Unit study package code: CHEN2003
Mode of study: Internal
Tuition pattern summary: Note: For any specific variations to this tuition pattern and for precise information refer to the Learning Activities section.
Lecture: 2 x 2 Hours Weekly
Science Laboratory: 2 x 3 Hours Semester
Workshop: 1 x 1 Hours Weekly
This unit does not have a fieldwork component.
Credit Value: 25.0
Pre-requisite units:
308807 (v.0) Fluid Mechanics 230 or any previous version
OR
ENGR2000 (v.0) Fluid Mechanics or any previous version
AND
302249 (v.0) Chemical Engineering Thermodynamics 223 or any previous version
OR
CHEN2001 (v.0) Chemical Engineering Thermodynamics or any previous version
Co-requisite units: Nil
Anti-requisite units:
302200 (v.0) ChE 516 Mass Transfer Operations or any previous version
AND
CHEN5005 (v.0) Mass Transfer Operations or any previous version
Result type: Grade/Mark
Approved incidental fees: Information about approved incidental fees can be obtained from our website. Visit fees.curtin.edu.au/incidental_fees.cfm for details.
Unit coordinator:
Title: Dr
Name: Ben Seligmann
Phone: 0892667702
Email: Ben.Seligmann@curtin.edu.au
Location: Building: 216 - Room: 430
Consultation times: Monday 2-4 PM
Teaching Staff:
Name: Professor Ming Ang
Phone: 0892667894
Email: m.ang@curtin.edu.au
Acknowledgement of Country

We respectfully acknowledge the Indigenous Elders, custodians, their descendants and kin of this land past and present.

Syllabus

In Process Mass Transfer, students will learn the fundamental theory and introductory practical applications of separation processes. The fundamental theory they will study includes molecular diffusion, convective mass transfer, interphase mass transfer, the two-film model, film and overall mass transfer coefficients and vapour-liquid equilibrium. Mass transfer theory is used to design and analyse unit operations for separation processes. These include flash and continuous distillation, gas absorption and stripping, solvent extraction, solid leaching and humidification. The methods used to study the unit operations are material balances for stage and continuous contact processes, McCabe-Thiele design methods, and packed tower design.

Introduction

The aim of the unit is to develop a theoretical and practical basis for mass transfer unit operations, including the determination of basic design parameters. Upon successful completion of this course, you will have developed knowledge and skills related to theoretical and practical aspects of separation processes. These include applying theoretical mass transfer concepts to industrial problems, designing mass transfer equipment to meet specific parameters and communicating the results in written and oral forms.

Unit Learning Outcomes

All graduates of Curtin University achieve a set of nine graduate attributes during their course of study. These tell an employer that, through your studies, you have acquired discipline knowledge and a range of other skills and attributes which employers say would be useful in a professional setting. Each unit in your course addresses the graduate attributes through a clearly identified set of learning outcomes. They form a vital part in the process referred to as assurance of learning. The learning outcomes tell you what you are expected to know, understand or be able to do in order to be successful in this unit. Each assessment for this unit is carefully designed to test your achievement of one or more of the unit learning outcomes. On successfully completing all of the assessments you will have achieved all of these learning outcomes.

Your course has been designed so that on graduating we can say you will have achieved all of Curtin's Graduate Attributes through the assurance of learning process in each unit.

<table>
<thead>
<tr>
<th>On successful completion of this unit students can:</th>
<th>Graduate Attributes addressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Apply theoretical knowledge to practical separation processes</td>
<td>🔄</td>
</tr>
<tr>
<td>2 Apply theoretical mass transfer concepts to industrial problems</td>
<td>🔄 🎨</td>
</tr>
<tr>
<td>3 Design mass transfer equipment to meet specific parameters</td>
<td>🔄 🍴</td>
</tr>
<tr>
<td>4 Communicate project results in written and oral forms</td>
<td>📝 🎤</td>
</tr>
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</table>
Curtin’s Graduate Attributes

<table>
<thead>
<tr>
<th>Icon</th>
<th>Attribute</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Apply discipline knowledge</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Thinking skills</td>
<td>(use analytical skills to solve problems)</td>
</tr>
<tr>
<td></td>
<td>Information skills</td>
<td>(confidence to investigate new ideas)</td>
</tr>
<tr>
<td></td>
<td>Communication skills</td>
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<td></td>
<td>Technology skills</td>
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<tr>
<td></td>
<td>Learning how to learn</td>
<td>(apply principles learnt to new situations)</td>
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<tr>
<td></td>
<td>(confidence to tackle unfamiliar problems)</td>
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</tr>
<tr>
<td></td>
<td>International perspective</td>
<td>(value the perspectives of others)</td>
</tr>
<tr>
<td></td>
<td>Cultural understanding</td>
<td>(value the perspectives of others)</td>
</tr>
<tr>
<td></td>
<td>Professional Skills</td>
<td>(work independently and as a team)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(plan own work)</td>
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</tbody>
</table>

Find out more about Curtin’s Graduate attributes at the Office of Teaching & Learning website: ctl.curtin.edu.au

Learning Activities

The learning activities for Process Mass Transfer are the following:

Lectures - a mixture of content delivery and in-class problems.

