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Subject:	Module 2 Smart environmrnts handleiding en verbeteringen
Attachments:	Verbeteringen 2015.pdf; Manual Smart Environments-2015-v1.0.pdf

Hallo Mannes,

Ik heb begrepen dat module 2 op de agenda staat van de komende olc. Een beetje laat (organisatie van de module had even een iets hogere prioriteit), maar bijgevoegd zijn de nieuwe handleiding en een document met de verbeteringen in de module t.o.v. de vorige jaren.

Groeten,
Hans

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Create Module 2 Smart Environments (2015-2016)

J. Scholten
8 november 2015

De derde editie van Module 2 Smart Environments gaat van start in het tweede kwartiel van het studiejaar 2015-2016. De bevindingen van het eerste jaar zijn terug te vinden in Bijlage A. De belangrijkste problemen die bij de evaluaties boven water kwamen en de maatregelen die vorig en dit jaar genomen zijn zijn de volgende:

- Niet alle informatie is aanwezig of is niet goed te vinden op Blackboard
- Het is niet duidelijk wat de gevolgen zijn van het missen van een onderdeel

  Blackboard is nu anders georganiseerd met een betere structuur. Elk onderdeel heeft een eigen folder, maar bijvoorbeeld alle toetsresultaten zijn op een plek terug te vinden. De modulehandleiding is veranderd en staat prominent op de site. Zaken als leerdoelen, beschrijving van de verschillende onderdelen, tentaminering, berekeningen van cijfers en toetsdata zijn erin opgenomen.

- Er is grote druk door de hoeveelheid nieuwe opdrachten elke week en het verbeteren van opdrachten van de week ervoor
- Systematic Engineering and Design, hoewel een klein onderdeel, overschaduwde het project

  SED was inderdaad een grotere last dan de 1EC die ervoor staat. Vooral de reeks van documenten die geschreven moesten worden, gecombineerd met de herziene versies de week erop gaven een grote werkdruk. SED als apart onderdeel is in het tweede, en nu het derde jaar, geïntegreerd in het project en het aantal te schrijven documenten is verminderd. Voor het project en SED moet nu een projectplan, tijdsplanning en ontwerp geschreven te worden (in een document gecombineerd) en dienen twee presentaties te worden gegeven.

- Het tempo is te hoog en er is geen ruimte voor ziekte of andere tegenslagen

  De opzet van TOM werkt het gevoel dat het tempo te hoog is in de hand. De vele opdrachten van met name SED werkte dit gevoel nog eens in de hand. Bovendien moest zelfs de kleinste opdracht met een voldoende worden afgesloten, anders kon geen geen voldoende eindcijfer worden gehaald. Vorig jaar is de opzet van SED veranderd (zie het vorige punt) en blijkt nu geen struikelblok meer te zijn. Het tempo is nog steeds hoog, maar wordt nu niet als te hoog door de studenten ondervonden.
  Afgelopen jaar is zoveel mogelijk rekening gehouden met ziekte en andere dringende redenen waardoor onderdelen van de module werden gemist door extra herkansingen toegesneden op de student aan te bieden. Vrijwel iedereen die met dit probleem te kampen had is op deze manier geholpen. Ook dit jaar wordt deze manier van werken aangehouden
  Dit jaar is de berekening van de eindcijfers van EDF en PPC veranderd. Kon het in vorige jaren gebeuren dat iemand een onvoldoende kreeg als eindcijfer omdat een kleine

opdracht niet was afgetekend, nu is geen enkele opdracht apart fataal. In de regeling van dit jaar worden punten voor elk op tijd ingediende opdracht toegekend en elke niet ingediende opdracht levert een kleine aftrek op. De student heeft dus nu zelf de keus een opdracht niet te doen en de tijd ergens anders aan te besteden. Bij zowel EDF als PPC komen de onderwerpen van de opdrachten terug in de tentamens, waardoor toch aan de leerdoelen wordt voldaan.

- De wiskunde component in de module staat geïsoleerd van de rest en de toetsen zijn te moeilijk

  Vorig jaar zijn EDF en IMM aan elkaar gekoppeld. Onderwerpen die 's morgen bij de wiskunde aan de orde komen worden in de context van EDF nog eens herhaald en toegepast. B.v. wiskunde behandelt sinussen en EDF past ze toe bij het onderwerp geluid/muziek.
  Studenten die grote moeite hebben met wiskunde krijgen de mogelijkheid om in het kader van een challenge in Portfolio een build-up course wiskunde te volgen.

