Assessment: Additional requirements

Eligibility for Supplementary Assessment

Your eligibility for supplementary assessment in a course is dependent on the following conditions applying:

a) The final mark is in the percentage range 47% to 49.4%

b) The course is graded using the Standard Grading scale

c) You have not failed an assessment task in the course due to academic misconduct

10.3 Assessment: Submission penalties

Late submission of assessment tasks will be penalised at the following maximum rate:

- 5% (of the assessment task’s identified value) per day for the first two days from the date identified as the due date for the assessment task.
- 10% (of the assessment task’s identified value) for the third day
- 20% (of the assessment task’s identified value) for the fourth day and subsequent days up to and including seven days from the date identified as the due date for the assessment task.
- A result of zero is awarded for an assessment task submitted after seven days from the date identified as the due date for the assessment task.

Weekdays and weekends are included in the calculation of days late.

To request an extension, you must contact your Course Coordinator and supply the required documentation to negotiate an outcome.

10.4 Study help

In the first instance, you should contact your tutor, then the Course Coordinator. Additional assistance is provided to all students through Academic Skills Advisers. To book an appointment or find a drop-in session go to Student Hub.

Contact Student Central for further assistance: +61 7 5430 2890 or studentcentral@usc.edu.au

10.5 Links to relevant University policy and procedures

For more information on Academic Learning & Teaching categories including:

- Assessment: Courses and Coursework Programs
- Review of Assessment and Final Grades
- Supplementary Assessment
- Administration of Central Examinations
- Deferred Examinations
- Student Academic Misconduct
- Students with a Disability

Visit the USC website:
http://www.usc.edu.au/explore/policies-and-procedures#academic-learning-and-teaching

10.6 General Enquiries

In person:

- USC Sunshine Coast - Student Central, Ground Floor, Building C, 90 Sippy Downs Drive, Sippy Downs
- USC SouthBank - Student Central, Building A4 (SW1), 52 Merivale Street, South Brisbane
- USC Gympie - Student Central, 71 Cartwright Road, Gympie
- USC Fraser Coast - Student Central, Student Central, Building A, 161 Old Maryborough Rd, Hervey Bay

Tel: +61 7 5430 2890

Email: studentcentral@usc.edu.au