Workshops - Smaller groups of students working on a number of focussed mass transfer problems in a tutorial-style environment with discussion elements.

Laboratories - an opportunity to get ‘hands-on’ with mass transfer phenomena. What you do in the labs will be used for later assessment

Learning Resources

Essential texts

The required textbook(s) for this unit are:

  (ISBN/ISSN: 00704448442)

Recommended texts

You do not have to purchase the following textbooks but you may like to refer to them.

  (ISBN/ISSN: 978-0470481837)

Other resources

1. All the lecture notes of this unit are available on Blackboard.
2. All Class Problems & Tutorial Problems will be uploaded onto Blackboard.
   JW-021 (P-10)
   ISBN 0-07115982-7
Assessment

Assessment schedule

<table>
<thead>
<tr>
<th>Task</th>
<th>Value %</th>
<th>Date Due</th>
<th>Unit Learning Outcome(s) Assessed</th>
</tr>
</thead>
</table>
| Test          | 20 percent | **Week:** 4  
**Day:** Monday, Aug 22nd  
**Time:** 12pm-2pm  
(During Lecture 1 Slot) | 1,2 |
| Laboratories  | 30 percent | **Week:** Weeks 8 and 9 (Lab 1), Weeks 11 and 12 (Lab 2)  
**Day:** Wednesday (Lab 1), Tutorial Day (Lab 2)  
**Time:** 11:59 PM (Lab 1), Tutorial Time (Lab 2) | 1,3,4 |
| Final Examination | 50 percent | **Week:** Exam Period  
**Day:** TBA  
**Time:** TBA | 1,2,3 |

Detailed information on assessment tasks

1. This is a closed book, individual mid-semester exam which is worth 20% of your final grade. The topics covered will be the early topics in the unit: Molecular Diffusion, Convective Mass Transfer and Interface Mass Transfer. The early sections of Vapour Liquid Equilibrium may be included. The test will be in the first lecture slot of week 4, on the Monday lecture, in 210-102. You may bring a departmentally approved calculator (HP10S). If required, formula sheets will be provided.

2. The laboratory experiments will be performed in groups, and you need to take two laboratory sessions for the unit. Each group is required to write up one experimental REPORT for the first lab session and do a PRESENTATION in their tutorial time for the second lab session.

   15% - The REPORT should include Summary, Aim, Method, Results and Conclusions, more details of the format can be found on Blackboard, please submit the report through Turnitin. 5% (out of the 15%) will be for individual participation and engagement DURING the lab sessions, and 10% will be for the group report.

   15% - The PRESENTATION is a new assessment this year, and therefore, the details of this assessment will follow later. In general, though, you need to perform a simple design of mass transfer equipment, based on the data you've collected from the laboratory session, and then assess the strengths and weaknesses of your design. The Presentation is done in a group. 5% (out of the 15%) will be for individual participation and engagement DURING the lab sessions, and 10% will be for the group presentation.

   The groups will be determined by the end of week 3, and will be based on your tutorial classes. The groups will be groups of 4.

3. This is the final exam for the unit. It is a closed book exam. Formula sheets will be provided if necessary. A HP10S calculator is permitted. Please bring a RULER to the exam. The exam will cover topics from Distillation to Humidification.

Pass requirements

A minimum of 50% overall constitutes the minimum requirement for a pass. This means that you have achieved the Unit Learning Outcomes in a minimal way.
Fair assessment through moderation

Moderation describes a quality assurance process to ensure that assessments are appropriate to the learning outcomes, and that student work is evaluated consistently by assessors. Minimum standards for the moderation of assessment are described in the Assessment and Student Progression Manual, available from policies.curtin.edu.au/policies/teachingandlearning.cfm

Late assessment policy

This ensures that the requirements for submission of assignments and other work to be assessed are fair, transparent, equitable, and that penalties are consistently applied.