- De module is te fijnmazig, d.w.z. teveel kleine onderdelen tellen mee voor het eindcijfer

  Vorig jaar zijn de clusters ingevoerd om de onderwerpen in de module beter op elkaar af te stemmen en om integratie van onderdelen te bevorderen. Een bijkomend voordeel is dat het aantal eindcijfers voor onderdelen is verminderd van 7 tot 5, wat het overzicht in de module verbetert. De clusters zijn Introduction to Engineering (EDF en IMM), Ubiquitous Systems (PPC en SE), en Project (CA2 en SED). Portfolio en Sketching blijven als afzonderlijke onderdelen bestaan.

- Groepen kunnen uiteenvallen met grote consequenties voor de overgebleven studenten

  Dit is inderdaad in het eerste jaar gebeurd. Sinds vorig jaar wordt actief gekeken hoe de groepen zich ontwikkelen, bv. door aan het begin van elk college SE of tijdens het project hier tijd voor te reserveren. Groepen die te klein worden doordat studenten afvallen worden gecombineerd met andere groepen of de doelstellingen voor het project worden aangepast in overleg tussen de groep en de modulecoordinator.

- Hoe om te gaan met het werkethos van studenten. Er zijn altijd wel meelifters in projectgroepen.

  Ingaand dit jaar wordt het systeem van rode kaarten overgenomen van module 1.

Bijlage A – Bevindingen Module 2 na n.a.v. diverse evaluaties

Achtergrond

In dit document staat een aantal bevindingen beschreven naar aanleiding van evaluaties door de CreaTe Evaluation Committee (CREEC) en een informele evaluatie uitgevoerd door Erik Faber met een studentenpanel van 10 studenten op 12 maart 2014. Sommige punten die hieronder vermeld staan zijn niet uniek voor deze module maar komen terug bij andere modules.

Bevindingen

1. Blackboard en informatievoorziening overzichtelijk op 1 plek:
    a. 1 plek voor cijfers op blackboard.
    b. Contact informatie van alle betrokken docenten moeten op Blackboard te vinden zijn.
    c. Helder overzicht van deadlines en assignments per onderdeel.
2. De wiskunde (IMM) werd als teveel een stand-alone onderdeel ervaren. Volgens de studenten kon de docent zich moeilijk verplaatsen in “het (tempo en niveau) van het leren van de CreaTe student”. Toetsen vielen vaak zwaarder uit dan de proeftoetsen waardoor studenten niet goed wisten hoe ze zich moesten voorbereiden.
3. De module is te fijnmazig georganiseerd. Er zijn zeer veel onderwerpen die meetellen voor het eindcijfer (veel 1EC onderdelen). Voor de studenten zijn alle onderdelen even belangrijk omdat 1 onderdeel niet halen gelijk staat aan de hele module niet halen. Elke verplichte assignment en opdracht voelt aan als pass/fail voor de module. De snaar lijkt continu hierdoor (te) strak gespannen te zijn. “Learning skills should not become deadline skills.” (quote van een van de studenten).
4. Meer lucht inbouwen in deze module. Studenten ervaren het tempo als zeer hoog in deze module, zeker in vergelijking met module 1. Er is nauwelijks ruimte om een week ziek te zijn zonder op grote achterstand te komen met alle vakken (uitgezonderd wiskunde dat geen deadlines heeft).
5. Het is niet duidelijk wat de gevolgen zijn van het missen van 1 onderdeel van een vak.
6. In module 2 zal het vaker dan gemiddeld voorkomen dat projectgroepen uiteen vallen door studenten die besluiten te stoppen met hun studie (1 februari regel). Hierop zouden docenten al vroegtijdig moeten inspelen. Ook bij groepen die op een laat tijdstip in de module uiteenvallen zou er een beoordeling mogelijk moeten zijn dat studenten een duidelijke individuele component hebben ter beoordeling.
7. Er waren veel opdrachten die ingeleverd moesten worden in module 2. Het verbeteren (verwerken van de feedback) van deze opdrachten was niet in de tijdbegroting opgenomen. Veel studenten gaven aan druk bezig te zijn met zowel de opdrachten van een bepaalde week als met het verbeteren van de opdrachten van de week ervoor.
8. In het project gedeelte was de onderverdeling tussen Creative Applications 2 (CA2) en Systematic Engineering Design (SED). SED ging over fasering van projectwerk, planmatig werken en rapportage bij elke fase. Voor studenten overheerste het gevoel dat deze taak het project overschaduwde.
9. Kunnen kleine onderdelen (~1EC studiebelasting) als 1 blok worden gegeven (bijvoorbeeld een sprintweek waarin alleen dat onderdeel onderwezen wordt).
10. Hoe om te gaan met het werkethos van studenten. Er zijn altijd wel meelifters in projectgroepen. Shepherds van projectgroepen kunnen deze er niet altijd uitfilteren tot dusver.

