1. Staff

<table>
<thead>
<tr>
<th>Position</th>
<th>Name</th>
<th>Email</th>
<th>Consultation times and locations</th>
<th>Contact Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course Convenor</td>
<td>A/Prof. Runyu Yang</td>
<td><a href="mailto:r.yang@unsw.edu.au">r.yang@unsw.edu.au</a></td>
<td>Room 349, School of Materials Science and Engineering (Building E10) Open door, but make an appointment if important</td>
<td>Phone: 9385 6787</td>
</tr>
</tbody>
</table>

2. Course information

Units of credit: 6
Pre-requisite(s): None
Timetabling website: TBA
Teaching times and locations:

<table>
<thead>
<tr>
<th>Day</th>
<th>Lecture</th>
<th>Lecture</th>
<th>Lecture/ Tutorial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>16:00-18:00</td>
<td>16:00-18:00</td>
<td>11:00-13:00</td>
</tr>
<tr>
<td>Location</td>
<td>Webster Theatre A</td>
<td>Colombo Theatre A</td>
<td>Webster Theatre B</td>
</tr>
<tr>
<td>Weeks</td>
<td>1, 3-11</td>
<td>1-10</td>
<td>1-10</td>
</tr>
</tbody>
</table>

2.1 Course summary

Fluid properties, Newtonian and non-Newtonian fluids; principles of fluid motion, mass and momentum balances; turbulent flow, dimensional analysis; mechanical energy balance, Bernoulli’s equation; conduction and Fourier’s law, steady-state conduction; forced and natural convection heat transfer; radiation, single body radiation, radiation exchange between objects.

2.2 Course aims

This course introduces the basic concepts in fluid flow and heat transfer and their applications in materials and mineral processing. The aims are to develop an understanding of basic principles governing fluid flow and heat transfer and to solve related problems in materials engineering.
2.3 Course learning outcomes (CLO)
At the successful completion of this course you (the student) should be able to:

1. Understand the principles and concepts in fluid flow and heat transfer
2. Follow proper procedures and apply fundamental equations to analyse fluid flow and heat transfer related problems
3. Develop analytical and problem-solving skills
4. Communicate effectively and be able to critically analyse information

2.4 Relationship between course and program learning outcomes and assessments

<table>
<thead>
<tr>
<th>Course Learning Outcome (CLO)</th>
<th>LO Statement</th>
<th>Program Learning Outcome (PLO)</th>
<th>Related Tasks &amp; Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLO 1</td>
<td>Understand…</td>
<td>1.3, 1.4, 3.2, 3.3 &amp; 3.4</td>
<td>1, 2, 3 &amp; 4</td>
</tr>
<tr>
<td>CLO 2</td>
<td>Follow…</td>
<td>1.3, 1.4, 3.2, 3.3 &amp; 3.4</td>
<td>1, 2, 3 &amp; 4</td>
</tr>
<tr>
<td>CLO 3</td>
<td>Develop…</td>
<td>2.1, 2.3 &amp; 3.6</td>
<td>1, 2, 3 &amp; 4</td>
</tr>
<tr>
<td>CLO 4</td>
<td>Communicate…</td>
<td>1.3 &amp; 3.4</td>
<td>3 &amp; 4</td>
</tr>
</tbody>
</table>

3. Strategies and approaches to learning

3.1 Learning and teaching activities
(Based on UNSW Learning Guidelines)

- **Students are actively engaged in the learning process.**
  It is expected that, in addition to attending classes, students will read, write, discuss, and engage in analysing the course content.

- **Effective learning is supported by a climate of inquiry where students feel appropriately challenged.**
  Students are expected to be challenged by the course content and to challenge their own preconceptions, knowledge, and understanding by questioning information, concepts, and approaches during class and study.

- **Learning is more effective when students’ prior experience and knowledge are recognised and built on.**
  Coursework, tutorials, assignments, laboratories, examinations, and other forms of learning and assessment are intended to provide students with the opportunity to cross-reference these activities in a meaningful way with their own experience and knowledge.