1. All assessments students are required to submit will have a due date and time specified on this Unit Outline.
2. Students will be penalised by a deduction of ten percent per calendar day for a late assessment submission (eg a mark equivalent to 10% of the total allocated for the assessment will be deducted from the marked value for every day that the assessment is late). This means that an assessment worth 20 marks will have two marks deducted per calendar day late. Hence if it was handed in three calendar days late and given a mark of 16/20, the student would receive 10/20. An assessment more than seven calendar days overdue will not be marked and will receive a mark of 0.

Assessment extension

A student unable to complete an assessment task by/on the original published date/time (eg examinations, tests) or due date/time (eg assignments) must apply for an assessment extension using the Assessment Extension form (available from the Forms page at students.curtin.edu.au/administration/) as prescribed by the Academic Registrar. It is the responsibility of the student to demonstrate and provide evidence for exceptional circumstances beyond the student’s control that prevent them from completing/submitting the assessment task.

The student will be expected to lodge the form and supporting documentation with the unit coordinator before the assessment date/time or due date/time. An application may be accepted up to five working days after the date or due date of the assessment task where the student is able to provide an acceptable explanation as to why he or she was not able to submit the application prior to the assessment date. An application for an assessment extension will not be accepted after the date of the Board of Examiners’ meeting.

Deferred assessments

If your results show that you have been granted a deferred assessment you should immediately check OASIS for details.

Deferred examinations/tests will be held from 15/02/2017 to 17/02/2017. Notification to students will be made after the Board of Examiners’ meeting via the Official Communications Channel (OCC) in OASIS.

Supplementary assessments

Supplementary assessments are not available in this unit.

Reasonable adjustments for students with disabilities/health circumstances likely to impact on studies

A Curtin Access Plan (CAP) is a document that outlines the type and level of support required by a student with a disability or health condition to have equitable access to their studies at Curtin. This support can include alternative exam or test arrangements, study materials in accessible formats, access to Curtin’s facilities and services or other support as discussed with an advisor from Disability Services (disability.curtin.edu.au). Documentation is required from your treating Health Professional to confirm your health circumstances.

If you think you may be eligible for a CAP, please contact Disability Services. If you already have a CAP please provide it to the Unit Coordinator at the beginning of each semester.
Referencing style

The referencing style for this unit is Chicago.
More information can be found on this style from the Library web site:

Copyright

© Curtin University. The course material for this unit is provided to you for your own research and study only. It is subject to copyright. It is a copyright infringement to make this material available on third party websites.

Academic Integrity (including plagiarism and cheating)

Any conduct by a student that is dishonest or unfair in connection with any academic work is considered to be academic misconduct. Plagiarism and cheating are serious offences that will be investigated and may result in penalties such as reduced or zero grades, annulled units or even termination from the course.

Plagiarism occurs when work or property of another person is presented as one's own, without appropriate acknowledgement or referencing. Submitting work which has been produced by someone else (e.g. allowing or contracting another person to do the work for which you claim authorship) is also plagiarism. Submitted work is subjected to a plagiarism detection process, which may include the use of text matching systems or interviews with students to determine authorship.

Cheating includes (but is not limited to) asking or paying someone to complete an assessment task for you or any use of unauthorised materials or assistance during an examination or test.

From Semester 1, 2016, all incoming coursework students are required to complete Curtin’s Academic Integrity Program (AIP). If a student does not pass the program by the end of their first study period of enrolment at Curtin, their marks will be withheld until they pass. More information about the AIP can be found at:
https://academicintegrity.curtin.edu.au/students/AIP.cfm

Refer to the Academic Integrity tab in Blackboard or academicintegrity.curtin.edu.au for more information, including student guidelines for avoiding plagiarism.

Information and Communications Technology (ICT) Expectations

Curtin students are expected to have reliable internet access in order to connect to OASIS email and learning systems such as Blackboard and Library Services.

You may also require a computer or mobile device for preparing and submitting your work.

You will need to make use of Blackboard and emails extensively to keep up to date with this unit. The teaching staff will assume that you check these facilities regularly.