Bijlage B – Toetsen in Module 2 Smart Environments

	wk 1	wk 2	wk 3	wk 4	wk 5	wk 6	wk 7	wk 8	wk 9	wk 10
EDF								T(1)	R(5)	P(1)
IMM			IT(1)		IT(1)	IT(1)			T(3)	R(5)
SEL						T(4)			R(1)	
PPC							T(1)		R(4)	
Sk				Pf				Pf		
Prtf										
CA2			P(5)					P(5)		DM(2)
PM			P(5)	D(5)						

IT: Intermediate test
T: Test
R: Resit
P: Presentation
DM: Demo market
Pf: Portfolio (day depends on group)
D: Documentation (PM project plan)
(n): Day of week: 1=Monday, 2=Tuesday, etc.

Manual Smart Environments

Quarter 2 – 2015-2016

Version of 14.10.2015

UNIVERSITY OF TWENTE.

Moduleteam

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Eddy de Weerd

Tutors

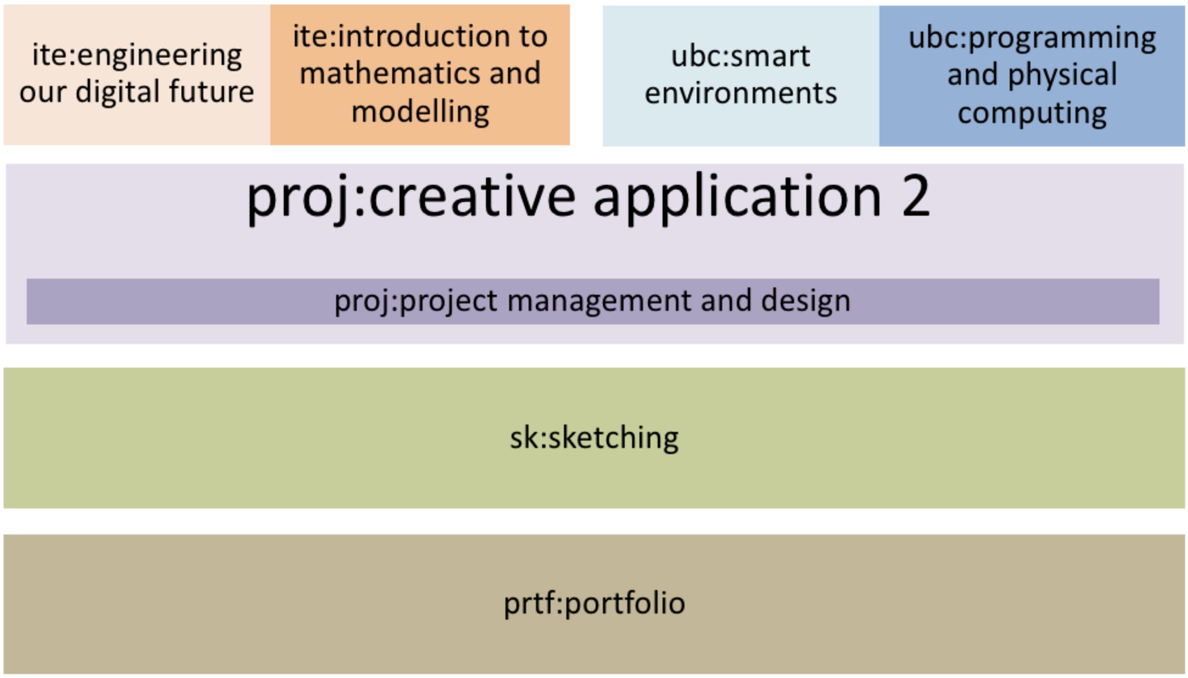
Introduction Smart Environments Module

The Smart Environments module serves as an introduction to Smart Technology. During this module, the students learn about the properties of Smart Environments, learn to translate a concept of a Smart Environment into a real one.

This manual provides an overview of the activities of the module. The parts within this module are described, the learning objectives listed in detail and the examination is explained.

In the Smart Environments module students learn various techniques from different disciplines that are needed to invent, design and realize (a prototype of) a smart environment.

Clusters and Subjects



The module has five clusters:

1. Introduction to Engineering (ITE)
2. Ubiquitous Computing (UbC)
3. Project (Proj)
4. Sketching (Sk)
5. Portfolio (Prtf)

Clusters one, two and three each consist of two parts

1. Introduction to Engineering:

    - Engineering our Digital Future (EDF)
    - Introduction to Mathematics and Modelling (IMM)

2. Ubiquitous Computing:

    - Smart Environment Lectures (SEL)
    - Programming and Physical Computing (PPC)

3. Project

    - Creative Application 2 (CA2)
    - Management and Design (PM)

For each cluster one final (sub-) grade will be given. For clusters as well as the module compensation rules concerning the final grade apply. These are explained in detail in the Examination section of this document.

