

# UNIVERSITEIT TWENTE.

To: Prof.dr. A.A. Stoorvogel, Programme Director AM  
From: Programme Committee AM (OLC-TW)

## FACULTY OF ELECTRICAL ENGINEERING, MATHEMATICS AND COMPUTER SCIENCE

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PC-AM@utwente.nl	OUR REFERENCE	CC:
	EWI22/BOZ/10835/MvdK	--

SUBJECT  
Comments on the current draft bachelor curriculum AM

Dear Programme Director,

We have read the current proposal for a new bachelor programme Applied Mathematics with interest. After our discussion of May 10, we have the following main points of concern on this draft.

First, one of the goals for this proposal is to address the following issue: "There is a general feeling that we need to improve the ability of students to handle abstraction and to improve their logical reasoning." We wonder if this is resolved in this suggested curriculum, and how?


Second, several learning lines are not yet well described. We feel that the description of Calculus and Analysis is not sufficient, as the calculus part is not explicitly formulated. The way differential equations is treated from very basic, to simple nonlinear ODEs to an introduction to PDEs is not clear. These courses build on each other but without a clear start, it is not clear what the courses should contain.

Third, Academic skills, including presenting, is lacking. Also, programming skills have been discussed at length. The PC-AM wants to see more details on objectives than the placeholder "to be able to program in Python or R."

Finally, for the proposed double-degree programmes with AP and CS, we suggest that Hilbert Spaces is replaced by another course for AM/AP, while for AM/CS, we suggest to incorporate the project of AM-module 6 on machine learning.

More specific comments on modules and their components can be found below.

Best regards,

  
Hil Meijer  
Chair PC-AM  
Module 1;

DE ONDERNEMENDE UNIVERSITEIT

P.O. Box 217 7500 AE  
Enschede  
The Netherlands  
www.utwente.nl

## Linear Structures 1:

-The content given is exactly the same as the current 6 EC version, but in the new curriculum a student gets only 5 EC. This discrepancy is not explained.

-The exam consists of two parts. Does the resit have the same structure?

## Analysis 1;

-Will the resit also consist of two parts?

-Learning goal 6; "understand the principles..." It is unclear how this goal can be examined.

-Learning goals 8-12; we believe Learning goal 1 contains writing already, and also they appear as partially overlapping. These five are all about being able to give a correct proof and communicate it in written and verbal forms. This also re-appears for Analysis 2. Once you have obtained a learning goal, why should it be examined again? So would it be possible to squeeze these learning goals together? The goals are much related to the assessment form, and perhaps it is better to separate the knowledge and skills in testing.

-Final learning goal; the use of "this" on its own should be avoided, as it should be comprehensible on its own. The reference is unclear.

## Modelling 1;

Following the discussion on May 10 during meeting, we are not strictly against incorporating the part Programming into Modelling.

First, we are concerned about the nature and level of the programming instructions. Given the current description, we do not know what coding skills students will attain. We strongly suggest to provide a more detailed description. Such a detailed description should also apply to Modules 3 and 4, where the objective "Program in Python" is at this time only seen as a placeholder.

Second, we are concerned however that the proposed course is not positioned well to achieve its goal of individual skills for a student. An individual test helps, but within a project it could still be that only one or two students in a project group are involved with programming. Making Programming part of Modelling 1 does not necessarily resolve that issue. It has been stated orally that coding is an important part for some Modelling assignments, but we feel we cannot judge that as the description does not make that link very clear. Linking programming to computations and visualization for functions and linear algebra is also useful, and does not require it to be part of Modelling 1.

We conclude that we insist on seeing more details for this course, and that Programming has a clear separate identity in this course.

Textual; remove "basically", it makes people feel awkward, and in this case you suggest you mean something else.

## Module 2;

Linear Structures 2: The comment on LS1 carries over. This 1 EC difference is still not explained.

## Analysis 2:

- Learning goals; see Analysis 1.
- typo: "...functions on an interval. focus on..." ->?
- partial integration=integration by parts?
- there is one empty bullet at the end

## Systems Theory:

- Description; There is no such thing as an unstable ODE. It is slang for an ODE with a solution diverging away from the desired one.
- The re-ordering is strange; the ODE course after Systems Theory, where we treat a given system, and here we design time-varying inputs on top of it.
- Learning goal 1; it is unclear which methods students learn to solve the ODEs.
- Learning goals: The connection to Linear Structures 2 with matrix exponentials is not made, but it would be almost ideal to do so. Note that that requires Jordan blocks to be treated in LS 2 which currently is not done.
- An assignment is mentioned, but whether this is individual or group work(how large?!?) is unclear. The division between theory and practical aspects is unclear too.
- We conclude that the current description of Systems Theory requires improvement, and that the assignment could be described better.

## Module 3;

General; the courses use two partial tests, but that also increases workload for both teachers and students. Is it still necessary to have two tests?

