Syllabus MOOC TP101x

The Basics of Transport Phenomena

Learn the basic framework to work on a broad spectrum of engineering problems concerning transfer of heat, mass and momentum. Learn through examples of everyday processes at home, in the lab and in industry.

October 21st, 2015
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Introduction
Welcome to our MOOC on Transport Phenomena!
In this Syllabus you’ll find all info on how to progress through our MOOC. We have worked hard to make 7 weeks of interesting and interactive material. Check out below how the course is build up. Most importantly: please try to stay with the given weeks as we progress throughout the course. Our experience with other courses show that falling behind will in most cases end in not finishing the course.
The hard deadline for this course will be 23rd of December.
Only the graded questions and the final exam will add to your overall result. Getting 60% or higher will entitle you a certificate!
Hope to see you on our discussion forums!
**Build-up of the course & workload**

As shown in the intro movie, we have kept a consistent build-up of the course. The elements per week can be found below.

**Weeks**

<table>
<thead>
<tr>
<th>Subsections</th>
<th>Description</th>
<th>Estimated duration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Introduction (B)</strong></td>
<td>A video can be found here giving feedback on how we are doing so far and giving a small overview on the coming week. Furthermore a short description of the week, a formula sheet with the most important formulas and an estimated duration for this week can be found here.</td>
<td>15 min</td>
</tr>
<tr>
<td><strong>Chapters (C)</strong></td>
<td>A chapter is a learning block. Every chapter consists of units (F) (also known as a learning cycle). In these chapters you can find the lectures and (ungraded) exercises to practice your new knowledge. Our TA’s also have made some movie clips to make the course more fun and clear. For a more detailed description of a chapter, see below.</td>
<td>3 – 5 hrs</td>
</tr>
<tr>
<td><strong>Do It Yourself (D)</strong></td>
<td>We prepared some experiments which are fun to do and give you some insight in Transport Phenomena. You can do these experiments at home. We would like to hear from you how it went on the forum!</td>
<td>½ - 1 hr</td>
</tr>
<tr>
<td><strong>Graded Questions (E)</strong></td>
<td>At the end of every week we have made some exercises – these are obligatory if you want to get a certificate. To grasp the concept of this course, doing the exercises in the chapters before you do the graded questions is highly recommended.</td>
<td>1½ - 2 hrs</td>
</tr>
<tr>
<td><strong>Time for discussion forums</strong></td>
<td>Share your experiences, share interesting links, help others, ask questions, check out stuff others share... Being involved this way improves your learning!</td>
<td>½ - 1 hr</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>6 – 9 hrs</td>
</tr>
</tbody>
</table>

A week (A) consists of 5 or 6 subsections. Every week should take you 6-9 hours of work. Besides putting effort in the work we also expect you to spend ½ - 1 hr per week on the discussion forums.
# Units

<table>
<thead>
<tr>
<th>Unit</th>
<th>Description</th>
<th>Estimated time</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Introduction</strong></td>
<td>A short description of the chapter, with an estimated time given per unit.</td>
<td>2 min</td>
</tr>
<tr>
<td><strong>Spark</strong></td>
<td>A short funny movie to give you an idea of the concept we will teach you in this chapter.</td>
<td>5 min</td>
</tr>
<tr>
<td><strong>Theory</strong></td>
<td>The course teachers will explain the concepts of the chapter.</td>
<td>30 - 60 min</td>
</tr>
<tr>
<td><strong>Examples</strong></td>
<td>With Transport Phenomena you can solve a wide range of problems. To get you started, the course teachers will help you get the problem solving skills by giving you some examples of how they handle a question.</td>
<td></td>
</tr>
<tr>
<td><strong>Exercises 1</strong></td>
<td>To get a good understanding, you also have to do exercises. Transport Phenomena is only learned by doing!</td>
<td>30 - 90 min</td>
</tr>
<tr>
<td><strong>Exercises 2</strong></td>
<td>More exercises for getting a good understanding.</td>
<td></td>
</tr>
<tr>
<td><strong>Answer Video's</strong></td>
<td>We tried to facilitate your learning as good as possible by letting our course team students solve all exercises for you. But don’t be tempted not to do it yourself!</td>
<td>10 - 30 min</td>
</tr>
<tr>
<td><strong>Ending</strong></td>
<td>Here you can check if you got all the learning objectives. We end every chapter with a short text, so you know what we wanted you to learn in this chapter.</td>
<td>2 min</td>
</tr>
</tbody>
</table>
Grading