Section Activities gives an overview of all subjects of the module. It should be noted that the schedule of the module at rooster.utwente.nl shows the separate parts of clusters and not the clusters as a whole.

Learning objectives

Smart Environments has a number of learning objectives, which are divided in domain specific skills and knowledge, and the generic skills that the students develop during the module. The main objectives are the following:

Generic Skills: Generic skills are skills that are not only applicable to smart environments or creative technology, but can be applied to other fields as well.

The generic skills that are taught in this module are in three domains:

- **Collaboration:** Students must be able to work in a team and be able to deal with problems that occur within a team in a professional manner.
- **Communication:** Students must be able to communicate about their work in writing and by giving a (verbal) presentation.
- **Project management:** The project is a first time for students to participate in a project using a structured and phased approach.

Domain specific skills and knowledge: The domain-specific skills are skills that are not applicable to all fields of science, but are specifically related to this field. In this module the domain specific skills include analysis, design and implementation.

- **Analysis:** Students must be able to analyse the problem.
- **Design:** Students must be able to make (parts of) a design of a solution for a given problem.
- **Implementation:** Students must be able to build a system according to a design.
- **Knowledge**: Students must have sufficient background knowledge to be able to make good choices for methods and techniques, and to be able to place their own work in context.
- **Mathematics and physics:** Students must be able to translate a problem into a mathematical description and solve it using a number of mathematical methods and techniques.

Generic Skills

In this section, learning objectives in the Smart Environments module with regard to the generic skills are described. These generic skills are divided into three subcategories of generic skills: project management, communication and collaboration skills. In this chapter, a list of competences the student should acquire during this module is shown. The generic skills are practiced in the project (Creative Application 2).

Communication

The communication skills taught in the module include both verbal communication skills and writing skills. Below, a list of competences is given which defines the communication skills the student should have acquired at the end of the module.

	Communication competences
Cm1	Students can present their work using reports, such as a project plan
Cm2	Student can communicate about their work in a verbal presentation
Cm3	Students can use tools, such as PowerPoint or other presentation software, to support a verbal presentation

Collaboration

Below, a list of competences is given which defines the collaboration skills the student should have acquired at the end of the project.

	Collaboration competences
Cl1	Students behave sufficiently assertive in the project group
Cl2	Students enter into concrete agreements and keep to these engagements
Cl3	Students participate actively in group meetings
Cl4	Students accept directions and feedback from coach and tutor
Cl5	Students accept feedback from other group members
Cl6	Students show a shared responsibility for the project
Cl7	Students show initiative (e.g. suggest solutions for problems with regard to project process and content)

Project Management and Design

The following table lists the competences that define the project management skills students should have acquired at the end of the project.

	Project management competences
P1	Students are able to separate the project in a number of phases
P2	Students are able to write down a project description
P3	Students are able to make a time schedule
P4	Students are able to make an estimation of the time that will be spent on each task
P5	Students are able to evaluate the organization of the project and reflect on their functioning during the project

Time Management

Below, the competences are given that define the time management skills the student should have acquired at the end of the project.

	Time management competences
T1	Students are able to set clear goals for the short and the long term
T2	Students are able to plan and prioritize own and group activities
T3	Students are able to make a planning fitting their own personality
T4	Students are able to recover from a period of falling behind

Domain-specific Skills

The Smart Environments module teaches students to invent, design and realize (a prototype of) a smart environment. This means that they need to be able to use various techniques that are specific for fields related to Creative Technology. After this course students must be able to do the following:

- Students must be able to analyse properties of a smart environment
- Students must be able to design a smart environment
- Students must be able to build a prototype of a smart environment
- Students must be able to use mathematical concepts in the context of designing and building a smart environment.
- Students must have knowledge about smart environments and related concepts.

In the sections below, these learning objectives are specified in more detail. For each competence, the part of the module in which it is assessed is listed. For this, the following abbreviations are used:

SK	Sketching
CA2	Creative Application 2
PM	Project Management and Design
EDF	Engineering our Digital Future
IMM	Mathematics and Modelling
PPC	Programming and Physical Computing
SEL	Smart Environments Lectures
PRTF	Portfolio

Analysis

One of the objectives of the Smart Environments module is to teach the students perform problem analysis in the context of smart environments. After successfully finishing this module, the students have knowledge of and experience using a number of analysis techniques.

	Analysis competences	
A1	Students must have introductory knowledge about the process of requirements analysis	PM
A2	Students are able to use sketching as a tool for creative thinking	SK
A3	Students are able to realize sketches with sufficient speed	SK
A4	Students are able to use sketching to communicate about the product's requirements	SK
A5	Students must be able to draw a story board	SK
A6	Students must be able to draw a info graphic	SK

Design

After successfully finishing the Smart Environments module, the student must be able to make a design in which special characteristics of a smart environment are considered. During this module the student is taught a number of techniques and approaches, including drawing techniques and system design techniques.