For general ICT assistance, in the first instance please contact OASIS Student Support:
oasisapps.curtin.edu.au/help/general/support.cfm

For specific assistance with any of the items listed below, please contact The Learning Centre:
life.curtin.edu.au/learning-support/learning_centre.htm

- Using Blackboard, the I Drive and Back-Up files
- Introduction to PowerPoint, Word and Excel
### Engineers Australia (EA) Competencies Assessed and Level of Thinking

<table>
<thead>
<tr>
<th>Assessment Task</th>
<th>EA Professional Competencies Assessed</th>
<th>Level of Thinking</th>
</tr>
</thead>
</table>
| Test            | 1.1 Science / engineering fundamentals  
1.2. Conceptual understanding of maths and IT  
1.3. Specialist knowledge  
2.1. Problem solving  
3.2. Communication | Knowledge  
Comprehension  
Application |
| Laboratories    | 1.1. Science / engineering fundamentals  
1.2. Conceptual understanding of maths and IT  
1.3. Specialist knowledge  
2.1. Problem solving  
2.2. Use of engineering techniques  
2.4. Project Management  
3.1 Professionalism  
3.2. Communication  
3.3. Creativity  
3.4. Information management  
3.5 Self-Conduct  
3.6 Teamwork | Comprehension  
Application  
Analysis  
Synthesis |
| Final Exam      | 1.1 Science / engineering fundamentals  
1.2. Conceptual understanding of maths and IT  
1.3. Specialist knowledge  
2.1. Problem solving  
2.2. Use of engineering techniques  
3.2. Communication | Application  
Analysis  
Synthesis |

**ENGINEERS AUSTRALIA Stage 1 Competencies** and elements of competency assessed in this unit

1. **KNOWLEDGE AND SKILL BASE**

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

   **1.2. Conceptual understanding of maths and IT:** Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline.

   **1.3. Specialist knowledge:** In-depth understanding of specialist bodies of knowledge within the engineering discipline.

   **1.4. Development and research:** Discernment of knowledge development and research directions within the engineering discipline.

   **1.5. Context:** Knowledge of contextual factors impacting the engineering discipline.

   **1.6. Engineering practice:** Understanding of the scope, principles, norms, accountabilities and bounds of contemporary engineering practice in the specific discipline.

2. **ENGINEERING APPLICATION ABILITY**

   **2.1. Problem solving:** Application of established engineering methods to complex engineering problem solving.

   **2.2. Use of engineering techniques:** Fluent application of engineering techniques, tools and resources.

   **2.3. Systematic design:** Application of systematic engineering synthesis and design processes.

   **2.4. Project management:** Application of systematic approaches to the conduct and management of engineering projects.

3. **PROFESSIONAL AND PERSONAL ATTRIBUTES**
3.1. Professionalism: Ethical conduct and professional accountability.

3.2. Communication: Effective oral and written communication in professional and lay domains.

3.3. Creativity: Creative, innovative and pro-active demeanour.

3.4. Information management: Professional use and management of information.

3.5. Self-conduct: Orderly management of self and professional conduct.

3.6. Teamwork: Effective team membership and team leadership.

Levels of Thinking

Knowledge: Recall of something encountered before but without having to change it, use it or understand it; facts.

Comprehension: Understanding the knowledge that has been acquired without needing to relate it to other information.

Application: Use of a learned concept to resolve some situation or solve a new problem in an appropriate way.

Analysis: Separating something learned into its components for the purposes of thinking about the parts and how they fit together.

Synthesis: Generating or creating something different by assembling or connecting ideas in a way that makes a whole.

Evaluation: Looking at the particular value of materials, information or methods in characterizing the whole.

Enrolment

It is your responsibility to ensure that your enrolment is correct - you can check your enrolment through the eStudent option on OASIS, where you can also print an Enrolment Advice.

Student Rights and Responsibilities

It is the responsibility of every student to be aware of all relevant legislation, policies and procedures relating to their rights and responsibilities as a student. These include:

- the Student Charter
- the University’s Guiding Ethical Principles
- the University’s policy and statements on plagiarism and academic integrity
- copyright principles and responsibilities
- the University’s policies on appropriate use of software and computer facilities

Information on all these things is available through the University’s "Student Rights and Responsibilities" website at: students.curtin.edu.au/rights.

Student Equity

There are a number of factors that might disadvantage some students from participating in their studies or assessments to the best of their ability, under standard conditions. These factors may include a disability or medical condition (e.g. mental illness, chronic illness, physical or sensory disability, learning disability), significant family responsibilities, pregnancy, religious practices, living in a remote location or another reason. If you believe you may be unfairly disadvantaged on these or other grounds please contact Student Equity at eesj@curtin.edu.au or go to http://eesj.curtin.edu.au/student_equity/index.cfm for more information

You can also contact Counselling and Disability services: http://www.disability.curtin.edu.au or the Multi-faith services: http://life.curtin.edu.au/health-and-wellbeing/about_multifaith_services.htm for further information.