Of course you would like to earn a certificate, right? What do you have to do for that:

- **Practice!** Do the exercises in the Chapters before trying the Graded Questions and check the answers. You learn the most from what you do yourself. Also check the example videos on the glass plate.
- **Try to keep up the pace.** Our team will be ready to help you during the course but unfortunately we do not have an infinite capacity. The focus of our TA’s main focus lies on the ‘current’ week (see Deadlines for more information).
- Do the **Graded Questions!** These are graded and account for 70% of your final grade. The lowest mark of the 6 weeks is dropped.
- Do the **Final Exam** in week 7. This will account for 30% of your final grade.
- **Get a 60% overall grade.** You can now call yourself a Master in the Basics of Transport Phenomena!

<table>
<thead>
<tr>
<th>Week (only graded questions)</th>
<th>% of overall grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>70*</td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
</tr>
<tr>
<td>7 (final exam)</td>
<td>30</td>
</tr>
</tbody>
</table>

* The lowest grade of the first 6 weeks will be dropped.

Deadlines

The course consists of 7 weeks. The course content will be launched sequentially, starting on **Wednesday 21st of October 2015** with week 1 and the last week is launched on **Wednesday 2nd of December 2015**. The course moderators and course teachers will mainly focus on the forums in the current week, following the scheme below. Although we recommend you to try to follow the course on a weekly basis, the course has only one final deadline: **23rd of December, just before Christmas (23rd of December)**, so you as well as us can quietly enjoy the holidays!

The certificates will be issued shortly after the 23rd of December.

<table>
<thead>
<tr>
<th>Week</th>
<th>Start date</th>
<th>Suggested deadline</th>
<th>Hard deadline</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>21-oct</td>
<td>28-oct</td>
<td>23-dec</td>
</tr>
<tr>
<td>2</td>
<td>28-oct</td>
<td>04-nov</td>
<td>23-dec</td>
</tr>
<tr>
<td>3</td>
<td>04-nov</td>
<td>11-nov</td>
<td>23-dec</td>
</tr>
<tr>
<td>4</td>
<td>11-nov</td>
<td>18-nov</td>
<td>23-dec</td>
</tr>
<tr>
<td>5</td>
<td>18-nov</td>
<td>25-nov</td>
<td>23-dec</td>
</tr>
<tr>
<td>6</td>
<td>25-nov</td>
<td>02-dec</td>
<td>23-dec</td>
</tr>
<tr>
<td>7</td>
<td>02-dec</td>
<td>09-dec</td>
<td>23-dec</td>
</tr>
</tbody>
</table>
Course content and main learning objectives

<table>
<thead>
<tr>
<th>Week</th>
<th>Title</th>
<th>Content Description:</th>
<th>Main learning objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Balance equation: Our working horse</td>
<td>Total mass balance and component balance (no chemical reactions)</td>
<td>Student is able to set up and solve total mass balances and component balances</td>
</tr>
<tr>
<td>2</td>
<td>Energy balances</td>
<td>Thermal and mechanical energy → Bernoulli</td>
<td>Student is able to set up a total energy balance</td>
</tr>
<tr>
<td>3</td>
<td>Drag force</td>
<td>Flow around objects and drag force</td>
<td>Student is able to calculate terminal velocity</td>
</tr>
<tr>
<td>4</td>
<td>First steps into heat and mass transfer</td>
<td>Conduction and diffusion: molecular transport forms 1-dimensional temperature and concentration profiles</td>
<td>Student is able to derive the temperature and concentration distribution in a 1D-geometry using energy and mass balances</td>
</tr>
<tr>
<td>5</td>
<td>Newton’s law of cooling</td>
<td>Including overall transfer coefficient and resistance</td>
<td>Student is able to use the concept of transfer coefficients</td>
</tr>
<tr>
<td>6</td>
<td>Unsteady conduction and diffusion</td>
<td>Penetration theory as well as heat transfer for long times</td>
<td>Student is able to apply Fourier / Fick’s second law</td>
</tr>
<tr>
<td>7</td>
<td>Transport Phenomena in the world around us</td>
<td>Application of learned modules of previous weeks to different situations</td>
<td>The student is able to apply the concepts of Transfer Phenomena to problems observed at home, in a laboratory and industrial environment</td>
</tr>
</tbody>
</table>

Prerequisites
High School physics and basic knowledge of calculus (derivative, integral, simple differential equations) and thermodynamics (concepts of first law and second law, properties of fluids, heat effects).