	Design competences	
D1	Students must be able to indicate hierarchy (system-subsystem-component) and their connections in a smart environment	PM, CA2
D2	Students must be able to motivate design choices	PM, CA2
D3	Students are able to explain basic principles of object oriented languages, such as objects, classes and subclasses, inheritance	PPC
D4	Students are able to use sketching to communicate about the product's physical appearance using perspective, construction and the basic principles of toning in a sketch	SK

Building

After successfully finishing the Smart environments module, the student must be able to build a prototype of a smart environment. To this aim, students acquire experience with programming different platforms and get experience with and knowledge about electronic circuits and building blocks.

Below, a list is given of what students should be able to do with regard to building after they finish the course.

	Building competences	
B1	The students are able to program, construct and document creative physical computing applications using a microcontroller (Arduino), a number of different sensors, actuators, interfacing electronics and communication media (wireless, internet)	PPC, CA2
B2	The students are able to write Processing applications using images, videos and text, input as well as output, serial input and internet connectivity.	PPC, CA2
B3	The students are able to apply basic principles of object oriented languages, such as objects, classes and subclasses (inheritance).	PPC
B4	The students must be able to motivate implementation choices (choice for sensors, platforms)	PPC, PM
B5	The students are able to document electronic circuits using software tools (Fritzing)	PPC
B6	Operationalize the skills learned in mathematics in a physical settings: a. Calculate average values of periodic functions using integral calculus b. Differentiate various periodic waveforms in inductors and capacitors. c. Integrate various periodic waveforms in inductors and capacitors. d. Analyze the i-v behavior of capacitors and inductors in practical settings (lab session)	EDF

Mathematics and physics

After successfully finishing the smart environments module, the students must have the following mathematical skills.

	Competences in Mathematics and Physics	
M1	The student understands mathematical concepts and techniques that form a basis for mathematical modelling of physical systems, necessary for subsequent courses in the curriculum.	IMM
M2	The students are able to analyse, graph and work with functions of one variable, in particular polynomials, trigonometric functions, power functions, exponential functions and logarithms.	IMM
M3	The students are able to differentiate functions of one variable. The student knows how to apply the rules of differentiation. The student understands the meaning of the derivative and can, also in applications, work out the derivatives of a function, using derivative rules and use this to describe the behaviour of functions, including extreme values and put a meaning on them in a particular context.	IMM
M4	The students understand the notion of the definite integral of a function of one variable and understands how the definite integral arises from the Riemann sum.	IMM
M5	The students are well versed in the methods of substitution and the method of integration by parts.	IMM
M6	Students can apply some basics of mathematical modelling in sound engineering.	EDF
M7	Operationalize the skills learned in mathematics in physical settings: e. Calculate average values of periodic functions using integral calculus f. Differentiate various periodic waveforms in inductors and capacitors. g. Integrate various periodic waveforms in inductors and capacitors. h. Analyse the i-v behaviour of capacitors and inductors in practical settings (lab session)	EDF

Knowledge

During the module, the students acquire theoretical knowledge about topics related to smart environments. In the table below, this domain specific knowledge is defined.

	Domain specific knowledge	
K1	Students understand what a smart environment is, and are able to explain and apply the five properties of a smart environment	SEL
K2	Students are able to explain how a wireless (sensor) network contributes to a smart environment	SEL
K3	Students are able to explain how context aware sensing contributes to a smart environment	SEL
K4	Students know the important terms in sound engineering and know 2 important standards for communication in sound engineering: a) Important terms in sound engineering: pitch, fundamental frequency, tone, volume, delay, timbre or color of an instrument, higher harmonics b) Important standards: a musical score and the MIDI protocol for transfer of instrumental data.	EDF
K5	Students know that real physical signals have an amplitude decaying in time (envelope function) where: a) The mathematical description is $s(t) = e(t) \cdot p(t)$ where $p(t)$ is the periodic function and $e(t)$ is the (amplitude) envelope function decaying in time (only linear and exponential functions are considered). b) Envelope functions can be divided in four intervals in time via the ADSR parameters c) The reverb time (RT60) time can be calculated of an envelope function	EDF
K6	Students know the following items, quantities, laws and relations and can apply these in the analysis of DC electric circuits with constant (static) signals: a. Quantities and signals: voltage V, current I, charge q b. Resistors: the element resistor, resistors in series and parallel, rules for simplifying series and parallel resistive circuits c. Sources: ideal voltage source d. Laws: Ohm’s law, Kirchhoff’s voltage (KVL) and current law (KCL) e. Application of voltage division and KVL: the voltage divider	EDF

Activities

Smart Environments Lectures

The lectures on smart environments give an introduction to smart technology, environments and applications. It shows how developments in computer and sensor technology have led to smart systems. These systems, as found in e.g. ambient intelligence, urban sensing, crowd sourcing and wireless sensor networks, are networks of embedded computers, smart mobile phones and smart sensors that offer new and innovative services deemed impossible with traditional computers. The five main characteristics of typical smart environments (autonomous, context-aware, distributed, implicit interaction and intelligent) will be discussed in detail. The Smart Environments lecture series consists of five lectures on concepts and theories.