- **Students become more engaged in the learning process if they can see the relevance of their studies to professional and disciplinary contexts**
The course content is designed to incorporate both theoretical and practical concepts, where the latter is intended to be applicable to real-world situations and contexts.

**Lectures**: The core concepts will be taught in lectures, students will have access to the lectures notes before class for annotation during the lecture. Students will be engaged in the learning process through class discussions and problem-solving questions independently and working together with partners and groups.

**Tutorials**: Tutorials will consolidate the students learning of the core concepts through short-answer and problem-solving questions. Students will have the chance to work collaboratively in class and independently outside of class. Real world examples of the concepts will engage the students in the learning processing by connecting theory to practice.

### 3.2 Expectations of students

- Students must attend at least 80% of all classes with the expectation that students only miss classes due to illness or unforeseen circumstances
- Students must read through lecture notes and lab sheets prior to class
- During class, students are expected to engage actively in class discussions
- Students should work through lecture, tutorial and textbook questions
- Students should read through the relevant chapters of the prescribed textbook.
- Students should complete all assessment tasks and submit them on time.
- Students are expected to participate in online discussions through the Moodle page
### 4. Course schedule and structure

This course consists of 60 hours of class contact hours. You are expected to take an additional 90 hours of non-class contact hours to complete assessments, readings and exam preparation spread over the term.

<table>
<thead>
<tr>
<th>Week</th>
<th>Topics</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction of the course, applications of fluid flow and heat transfer in materials and mineral processing. Introduction to fluids, static fluids, pressure and measurement, Buoyancy force, Archimedes principle</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Laminar and turbulent flows, viscosity, Newtonian fluid, Reynolds number, transport of momentum, velocity and shear stress distributions in fluids, continuity and Navier-Stokes equations</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Turbulent flow, turbulence intensity, friction factor, dimensional analysis, flow inside a pipe/over a sphere/plate/through a packed bed, Ergun equation</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Mechanical energy balance, friction loss, Bernoulli’s equation and applications</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Revision tutorials</td>
<td>Mid-session exam Assignment Part 1</td>
</tr>
<tr>
<td>6</td>
<td>Introduction of heat transfer, heat transfer by conduction and convection, Fourier and Newton's laws, thermal conductivity, heat transfer coefficient, steady state conduction, general governing equation for conduction, transient heat transfer</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Introduction of heat transfer, heat transfer by conduction and convection, Fourier and Newton's laws, thermal conductivity, heat transfer coefficient, steady state conduction, general governing equation for conduction, transient heat transfer. Heat transfer by convection, thermal boundary layer, local heat transfer coefficient, forced and natural convection, Nusselt and Prandtl numbers, Grashof and Rayleigh number.</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Heat transfer by convection, thermal boundary layer, local heat transfer coefficient, forced and natural convection, Nusselt and Prandtl numbers, Grashof and Rayleigh number.</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Thermal radiation, radiation, irradiation and radiosity, Blackbody emission, Stefan-Boltzmann law, emissivity, radiation between surfaces, view factor</td>
<td>Assignment Part 2</td>
</tr>
<tr>
<td>10</td>
<td>Thermal radiation, radiation, irradiation and radiosity, Blackbody emission, Stefan-Boltzmann law, emissivity, radiation between surfaces, view factor Revision tutorials</td>
<td></td>
</tr>
</tbody>
</table>
5. Assessment

5.1 Assessment tasks

<table>
<thead>
<tr>
<th>Assessment task</th>
<th>Description</th>
<th>Weight</th>
<th>Due date</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-class quiz:</td>
<td>Self-tests will be conducted in class during the tutorial time</td>
<td>10%</td>
<td>During tutorials</td>
</tr>
<tr>
<td>Assignments:</td>
<td>Two assignments will be handed out. These assignments help assess your understanding of the material and will count toward your final grade. Students are encouraged to work with others on the homework, but not simply copy someone else</td>
<td>20% (10% each)</td>
<td>(1) Week 5 (2) Week 10</td>
</tr>
<tr>
<td>Mid-session exam:</td>
<td>The closed-book exam will be given during the lecture time in mid-session to assess students’ knowledge of fluid flow</td>
<td>35%</td>
<td>Week 5</td>
</tr>
<tr>
<td>Final exam:</td>
<td>The two-hour final exam will assess the students’ understanding of heat transfer. It will focus on the understanding of basic concepts and the ability to apply fundamental equations to a specific system.</td>
<td>35%</td>
<td>Final exam period</td>
</tr>
</tbody>
</table>