## Signals and Transforms;

- The current description requires Vector Calculus to be treated, and the new description is the same. Currently, VC treats the theorems of Gauss, Stokes and Green, but this is moved to Module 5, so that this is not yet available. Can we remove this as the lecturer suggested, and mention for minor students to have sufficient math skills?

## Modelling 2: Time Series

- Change "should be able to report" to "report" to describe the activity and not the objective.
- "able to program in Python" as an objective is too vague compared to what Module 1 offers.
- Change "in the project you work in a group" to "in the project, the students work in a group?". That is, one should not address the student.
- Is the test partially individual for programming?
- Again, remove "basically".

## Module 4;

### Differential Equations;

- We cannot judge whether the course can be taught this way as Systems Theory is not described in sufficient detail. It has implications for the PDE course in module 11 too.

-There is a change from 4 to 5 EC without changing objectives or material. It is natural to add boundary value problems arising from second-order PDEs. This topic was dropped when the course changed from 5 to 4 with the introduction of TOM.

Numerical Mathematics;

-The current version has weekly homework. That may be a little too much, but two homework assignments may be too few. It is good if the course has some practical aspects. We suggest four, biweekly homework sets.

-How much overlap in programming is there w.r.t. Project?

Modelling Project;

-It is unlikely the project in its current form can still be taught. Systems theory is lacking (e.g. minor students), the numerics course changes, and other unforeseen issues may arise.

-The description suggests to have a programming part on simulating ODEs, but this is also covered in the Num Math course simultaneously. Is the test partially individual for programming?

Module 5;

Mathematical Statistics 1;

-Instead of a list of topics, it is better to add a description how these topics are discussed.

-The Learning goals are too vague. Not all topics mentioned re-appear in the learning goals. The problem is that one is then teaching material that is not examined which is not motivating, for students.

-The applied part of AM is not well-reflected. R and data analysis are 25% of the course so this should be reflected in the learning goals and in the description.

Analysis 3;

-Can we add topics such as Cauchy sequences and completeness to the goals? Subsequent courses can then build on this knowledge.

-Learning goals 5 on con-/divergence of series is not sufficiently distinct from what is stated for Analysis 2.

Reflection 1;

-As the current historical part in module 3 is gone, the history of mathematical physics seems lost. However, the vector integrations theorems are taught in this module. Hence, it would be a good idea to connect to that too.

-The English of "Cases likes the use" has a rather unfortunate meaning. Please, rephrase.

Module 6;

Mathematical Statistics 2;

-The final concept "dependence" we cannot follow. This text is a little too short. Instead of a list of topics, a description how these topics are treated is more attractive.

-Delete "use" in the first learning goal as this is covered in the second one.

-R and data analysis are a substantial part of this course, but the difference in teaching R w.r.t. Math Stat 1 is unclear.

## Optimization

-Since we use British English at UT, should it not be Optimisation (with an s)?

-The learning goals use "describe" and "explain", this is hard to test. AS a suggestion, the current MO-course uses "knows conditions and how to check them" for proofs.

## Optimization Methods and Neural Networks;

-The Newton method is treated in Numerical Mathematics, module 4. We suggest to not treat topics again, or provide a more concrete description. Please arrange a discussion between the involved lecturers. Also just recapping the Newton Method is an option, as a prelude to gradient descent.

## Module 8;

What are the implications for this module now that IEM will not follow this module anymore? Do we need to update the module description or not?

## Project Stochastic models:

-what does "implementation in a computer" mean exactly? Is any language fine for instance? Maybe this could be stated then.

## Module 11;

Graph Theory; We would like to understand how this course differs from the project in module 7, and how it adds. We believe the way things are taught in practice differs from what is described in this proposal.

## Intro to PDE;

There is no description yet. If boundary value problems are added to the ODE-course, then it has implications for this course as well. We should also note the current course is 5 EC, and we have seen a new proposal which was suggested to have a too high workload. We value the previous proposal for a more theoretical treatment, which touches on numerics a bit, but we would not make the numerics the bigger part.

Electives; While a specific choice is not yet given, we believe this is what we can agree with for now.

## Module 12;

### Complex Function Theory;

-It would be much better to spell out the learning goals instead of summarizing text. Rather than knowing the basic concepts, it would be good to add that the student can work with those as well, and not just in the context of theorems.

-typo: "knowns"

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Reflection 2;

-After reading the description, we do not know what is treated in this 2 EC part.

-"can have insight" is an unfortunate formulation of a learning goal, please change. We do not want to leave it to chance.

Bachelor project;

-The description suggests students work on a model, but the learning goals do not relate to the model. Practically, the past years we saw some students working on topics not involving modelling. Hence it seems wise to adopt the description to the practice.

We note Presentation Skills is not treated in the current curriculum.

For the double degree programme with Physics:

-The topics of Hilbert space in module 6 are already mostly covered in Linear Structures, module 2. Also OSIRIS mentions it is 2 EC, not 3 EC.

For the double degree programme with Computer Science:

-Math Statistics 2 has been proposed as a 5 EC course, not 7, making the total 22 EC for module 6, not 21.

-The project from module 6 seems like a proper additional topic for module 10.