Introduction to Mathematics and Modelling

In Introduction to Mathematics and Modelling two basic concepts of analysis are studied: differentiation and integration. The course starts with an introduction to functions of one variable. Basic concepts like transformation of functions and graph sketching will be treated. Standard functions like polynomials, trigonometric and exponential functions will be dealt with in detail.

The next topic is differentiation. What is differentiation and where does it originate from? The formal definition of the derivative is too cumbersome to use, and therefore we subsequently learn to calculate the derivative of a function by applying *differentiation rules*.

Finally, we introduce the notion of the definite integral. We learn that the definite integral arises from Riemann sums, and can be defined as a limit of such sums. However, the definition has limited practical use. For actual computations we use the Fundamental Theorem of Calculus, which gives a relation between differentiation and integration including a number of integration rules. Two major methods for calculating integrals will be presented: the method of *substitution* and the method of *integration by parts*. It will turn out that calculating integrals is much harder than calculating derivatives. We will train the integrating skills extensively by making lots of exercises.

For the Introduction to Mathematics and Modelling (IMM), each week four hours of *colstruction* (*a combination of a lecture and a tutorial*) are scheduled. These hours are used for a short lecture about the theory and for working on assignments. During the module, three intermediate exams are scheduled, one in November, one in December and one in January. The resit for all three of them is in the last week of January. IMM will be continued in module 3, introducing (among other things) *differential equations*.

Sketching

In Sketching basic skills will be developed for the expression of ideas and concepts through sketching. With practical lab training the basic principles of perspective drawing are taught. Topics are: perspective and drawing, rules for shapes and environments, learning to look and see the construction of the 3d world, design drawing as a tool in the early stage of product development, drawing as a communication tool, drawing as an aid for idea development.

For sketching, four hours of colstruction are scheduled each week. During these hours, students work on small assignments. Each week the students have to work on one assignment. In the course of the module, the students build a portfolio containing the drawings made for both the sketching assignments and the drawings for the project.

Engineering our Digital Future

Engineering our Digital Future consists of two topics that are both related to physics and physical signals.

Part 1 deals with an introduction into sound engineering and digital music. Most common terminology used in sound and music engineering will be discussed. The relationship between signal mathematics and music tones from (analog and digital) musical instruments will be shown via descriptions, manipulations, analysis and synthesis of sound signals. Furthermore, graphical representations in time and frequency domain (spectra) of signals will be introduced. A laboratory session on spectral analysis of signals will accompany this part.

Part 2 deals with an introduction into electric circuits. Most important quantities and elements in DC (static) electric circuits will be introduced (voltage, current, sources, resistors, voltage dividers). Furthermore, a first introduction is provided on AC (dynamic) electric circuits on a signal level (periodic waveform in electric circuits) and via the introduction of the two elements capacitor and inductor. Special attention will be paid to the i-v relationship of the R,L, C elements to get the student acquainted with integration and differentiating actions in electrical systems and signals, The latter will be accompanied by a lab session. This set-up serves multiple purposes: introduce students in an early phase with the physical side (hardware) side of creative technology; operationalize the mathematics of this module in real physical systems and settings; provide both a theoretical and practical base for the physical systems course in module 3.

Creative application 2: Smart Environments

In the Creative Application 2 project all parts of module 2 come together. The students work together in a group of 4 to 6 persons to invent a new smart environment. They design, build and demonstrate the prototype they make for this environment. The grade (Pass/Fail) is based on a number of criteria: novelty of the idea, compliance to the five smart environments characteristics, structured approach and quality and demonstration of the prototype.

Project Management and Design

Project Management and Design gives an introductory overview of some software engineering techniques. There are no lectures, but a reader is available for self-study. Students have to write a project plan for their project. Writing the document is a group activity. Presenting the plan, initial idea and design, and the final prototype are essential activities.

