Preparing for Academic Success
In Applied Earth Sciences at Delft U. of Technology

Summary

The Applied Earth Sciences MSc is an interdisciplinary program, and we accept students from a variety of disciplines. Many incoming students lack, or are weak in, some aspect of the preparation we expect in our program. For instance, incoming students from various branches of engineering or applied physics usually lack any introduction to geosciences. Others, especially those who have been in the working world for a few years, need to revitalize their math skills. Many of our students tell us that they should have prepared better for the extensive use of computer programming in our curriculum. The summary below will help you decide which subjects you should prepare ahead of time, and give advice on how to do so.

If you have any questions, please contact Ayla Reerink at aylareerink@hotmail.com. Ayla is a current MSc student and can give you the best advice from the perspective of a student in our program. I have asked Ayla to send out this email, so you can contact her simply by replying to it.

There is a web site with information on preparing for our MSc: http://petro.citg.tudelft.nl/index.php?id=160000 .
There you will be able to find some useful information. This is a trustworthy university site, and you should be able to access it and download materials safely. This location includes

1. A description of our curriculum (2016-17 academic year) - document "AES_MASTER_2015_EN.pdf". The curriculum is substantially the same in 2017-18. Please note that this guide includes all the tracks in the Applied Earth Sciences MSc program. Your track, Petroleum Engineering and Geosciences, is summarized on the chart on the first page.
2. Some study materials, which are referred to below, in folder "Study Material."
3. A Power-Point presentation to last year's entering class on their first day of class, describing the program and giving some advice.

Geosciences

Geology

Our current students who came without geology or geophysics in their BSc program say what's most important is a quick orientation to the concepts of geology, rather than a lot of detailed study. To achieve this, we strongly advise you take the Massive Online Open Course (MOOC) prepared by Prof. Bertotti, dedicated to the basics of geology. The course, called geoMOOC, opened on May 30th and lasts 6 weeks. **Register now, if you have not already done so!** After 16 June, you will not be able to participate in this MOOC fully (taking the exams, receiving feedback, and completing the course). This course requires a time commitment of 8-10 hours/week for a series of weeks. You don't need to obtain the certificate for completion unless you want to. For some time after June 16 you will still be able to watch the videos but not take the exams to check your progress. Search for the geoMOOC (Geoscience: the Earth and its resources) at www.edx.org and register. Hundreds of individuals from all over the world participated last year in the first edition of the geoMOOC and have provided very positive evaluations on the course.

If you miss the registration deadline for this MOOC, there another online course that may be helpful: Introduction to Petroleum Geology, taught by former Prof. Luthi of TU Delft https://ocw.tudelft.nl/courses/petroleum-geology/

This course was taught in previous years to orient students from a non-geoscience background to our MSc program. There is not the opportunity to check your knowledge in this online course as there is with Prof. Bertotti's MOOC, but you can watch the lectures and see the course materials.

A final alternative is to read the BSc-level introductory book: *Sedimentology and Stratigraphy* by Gary Nicols (published by Wiley-Blackwell). The most important chapters to read are 1, 2, 4, 6, 9, 12, 13, 14, 15, 16, 21, 22 and 24.

Geophysics

We plan to offer a series of lectures this fall introducing reflection seismics for those who lack a background in geophysics. This course is of necessity compressed, and some of our students suggest it is challenging. If you lack a background in seismic interpretation and want a head start on this course, you will be able to find a text in the Study Materials folder of the web site described above (Study Materials/Reflection Seismics). Our students advise that you read these materials ahead of time, even if you plan to take the introductory course this fall. It will help you come up to speed in that course more quickly.

Petrophysics

For students lacking a background in this subject we will require a 1-credit class this fall (the credit can be counted against the electives requirement in our program). As with the course on reflection seismics, this course is compressed, and some of our students suggest it is challenging. If you want a head start on this course, you can find a text designed for self-study and a set of lecture slides under the Study Materials heading at the web site described above (Study Materials/Petrophysics). As with the geophysics materials, our students advise that you read these materials ahead of time, even if you plan to take the introductory course this fall.

Mathematics

Here is a list of specific topics you should be comfortable with:

From Analysis:

- (Partial) Differentiation of multivariate functions

Differential Equations:

- First-order differential equations
- Systems of first-order linear differential equations

Linear Algebra:

- Systems of linear equations

Numerical methods for initial value problems

- Numerical integration
- Non-linear equations

Probability and Statistics

- Mean, median, mode, range
- Probability-density function (incl. uniform, normal, binominal distributions)
- Discrete versus continuous variables

- Random versus stochastic variables
- Covariance, correlation, independence
- Bayes' theorem, conditional probability
- Estimators: e.g., maximum-likelihood, maximum a posteriori, method of moments
- Linear regression
- Confidence interval, precision, accuracy
- Testing of hypotheses

The Self-Study Guide at the web site has a list of texts on these subjects, but instead I would advise that students look first at their own course notes and texts from their Bachelors programs. That text and approach is probably already more familiar to you than starting with a new text. One good text for those new to probability and statistics is the Schaum Outline in this subject. Many years ago, when I would need to learn a completely new subject on my own, I found the Schaum Outlines a good start for the uninitiated. They are also available on a variety of subjects besides probability and statistics.

Computer Programming, MATLAB

We make extensive use of MATLAB programming in our curriculum, to work with and illustrate technical concepts. There is a compulsory course at the start of the fall semester on MATLAB. Some current students tell us that if someone is not familiar with computer programming, some preparation ahead of time is good.

We are revising the format of that course this fall. When that revision is complete in late July, we will contact you again with the revised course text that you can read ahead of time to prepare for the course.

Meanwhile, one of our instructors suggests the following YouTube instructional videos:
http://www.youtube.com/watch?v=jTS5ZmrrzMs
http://www.youtube.com/watch?v=lWSsUH_MQM4
http://www.youtube.com/watch?v=UKU1477cXVY
http://www.youtube.com/watch?v=WpAXzSJJqW4
http://www.youtube.com/watch?v=OisFNNzz3xQ
https://youtu.be/8wiIV-NfYwc

One student recommends the following online course:
https://www.coursera.org/learn/matlab

Those are the topics that our current students tell us are the most important to prepare before your arrival. I look forward to meeting you all this fall, and I wish you the best of success in your studies!

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