THE UNIVERSITY OF NEW SOUTH WALES

SCHOOL OF MATERIALS SCIENCE AND ENGINEERING

MATS5043

Heat, Fluid and Mass Flow

SESSION 2, 2009

Course staff

Staff	Responsibility	Contact details	Consultation hours
Dr Runyu Yang	Lecturer/ Course Co-ordinator	Room: 218, Ph: 9385 6787 r.yang@.unsw.edu.au	Open door, but make an appointment if important
Prof. Aibing Yu	Lecturer	Room: 106, a.yu@unsw.edu.au	

Time Table

Lecture/Tutorial	Day	Time	Location
Lecture	Thursday	9:00 – 11:00	Quad G053

Course information

Unit of Credit	3
Parallel teaching involved in this course	N/A
How the course relates to other course offerings and overall program(s) in the discipline	• The course covers various topics involving heat, mass and fluid flow and introduces a few numerical techniques widely used in metallurgy/materials engineering, including discrete modelling and computational fluid dynamics. Selected examples are discussed to demonstrate the application of these techniques to fluid flow, heat transfer and material processing. • The course offers an opportunity for students to apply the knowledge learned from other courses such as fluid flow, heat transfer, modelling, etc. It emphasizes solving problems at a larger scale, more related to engineering application.
Course Aims	• Development of an advanced understanding of fundamental principles governing transport phenomena and application to metallurgical operations
Expected student learning outcomes (including those related to graduate attributes)	Students are expected: • to understand the principles and concepts in the mass, heat and fluid flow • to understand the underlying fundamentals and develop some numerical skills Graduate attributes: • knowledge of fundamental principles governing transport phenomena and various numerical skills for problem solving in engineering • Information literacy and writing communication
Teaching Strategies used in the course and the ways they support student learning outcomes	• Lectures covering fundamentals and major concepts, with their applications demonstrated via selected examples • Students are expected to attend classes and prepare for discussion • Assignments to enhance students' understanding and generate opportunities for students to practise • Significant report writing to develop students' literature review and writing skill

Assessment

- **Assignments (4)** **100%**

Note: All assignments must contain a completed student declaration sheet and will be submitted on the due date. Late submissions will not be accepted without adequate reason in writing.

Course outline

1. **Packed bed and heat transfer**
   - Packed bed and macroscopic modelling
   - Computer simulation of packed bed
   - Heat transfer in porous media
2. **Solid flow modelling**
   - Analysis of stockpiling
   - Granular flow in drums
   - mixing, granulation/grinding processes
   - Fine powder flow in dry powder inhalers
3. **Multiphase flow modelling**
   - Gas flow in packed bed reactors (e.g. blast furnace)
   - Solid flow in process vessels
   - Gas-liquid flow in packed bed reactors
   - Gas-solid flow in fluid bed reactors (blast furnace and fluidised bed)
   - Multiphase flow: gas-powder-liquid flow in moving particles
4. **Advanced topics**
   - Discrete particle simulation: basic concepts and principles, simulation of solids flow, simulation of gas-solid two phase flow
   - CFD analysis of coupled fluid flow, heat and mass transfer in metallurgical operations

Resources

- An Introduction to Transport Phenomena in Materials Engineering. D.R. Gaskell. Macmillan (1992).
- Introduction to Particle Technology, M.Rhodes, John Wiley & Sons (1998).
- Rate Phenomena in Process Metallurgy. J. Szekely and N.J. Themlis. Wiley Interscience (1971).
- Rate Processes of Extractive Metallurgy. H.Y. Sohn and M.E. Wadsworth. Plenum Press (1979).
- Transport Phenomena in Metallurgy. G.H. Gerger and D.R. Poirier. Addison-Westley (1973).
- Engineering in Process Metallurgy. R.I.L. Guthrie. Clarendon (1992).
- Transport and Chemical Rate Phenomena, N. J. Themelis. Gordon and Breach (1995).
- The Mathematical and Physical Modelling of Primary Metals Processing Operations. J. Szekely, J.W. Evans and J.K. Brimacombe. John Wiley & Sons (1988).