Further information
UNSW grading system: https://student.unsw.edu.au/grades
UNSW assessment policy: https://student.unsw.edu.au/assessment

5.2 Assessment criteria and standards

Assessment criteria and standards for each assessment tasks are available on the course Moodle page.

NOTE: Students who fail to achieve a score of at least 40% for the overall exam component (i.e., mid-session exam and final exam marks combined), but achieve a final mark >50% for the course, will be awarded a UF (Unsatisfactory Fail) for the course.

5.3 Submission of assessment tasks

- All assignments must contain a completed student declaration sheet and will be submitted on the due date.
- Students will lose 10% of the original mark per working day late for late submission of assignments. Requests for special consideration must be submitted using the form available from the Student Desk in the Chancellery and must include medical certificates or other appropriate documents.
- UNSW operates under a Fit to Sit/ Submit rule for all assessments. If a student wishes to submit an application for special consideration for an exam or assessment, the application must be submitted prior to the start of the exam or before an assessment is submitted. If a student sits the exam/ submits an assignment, they are declaring themselves well enough to do so. Information on this process can be found here: https://student.unsw.edu.au/special-consideration. Medical
certificates or other appropriate documents must be included. Students should also advise the lecturer of the situation.

5.4. Feedback on assessment

In-class quiz: solutions will be provided after completion of the quiz. Answer sheets will be collected.

Assignments: The assignments will be marked and returned to students with comments two weeks after submission.

Mid-term exam: Students will receive their marks within two weeks of the exam.

Final exam: Students will receive their final grade when UNSW Sydney realises the marks via MyUNSW.

6. Academic integrity, referencing and plagiarism

Referencing is a way of acknowledging the sources of information that you use to research your assignments. You need to provide a reference whenever you draw on someone else’s words, ideas or research. Not referencing other people's work can constitute plagiarism.

Further information about referencing styles can be located at https://student.unsw.edu.au/referencing

Academic integrity is fundamental to success at university. Academic integrity can be defined as a commitment to six fundamental values in academic pursuits: honesty, trust, fairness, respect, responsibility and courage. At UNSW, this means that your work must be your own, and others’ ideas should be appropriately acknowledged. If you don’t follow these rules, plagiarism may be detected in your work.

Further information about academic integrity and plagiarism can be located at:

- The Current Students site https://student.unsw.edu.au/plagiarism, and
- The ELISE training site http://subjectguides.library.unsw.edu.au/elise/presenting

The Conduct and Integrity Unit provides further resources to assist you to understand your conduct obligations as a student: https://student.unsw.edu.au/conduct.

7. Readings and resources

- Bird, Stewart and Lightfoot, Transport Phenomena, John Wiley & Sons Inc.
- Additional resource materials including recommended web sites will be provided during class lectures

1 International Center for Academic Integrity, 'The Fundamental Values of Academic Integrity', T. Fishman (ed), Clemson University, 2013.
8. Administrative matters

School Office: Room 137, Building E10 School of Materials Science and Engineering
School Website: http://www.materials.unsw.edu.au/
Faculty Office: Robert Webster Building, Room 128
Faculty Website: http://www.science.unsw.edu.au/

9. Additional support for students

- The Current Students Gateway: https://student.unsw.edu.au/
- Academic Skills and Support: https://student.unsw.edu.au/academic-skills
- Student Wellbeing, Health and Safety: https://student.unsw.edu.au/wellbeing
- Disability Support Services: https://student.unsw.edu.au/disability-services
- UNSW IT Service Centre: https://www.it.unsw.edu.au/students/index.html
- Special Consideration: https://student.unsw.edu.au/special-consideration