Programming and Physical computing

Programming and Physical Computing aims to equip the students with tools for programming interactive applications using input from the physical world. The course is divided into two parts, of which the second part is in the Smart Environments module. In the first part, programming using the 'Processing' environment is extended by the ability to use images and text and an extension of object oriented concepts. In the second part an introduction into programming with an embedded microcontroller platform (Arduino) is given. The used toolchain, communication, input, output and the use of libraries is explained. Also the connection with processing is dealt with, necessary for making interaction between the physical world (trough Arduino) and screen applications (Processing).

For Programming and Physical Computing, each week eight hours of colstruction are scheduled. The students work on small assignments, which need to be graded with "pass", and one larger assignment which is graded with a number.

Portfolio Course

The portfolio, developed during the project in the first module, will be updated with information about products, developed in the SE-project of this module.

The aim of the portfolio course (or rather the portfolio learning line) is to teach students methods to achieve their professional aims and continuously develop their individual and team skills.

During the Portfolio course of module 2 students will be trained in time management by their tutors and challenged to reflect on their project activities and their capacities in time management. Students will also be ask to take a 'challenge' during the module, spending time on a specific subject of interest (related to CreaTe) or take a catch-up course to get rid of some kind of deficiency.

As part of the '*challenge*' in the tutoring activities it will be possible to do a build-up physics course during module 2. This course is intended for students that did not take physics in the final stage of their pre-university education and are missing some basic knowledge. The subjects that will be treated arte

- **Electricity** (and Magnetism)
- **Mechanics** (Newton)
- **Energy and Work**
- **Appling the Laws of Physics** (e.g. Newton 's, Ohm 's, Hooke 's law)
- **Use of Physical Units** (m/s, kg/m^3, A/m^2, Volt, etc.)
- **Analogies** to help to bridge the gap between existing knowledge and new physical principles and phenomena.

The lectures will be scheduled in consultation with the teacher (Eddy de Weerd), mainly on Wednesday afternoon.

Examination

The module grade is the weighted average of the cluster grades using the weights shown in the table below. The module grade is rounded to the nearest integer from 1 to 10.
A student passes the module successfully if the grade for Project is a Pass, and Portfolio is a Pass, and all other cluster grades are at least 5.5.

If all of the above conditions are met but for one cluster (except Project and Portfolio, which always have to be a Pass), a student still passes the module successfully if the grade for this cluster is at least 5.0 but below 5.5, and one other cluster is 7.0 or higher, and the weighted average of all clusters is 5.5 or higher. If either Project or Portfolio is a Fail the student will not pass the module.

Some parts of clusters consist of assignments with deadlines. In contrast to previous years failing such a deadline no longer leads to failing the cluster or module. Instead, failing such a deadline leads to a reduction of the grade for that part of the module. Details can be found in the following sections. Please note that because of the reduction of grades it becomes increasingly difficult, but not impossible, to pass the module.

Cluster	Weight
Introduction to Engineering	36
Ubiquitous Computing	36
Sketching	28
Portfolio	Pass/Fail
Project	Pass/Fail

The grade for a cluster is the weighted average of the parts in that cluster. The grade is rounded to one place behind the decimal point. All parts within a cluster must have a grade of 4.0 or higher. If one or more parts are less than 4.0 no grade is assigned to that cluster, resulting in a Fail for the module. The Project cluster is only assigned a Pass if both parts Creative Application 2 and Project Management and Design get a Pass. The relative weights within clusters are shown in the following table.

Cluster	Subject	Weight
Introduction to Engineering	Engineering our Digital Future	30
	Introduction to Mathematics and Modelling	70
Ubiquitous Computing	Smart Environment Lectures	30
	Programming and Physical Computing	70
Sketching	Sketching	100
Portfolio	Portfolio	Pass
Project	Creative Application 2	Pass
	Project Management and Design	Pass

The following section describes the examination of the different parts in the clusters. It also shows how the tests in a part account for the final grade of that part.

Engineering our Digital Future

EDF has two written tests and 7 assignments that must be signed off (first opportunity). Students may sign off missing assignments in week 8 (second opportunity). The two tests are of equal weight. The maximum contribution to the final grade obtained with the tests (the average of both) is 8.6 points. Each assignment signed of at the first opportunity accounts for 0.2 point of the final grade. When signed off at the second opportunity it gets 0.1 point. Every assignment not signed off will reduce the final grade by 0.25 point.

Two examples: a student that obtains the maximum score for both tests (8.6) but fails to sign off all assignments (-7*0.25) will get the final EDF grade 8.6-1.75=6.85, which is rounded to 6.9.

A student that get the maximum score for the tests and signs off all assignments on time gets the final EDF grade 8.6+7*0.2=10.

Introduction to Mathematics and Modelling

Introduction for Mathematics and Modelling is examined using three intermediate tests and one final test. The final grade is calculated by taking the maximum of the final exam and the average of the three intermediate tests.