The learning and teaching philosophy underpinning the course (based on UNSW Learning Guidelines)

- **Students are actively engaged in the learning process.**
  Students are expected to attend the classes and engage in discussion in and after class time. Students are also expected to read the textbook as well as other relevant materials, finish the assignments independently.

- **Effective learning is supported by a climate of inquiry where students feel appropriately challenged.**
  Heat, fluid and mass flows are often complex and challenging, requiring understanding of fundamentals, analysis skills and mathematical knowledge. Students will be given assignments which reflect these important aspects.

- **Learning is more effective when students' prior experience and knowledge are recognised and built on.**
  This course is built on prior courses on heat transfer and transport phenomena of fluid flow. A background in ordinary differential equation is helpful for proper understanding of the material.

- **Students become more engaged in the learning process if they can see the relevance of their studies to professional and disciplinary contexts**
  Students will be given assignments to solve problems relevant to material engineering.

Continual course improvement

- We welcome feedback at all times on presentation of course materials and any other course-related matters, and will be happy to discuss any issues raised in the lectures. You will be asked to provide evaluative feedback through the UNSW's Course and Teaching Evaluation and Improvement (CATEI) Process at the end of the course. Feedback from prior assessments will be discussed in lecture 1.
- Students are encouraged to address any problems regarding teaching of this course at the annual staff-student meeting.
- Student's comments on teaching during the session are welcome and will be appreciated.

Administrative Matters

- Students are expected to attend minimum 80% of lectures and tutorial, and to check the course website at WebCT-Vista regularly.

- Students unable to submit assignment on the due dates on the health grounds should submit requests for special consideration using the form available from the Student Desk in the Chancellery and must include medical certificates or other appropriate documents.

- Equity and diversity: those students who have a disability that requires some adjustment in their teaching or learning environment are encouraged to discuss their study needs with the course convener prior to, or at the commencement of, their course, or with the Equity Officer (Disability) in the Equity and Diversity Unit (9385 4734 or www.equity.unsw.edu.au/disabil.html). Early notification is essential to enable any necessary adjustments to be made. Information on designing courses and course outlines that take into account the needs of students with disabilities can be found at: www.secretariat.unsw.edu.au/acboardcom/minutes/coe/disabilityguidelines.pdf

Academic honesty and plagiarism

- The following extract should appear in all course outlines in unaltered form. It is recommended, however, that additional discipline-specific advice and/or material be added to assist students wherever possible:

What is Plagiarism?
Plagiarism is the presentation of the thoughts or work of another as one's own. *
Examples include:

- direct duplication of the thoughts or work of another, including by copying material, ideas or concepts from a book, article, report or other written document (whether published or unpublished), composition, artwork, design, drawing, circuitry, computer program or software, web site, Internet, other electronic resource, or another person's assignment without appropriate acknowledgement;
- paraphrasing another person's work with very minor changes keeping the meaning, form and/or progression of ideas of the original;
- piecing together sections of the work of others into a new whole;
- presenting an assessment item as independent work when it has been produced in whole or part in collusion with other people, for example, another student or a tutor; and
- claiming credit for a proportion a work contributed to a group assessment item that is greater than that actually contributed.†

For the purposes of this policy, submitting an assessment item that has already been submitted for academic credit elsewhere may be considered plagiarism.

Knowingly permitting your work to be copied by another student may also be considered to be plagiarism.

Note that an assessment item produced in oral, not written, form, or involving live presentation, may similarly contain plagiarised material.

The inclusion of the thoughts or work of another with attribution appropriate to the academic discipline does *not* amount to plagiarism.

The Learning Centre website is main repository for resources for staff and students on plagiarism and academic honesty. These resources can be located via:

www.lc.unsw.edu.au/plagiarism

The Learning Centre also provides substantial educational written materials, workshops, and tutorials to aid students, for example, in:

- correct referencing practices;
- paraphrasing, summarising, essay writing, and time management;
- appropriate use of, and attribution for, a range of materials including text, images, formulae and concepts.

Individual assistance is available on request from The Learning Centre.

Students are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting, and the proper referencing of sources in preparing all assessment items.

* Based on that proposed to the University of Newcastle by the St James Ethics Centre. Used with kind permission from the University of Newcastle
† Adapted with kind permission from the University of Melbourne.