Course Outline

Code: ENG400
Title: Heat Transfer

School: Science & Engineering
Teaching Session: Semester 1
Year: 2020
Course Coordinator: Carolyn Jacobs
Course Moderator: Ayodele Olofinjana

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
Heat transfer is an important part of many diverse areas of engineering. This course covers the fundamental physical processes of heat transfer, including the application of techniques to engineering problem solving. It extends upon the concepts and principles learned in fluid mechanics and thermodynamics courses. The Course topics will cover the three modes of heat transfer – conduction, convection, and radiation – and their application to the industry.

1.2 Field trips, WIL placements or activities required by professional accreditation

<table>
<thead>
<tr>
<th>Activity</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

1.3 Course topics
Major topic areas to be covered in this course include:
1. Basic concepts in heat transfer
2. Heat conduction
3. Numerical analysis of heat conduction
4. External forced convection
5. Internal forced convection
6. Natural convection
7. Heat exchangers
8. Radiation heat transfer

2. What level is this course?
400 level Graduate - Independent application of graduate knowledge and skills. Meets AQF and professional requirements. May require pre-requisites and developing level knowledge/skills. Normally taken in the 4th 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 and investigate the laws and principles of thermodynamics and heat transfer and use to solve problems.</td>
<td>Task 1, Task 3</td>
<td>Knowledgeable.</td>
</tr>
<tr>
<td>Investigate and apply the principles of heat transfer (conduction, convection, radiation) to complex systems.</td>
<td>Task 1, Task 2, Task 3</td>
<td>Knowledgeable. Empowered.</td>
</tr>
<tr>
<td>Solve heat transfer problems by appraising information, determining applicable concepts, and providing and verify a solution.</td>
<td>Task 2, Task 3</td>
<td>Creative and critical thinkers. Empowered.</td>
</tr>
<tr>
<td>Communicate results through reports, sketching, and modelling</td>
<td>Task 1, Task 2, Task 3</td>
<td>Knowledgeable. Creative and critical thinkers.</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
This course is only available to students enrolled in Program SC411.

5.2 Pre-requisites
ENG204 (MEC2101 USQ equivalent, or PHY201) and ENG300 (MEC3102 USQ equivalent)

5.3 Co-requisites
None

5.4 Anti-requisites
MEC4103 (USQ equivalent course)

5.5 Specific assumed prior knowledge and skills (where applicable)
Students are assumed to have foundational skills in thermodynamics and fluid mechanics.

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 Details of early feedback on progress
Early feedback will be provided through the regular discussion of worked examples in class, as well as the summative quiz held in week 3 of semester.

6.3 Assessment tasks

<table>
<thead>
<tr>
<th>Task No.</th>
<th>Assessment Product</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>Practical / Laboratory Skills</td>
<td>Individual</td>
<td>20%</td>
<td>Short answer questions</td>
<td>Two labs during weeks 3 – 12</td>
<td>In Class</td>
</tr>
<tr>
<td>2</td>
<td>Quiz/zes</td>
<td>Individual</td>
<td>40%</td>
<td>Short answer/numerical workings</td>
<td>Weeks 3, 6, 9, 12</td>
<td>In Class</td>
</tr>
<tr>
<td>3</td>
<td>Report</td>
<td>Individual</td>
<td>40%</td>
<td>10 pages</td>
<td>Week 15</td>
<td>Online Assignment Submission with Plagiarism check</td>
</tr>
</tbody>
</table>

Assessment Task 1: Laboratory reports

Goal: The goal of this task is to explain heat transfer principles through experimental applications and reporting on the results.

Product: Practical/Laboratory Skills

Format: You will attend 2 laboratory sessions over the semester. You will attend 1 session between weeks 3-7 and 1 session between weeks 8-12. Prior to each session, you will complete a series of pre-lab questions online. During the session, you will conduct an experiment and complete a report. This report will be submitted at the end of the session. The experimental work will be conducted in a group format, however the pre-lab questions and the reports are to be submitted individually by all students. A template will be provided for the report submission.

Criteria: You will be assessed on:
- Accuracy of the explanation and/or numerical result
- Investigation and application of heat transfer concepts
- Identification and verification of the system being analysed using sketches and modelling
- Communication of results

Generic skill assessed | Skill assessment level
--- | ---
Applying technologies | Graduate
Communication | Graduate

Engineers Australia competencies assessed in this task
1.1 Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline.
2.2. Fluent application of engineering techniques, tools and resources.
3.2 Effective oral and written communication in professional and lay domains
3.5 Orderly management of self, and professional conduct
Assessment Task 2: Quizzes

<table>
<thead>
<tr>
<th>Goal:</th>
<th>The quizzes are designed to evaluate your knowledge of heat transfer concepts and to demonstrate the use of standard methods to analyse heat transfer problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product:</td>
<td>Quiz/zes</td>
</tr>
<tr>
<td>Format:</td>
<td>These quizzes will occur in Weeks 3, 6, 9, and 12 during the lecture session. You will respond to questions using short answer. The quizzes will cover all content taught prior to that week.</td>
</tr>
</tbody>
</table>
| Criteria: | You will be assessed on:  
  - Accuracy of the explanation and/or numerical result  
  - Investigation and application of heat transfer concepts  
  - Identification and verification of the system being analysed using sketches and modelling |