It is important to note that the staff of the university may not be able to meet your needs if they are not informed of your individual circumstances so please get in touch with the appropriate service if you require assistance. For general wellbeing concerns or advice please contact Curtin's Student Wellbeing Advisory Service at: http://life.curtin.edu.au/health-and-wellbeing/student_wellbeing_service.htm
Recent unit changes

Students are encouraged to provide unit feedback through eVALUate, Curtin's online student feedback system. For more information about eVALUate, please refer to evaluate.curtin.edu.au/info/.

To view previous student feedback about this unit, search for the Unit Summary Report at https://evaluate.curtin.edu.au/student/unit_search.cfm. See https://evaluate.curtin.edu.au/info/dates.cfm to find out when you can eVALUate this unit.

Recent changes to this unit include:

The assessment has changed since 2015. There is now no longer an assignment, but instead the lab reports have been made larger to more fully integrate the lab experience with the learning of mass transfer concepts. See the “Assessment Tasks” section.
## Program calendar

<table>
<thead>
<tr>
<th>Date</th>
<th>Week Starting</th>
<th>Teaching Week</th>
<th>Lecture 1 Topic</th>
<th>Lecture 2 Topic</th>
<th>Workshop (Tutorial)</th>
<th>Labs</th>
<th>Assessment Due</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016/8/1</td>
<td>1</td>
<td>1</td>
<td>Intro to Mass Transfer</td>
<td>Molecular Diffusion 1</td>
<td>Workshop 1</td>
<td></td>
<td></td>
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<tr>
<td>2016/8/8</td>
<td>2</td>
<td>2</td>
<td>Molecular Diffusion 2</td>
<td>Convective Mass Transfer</td>
<td>Workshop 2</td>
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<tr>
<td>2016/8/14</td>
<td>3</td>
<td>3</td>
<td>Interface Mass Transfer</td>
<td>Vapour Liquid Equilibrium</td>
<td>Workshop 3</td>
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<tr>
<td>2016/8/21</td>
<td>4</td>
<td>N/A (See Assessment)</td>
<td>Distillation 1</td>
<td>NO WORKSHOP</td>
<td>CLASS TEST in Lecture Time</td>
<td></td>
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<tr>
<td>2016/8/29</td>
<td>TUITION FREE</td>
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<tr>
<td>2016/9/5</td>
<td>5</td>
<td>5</td>
<td>Distillation 2</td>
<td>Distillation 3</td>
<td>Workshop 4</td>
<td>LAB A 1</td>
<td></td>
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<tr>
<td>2016/9/12</td>
<td>6</td>
<td>6</td>
<td>Absorption 1</td>
<td>Absorption 2</td>
<td>Workshop 5 and Feedback from Class Test</td>
<td>LAB B 1</td>
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<tr>
<td>2016/9/19</td>
<td>7</td>
<td>7</td>
<td>Stripping 1</td>
<td>Stripping 2</td>
<td>Workshop 6</td>
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<tr>
<td>2016/9/26</td>
<td>TUITION FREE</td>
<td></td>
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<tr>
<td>2016/10/3</td>
<td>8</td>
<td>8</td>
<td>Extraction 1</td>
<td>Extraction 2</td>
<td>Workshop 7</td>
<td>LAB A 2</td>
<td>LAB REPORT A 1 Due</td>
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<tr>
<td>2016/10/10</td>
<td>9</td>
<td>9</td>
<td>Leaching 1</td>
<td>Leaching 2</td>
<td>Workshop 8</td>
<td>LAB B 2</td>
<td>LAB REPORT B 1 Due</td>
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<tr>
<td>2016/10/17</td>
<td>10</td>
<td>10</td>
<td>Humidification 1</td>
<td>Humidification 2</td>
<td>Workshop 9</td>
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<tr>
<td>2016/10/24</td>
<td>11</td>
<td>REVISION (Weeks 1-3)</td>
<td>REVISION (Distillation)</td>
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<td>PRESENTATIONS on LAB A 2 (in Workshop Time)</td>
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<tr>
<td>2016/10/31</td>
<td>12</td>
<td>REVISION (Absorption and Stripping)</td>
<td>REVISION (Extraction, Leaching, Humidification)</td>
<td>N/A (See Assessment)</td>
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<td>PRESENTATIONS on LAB B 2 (In Workshop Time)</td>
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<td>2016/11/7</td>
<td>STUDY WEEK</td>
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<tr>
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<td>Time</td>
<td>Location</td>
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<tr>
<td>2016/11/14</td>
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<tr>
<td>2016/11/21</td>
<td>EXAM Week 2</td>
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Final Exam