Course materials
Freely available:
- Weeks 1 to 7 that contain, amongst other things: theory, exercises, graded questions and a final exam
- Weekly formula-sheet

Recommended:
All materials you need will be freely available in this MOOC. But, if you really want to dive into Transport Phenomena for professional reasons, we recommend the book written by Harry van den Akker and Robert Mudde.

With the link below, you can easily order it on Amazon.
Communication and sharing

One of the great benefits of following a MOOC is that you can do it at home. A small drawback could be that it is harder to interact, ask direct feedback and be motivated by each other. But, the many discussion forums in the MOOC will be a great replacement for that! Try to meet each other on the discussion forums and/or on other platforms (Facebook, LinkedIn, etc)! Share interesting links and movies with us. We would really like to see what you all produce. For us it is also interesting to see you are also having fun! Please share your learning experiences with us on the discussion forms!

Take into account that our course team as well as the lecturers will check the forums. Therefore we take some general rules into account:

- Help others with questions. Answering questions will help you master TP
- Follow instructions by our TA’s
- The TP101x-team will check the forums regularly and try to help where needed
- Lecturers will also check the forums
- Please use normal language (check our forum guidelines)
- Share nice and interesting links with us via the forum or to MOOC-TP@tudelft.nl!

Course team

Course Teachers

Prof. Robert Mudde
Professor in Transport Phenomena

Dr. Peter Hamersma
Professor in Transport Phenomena

Course Manager

Vincent Renken
Coordinating the Transport Phenomena MOOC development

MSc in Bio-Pharmaceutical Sciences and Chemistry Education
Road biking, rock climbing, playing piano, table tennis, squash, improvisation theater

Community Managers & Teaching Assistants

Max van Amsterdam
Exercises, answer video’s and sparks

MSc Chemical Engineering, 1st year
Skiing, Sports & cooking.

Ruben Blesheuvel
Questions, graded Questions, sparks, answer videos, forum moderation
MSc Applied Physics, 1st year
Cooking and Weightlifting
Teaching Assistants

**Sharon Bosch**
*Sparks, exercises, answer videos, DIY, and graded questions.*
- BSc Molecular Science & Technology, 3rd year
- Hockey, running, skiing, handball, photography, travelling and reading literature.

**Anne de Blécourt**
*Course reviewer*
- MSc Applied Physics, 1st year
- Playing percussion, sailing

**Thysia Kleijwegt**
*Didactic input and betatester*
- MSc Real Estate & Housing (Architecture), 1st year
- Education, craftwork and housing

**Ivar de Hoogt**
*Introductions, exercises/graded questions & answer videos*
- MSc Systems & Control
- Chess, tennis, soccer, reading light novels, drinking beer is definitely included

**Guus Koipa**
*Sparks, video editing, questions*
- BSc Nanobiology, 3rd year student
- Skating, gaming and laying in the sun

**Boy Körver**
*Exercises, sparks, answer videos, management of the development process*
- Graduate student MSc. Applied Physics
- Video games, football and music. Also a big Star Wars fan

**Marijn de Smit**
*Designing the presentations*
- MSc Intergrated Product Design (Industrial Design Engineering), final year
- Graphic design, soccer

**Jochem Visser**
*Sparks, exercises, answer video's*
- MSc Chemical Engineering, 1st year
- Playing djembé, playing piano, scuba diving

**Loesie Willemsen**
*Graphic Design, Editing, Supporting*
- MSc Design For Interaction (Industrial Design Engineering), 1st year
- Sketching, Dancing, Music, Bicycling
Contact us
Of course you can contact us any time by posting on the forum.

If you want to give us feedback or have questions you do not want to post on the forum, you could email us at MOOC-tp@tudelft.nl.

We also have a YouTube channel (Transport Phenomena) where you can share your videos during the course by using the hashtag: #TP.101x15. For some weeks we will open a new playlist, so check the forum to see the hashtag to use in every week!

We hope you will enjoy the course as much as we had making it! Good luck and see you at the forum!