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Problem solving</td>
<td>Graduate</td>
</tr>
<tr>
<td>Applying Technologies</td>
<td>Graduate</td>
</tr>
</tbody>
</table>

**Engineers Australia competencies assessed in this task**

1.1 Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline.
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 3: Project

<table>
<thead>
<tr>
<th>Goal:</th>
<th>The goal of this task is to apply fundamental heat transfer concepts to analyse the heating for a given situation.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product:</td>
<td>Report</td>
</tr>
<tr>
<td>Format:</td>
<td>The report will be submitted electronically in Week 15 and will be approximately 10 pages long (3000 word equivalent). You will be required to develop models and solve a number of heat transfer problems within the provided context. This will involve conducting research to determine material properties and identifying other necessary information.</td>
</tr>
</tbody>
</table>
| Criteria: | You will be assessed on:  
  - Accuracy of the explanation and/or numerical result  
  - Investigation and application of heat transfer concepts  
  - Identification and verification of the system being analysed using sketches and modelling  
  - Communication of results |

<table>
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</tr>
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<td>Communication</td>
<td>Graduate</td>
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</tbody>
</table>

**Engineers Australia competencies assessed in this task**

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.
3.2 Effective oral and written communication in professional and lay domains
3.3 Creative, innovative and proactive demeanour.
# Course Outline: ENG400 Heat Transfer

## 7. Directed study hours

The directed study hours listed here are a portion of the workload for this course. A 12 unit course will have total of 150 learning hours which will include directed study hours (including online if required), self-directed learning and completion of assessable tasks. Directed study hours may vary by location. Student workload is calculated at 12.5 learning hours per one unit.

<table>
<thead>
<tr>
<th>Location:</th>
<th>Directed study hours for location:</th>
</tr>
</thead>
</table>
| USC Sunshine Coast | Lecture 1h per week  
| | Workshop 3h per week  
| | Laboratory 2 x 3h session during the semester |

7.1 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>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Directed Study Activities</td>
</tr>
</tbody>
</table>
| 1                      | Basic concepts of heat transfer        | Lecture  
|                        |                                        | Workshop  
| 2                      | Heat conduction                        | Lecture  
|                        |                                        | Workshop  
| 3                      | Heat conduction (steady, fin approximation) | Lecture  
|                        |                                        | Workshop  
|                        |                                        | Laboratory  
| 4                      | Heat conduction (transient)            | Lecture  
|                        |                                        | Workshop  
|                        |                                        | Laboratory  
| 5                      | Numerical analysis of heat conduction  | Lecture  
|                        |                                        | Workshop  
|                        |                                        | Laboratory  
| 6                      | Convection (forced external)           | Lecture  
|                        |                                        | Workshop  
|                        |                                        | Laboratory  
| 7                      | Convection (forced internal)           | Lecture  
|                        |                                        | Workshop  
|                        |                                        | Laboratory  
| 8                      | Convection (natural)                   | Lecture  
|                        |                                        | Workshop  
|                        |                                        | Laboratory  
| 9                      | Heat exchangers                        | Lecture  
|                        |                                        | Workshop  
|                        |                                        | Laboratory  
| 10                     | Thermal radiation                      | Lecture  
|                        |                                        | Workshop  
|                        |                                        | Laboratory  
| 11                     | Radiation heat exchange                | Lecture  
|                        |                                        | Workshop  
|                        |                                        | Laboratory  
| 12                     | Radiation heat exchange                | Lecture  
|                        |                                        | Workshop  
|                        |                                        | Laboratory  

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)**

Please note that you need to have regular access to the resource(s) listed below as they are required:

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Title</th>
<th>Publisher</th>
</tr>
</thead>
</table>

8.2 **Specific requirements**

Laboratory work will be undertaken in areas requiring students to wear closed footwear.

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 of 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 Wellbeing Services
Student Wellbeing Support Staff are available to assist on a wide range of personal, academic, social and psychological matters to foster positive mental health and wellbeing for your success. Student Wellbeing is comprised of professionally qualified staff in counselling, health and disability Services.

Ability Advisers ensure equal access to all aspects of university life. If your studies are affected by a disability, mental health issue, learning disorder, injury or illness, or you are a primary carer for someone with a disability, AccessAbility Services can provide assistance, advocacy and reasonable academic adjustments.

To book an appointment with either service go to Student Hub, email studentwellbeing@usc.edu.au or accessability@usc.edu.au or call 07 5430 1226

10.6 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
10.7 General Enquiries

In person:

- **USC Sunshine Coast** - Student Central, Ground Floor, Building C, 90 Sippy Downs Drive, Sippy Downs
- **USC Moreton Bay** – Service Centre, Ground Floor, Foundation Building, Gympie Road, Petrie
- **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
- **USC Caboolture** - Student Central, Level 1 Building J, Cnr Manley and Tallon Street, Caboolture

Tel: +61 7 5430 2890

Email: studentcentral@usc.edu.au