Programming and Physical Computing

The grade for Programming and Physical Computing is formed by 50% from a multiple choice test, by 50% from an end assignment that has to be demonstrated, and additionally a bonus or malus for doing the assignments according to the following rules:

- There are 6 assignments, one per week for 6 weeks. In general, the deadline for an assignment is Tuesday of the week after it was given. Then it has to be signed by student assistants and uploaded to blackboard. Having finalised an assignment before the deadline gives a bonus of 0.2 to the final grade, altogether a bonus of 1.2 is possible.
- Finalising an assignment (i.e. getting signed and uploaded) not before the weekly deadline, but before end of week 8 of the module, will still give a bonus of 0.1 on the final grade.
- Not doing an assignment (or only after week 8) will result in a malus of 0.25 on the final grade, i.e. per assignment not done the final grade will be 0.25 lower.

Altogether we have:

final grade = (grade for multiple choice + grade for end assignment)/2 + bonus - malus

Smart Environments Lectures

The grade for Smart Environments is based on one written exam.

Sketching

During the sketching lectures students build a portfolio. From this portfolio, the students submit ten drawings. These drawings include at least one drawing from the idea phase, one storyboard, one drawing of the final product and one exploded view from the final product in the project. The drawings are assessed using the following criteria: perspective, construction, composition, proportions, marker skills, speed, and communication.

Portfolio Course

The pass or fail for the Portfolio course is based on the participation in the group session(s) and individual meeting(s) and on the updated version of the professional portfolio (see information on Blackboard), the reflection assignment and the personal *challenge*. The rubrics provided by the tutor show the details and can be found on the tutoring Blackboard site.

Creative application 2: Smart Environments

The grade (Pass/Fail) is based on the following criteria: the prototype complies with the five smart environment components, quality of the prototype, demonstration of the working prototype, and two presentations. In the first one groups present the initial idea for a smart environment and the project plan (as part of "Project Management and Design"). The second presents the final design and prototype. During the demo market the working prototype is shown and demonstrated.

Project Management and Design

The grade (Pass/Fail) for Project Management and Design is determined by the document that has to be written as a group activity: project plan and design. The document must have a Pass.

Study Materials

Books

- "Learning Processing: A Beginner's Guide to Programming Images, Animation and Interaction", Daniel Shiffman, ISBN-13:978-0123736024.
- "Making things Talk", Tom Igoe, ISBN-13: 978-1449392437 (2nd edition recommended)
- "Thomas' Calculus, Early Transcendentals", G. Thomas et al. and MyLabsPlus.
- "Engineering Our Digital Future: The Infinity Project", Geoffrey C. Orsak" et al (recommended)
- "Sketching" the basics, Koos Eissen, BISpublishers, ISBN 978-90-6369-253-7 (recommended)
- "Skill Sheets", Rob van Tulder, ISBN 978-90-430-2313-9

Readers etc.

- Reader: "Physical Computing for Creative Technology"
- Reader: "Project management"
- Toolkit: "Arduino starter kit". Available as 'Create ProtoBox' at the STORES
- Sheets and handouts with assignments
- Materials for Sketching (via Proto/IAPC):
    - 1x Copic Marker Grey C2 (or N2)
    - 1x Copic Marker Grey C4 (or N4)
    - 1x Copic Marker Colour
    - 1x Copic navulinkt Grey C2 (or N2 if marker is N2)
    - 1x Copic navulinkt Grey C4 (or N4 if marker is N4)
    - 1x Loox Schneider ballpoint
    - 1x Markerblok A3
    - 1x Schetsblok A3
    - 1x Copic fineliner 0.3/0.5 grijs
    - 1x UniPin fineliner 0.5 zwart
    - 1x Derwent potlood Spectrum Blue

Schedule for Tests

The next table shows the weeks and days test or other events take place for the different parts of the module. The schedule does not show all deadlines for assignments. These, as well as any deviation from the schedule, can be found on Blackboard or will be announced during the lectures.

	wk 1	wk 2	wk 3	wk 4	wk 5	wk 6	wk 7	wk 8	wk 9	wk 10
EDF								**T(1)**	**R(5)**	**P(1)**
IMM			**IT(1)**		**IT(1)**	**IT(1)**			**T(3)**	**R(5)**
SEL						**T(4)**			**R(1)**	
PPC							**T(1)**		**R(4)**	
Sk				**Pf**				**Pf**		
Prtf										
CA2			**P(5)**					**P(5)**		**DM(2)**
PM			**P(5)**	**D(5)**						

IT: Intermediate test

T: Test

R: Resit

P: Presentation

DM: Demo market

Pf: Portfolio (day depends on group)

D: Documentation (PM project plan)

(n): Day of week: 1=Monday, 2=Tuesday, etc.