Fontys School of Engineering
Academic year 2021-2022

Engineering Minor
February 2021 – July 2021

Coordinator

W. Broekman Room: Rondom 0.17

Semester number: 6

Contents

1. Introduction

This guide was produced for students following the Engineering minor.
It contains information about the various modules and projects, the study load table, an overview of the examination moments and retakes, the year calendar and the booklist.

The Engineering minor is a minor in which you decide on your own route!
You can opt for greater depth in your study or broaden your horizons by selecting subjects from a different study programme. In general the minor consists of 5 theory modules and a project. The theory modules are worth 4 ECTS per module (total 20 ECTS) and the project is worth 10 ECTS. If you complete the minor with a pass grade, you will have scored your full 30 study credits.
New (in 2021)is the possibility to exchange at a maximum of 2 courses to extend the credits of the project. This will be confirmed with a learning agreement.

Technical students from the study programmes Mechanical Engineering, Mechatronics, Electrical Engineering and Automotive, can register for this minor. Students must have sufficient prior knowledge of the modules they wish to follow. In case of doubt we can ask students to demonstrate their prior skill.

Which project and which modules you can select will depend on the study programme you follow and the prior knowledge you have of the various subjects. The options per study programme appear in chapter 4.1 ‘Engineering minor: choice of subjects’. The subjects on offer are ordered according to the 3 study programmes Electrical Engineering, Mechatronics and Mechanical Engineering.

When you register for the minor, you must already have made your choice of project and 5 modules. This means that the information in this guide about the other modules is not applicable to you.
Perhaps unnecessarily: in the calendar and examination timetable for the minor, you only need to look at the modules which you have chosen.

This guide was prepared with the greatest possible care and attention. There may nonetheless still be errors or uncertainties. If in doubt, contact one of the coordinators. Should you have any comments or questions, or if important subjects are missing, please let us know.

On behalf of the Fontys School of Engineering, October 2020

The coordinator
Wim Broekman

2. Year timetable

Check the Fontys site: Year calendar 2021-2022.xlsx (fontys.nl)

3. Study load table, standards and Completing the minor

The study load table for the engineering minor in semester 6 consists of two elements

1	Project component: this module has a study load of		280 SBU
2	Theory component consisting of 5 modules each of 112 SBU		
	In total		560 SBU
Total		+	840 SBU

The project must be completed with a grade > 5.5. For the theory modules, each module must be ended with a pass grade > 5.5. How the final grade for a module is determined appears in the module descriptions.

The Engineering Minor is considered completed once all modules are concluded with a pass grade! At that point you have fulfilled your minor obligations.

Once the Engineering minor is fully completed, you will receive a minor certificate. For students of Engineering, the minor will be automatically ticked off in Progress (v pass). Students from other study programmes are required to submit the original certificate to the company office or secretariat of their study programme, as proof of completion. The staff will prepare a copy and tick off the minor.

In the event of disputes about the minor, complaints can be submitted to the central Examination Board Chamber at Fontys Engineering. In other words not the Examination Board of your own study programme.

4. The minor: choice of subjects

During this minor, we aim to offer you a range of choices that you can select based on your own preferences. Students at Fontys School of Engineering and Automotive must announce their choices in advance, via Progress. Other students announce their choice via a registration form at the Engineering company office.
The coordinator will then allocate you to the various modules based on your choices, if you have sufficient prior knowledge for each module. If this is not the case, we will contact you to discuss other possibilities.
A number of projects and/or theory modules are taught in English. These have an English module description. The examinations for these modules are also held in English.

Projects
In the projects, we work in multidisciplinary teams of around 6 people. The companies want 'value for money'. We assume that you will apply a project-based approach, according to the principles of Method-based Design. This approach is described in the reader 'Method-based Design – the problem of innovative concepts'. Each project will be tackled in a systematic a structured manner, so that the product is developed in an innovative approach.

Below are the theory modules that are open to **everyone**:

Subject	**Code**	**Lecturer**
Business Economics	MNHE4	Haasnoot
Customer Oriented Innovation	MNHE20	Peter van Kollenburg
Vision	MNVSN	Kerstjens
Extra options for Electrical Engineering students		
Elec. Magn. Compatibility	MNEMC	Piet Slenders
System Identification	MNSYI	Aslan
Extra options for Mechatronics students		
System Identification	MNSYI	Aslan
Lean Manufacturing	MNPM10	Hutten
Drive Technics	MNCM6	Geraerdts
Dynamic Behaviour	MNCM7	Geraerdts
Extra options for Automotive students		
Elec. Magn. Compatibility	MNEMC	Piet Slenders
Drive Technics	MNCM6	Geraerdts
Dynamic Behaviour	MNCM7	Geraerdts
Extra options for Mechanical Engineering		
System Identification	MNSYI	Aslan
Lean Manufacturing	MNPM10	Hutten
Drive Technics	MNCM6	Geraerdts
Dynamic Behaviour	MNCM7	Geraerdts

5. Overview of examination moments

For each module (both project and theory) in semester S6, the module descriptions in this guide include a description of how the module must be completed and how your work will be assessed. (If in doubt contact the module coordinator, certainly in the case of retakes.) A large number of modules rely on written examinations in the official examination periods

Note!
There is no enrolment for the written exams.

Extended examination time
Physically or sensory challenged students (for example with dyslexia) are offered an opportunity to take the examinations subject to a special regime. This may for example include extra time.
If you wish to be considered for this possibility, you must submit a written request to the examination board in good time. Student counsellors can advise you and have sample letters available.

These facilities are however not available for interim examinations.

The examination timetables for the completion of a teaching period are always announced on the Friday of week 5 of the teaching period in question.
The grades, assessments, etc. on completing teaching periods will be communicated via portal.fontys.nl.
Following publication of the grades, students will have 2 teaching weeks following the final publication date to submit a request to the lecturer to view the examination paper. After this period, the grades are considered definitive.

	Code	Duration min	March/ April	June/ July	Oct/ Nov	Jan/ Feb
Elec. Magn. Compatibility	EMC	100		Reg		Resit
Business Economics	HE4	100		Reg		Resit
Customer Oriented Innovation	HE20	none				
Lean Production	PM10	100		Reg		Resit
System identification	SYI	100		Reg		Resit
Vision	VSN	none				
Drive Technics	CM6	150		Reg		Resit
Dynamic Behaviour	CM7	100		Reg		Resit

6. Module description Minor Engineering Projects

6.1. Module description 'Minor Engineering Projects '

Module-identification

Module name:	Minor Engineering Projects	
Module code:	MNPROJ	
Semester:	S6	
Workload in ECTS:	10 ECTS	
Module coordinator:		
	Email: w.broekman@fontys.nl	08850 77371 / 0622947217
Lecturer(s):	Wim Broekman, and several tutors	

Course description

In Minor Engineering projects, we work in multidisciplinary teams on realistic business tasks (the development and realization of innovative products). We address the problem in a systematic, structured manner. The client (company) obviously looks for 'value for money'. We will work on a project based approach and according to the principles of Methodical Design. This approach is described in the reader 'Methodical Design - from problem to innovative concept.

In implementing the project, we are dealing with (four) generic competencies. These competencies are action-oriented. Conscious acting is always a matter of:

1. UNDERSTAND (reflection, orientation) in the problem situation / task.
2. DESIGN of the product, service or control.
3. PLAN the implementation.
4. EXECUTE the plan.

Examples of actions / operations are: diagnose, analyse, evaluate, reflect, plan, model, create, deploy. These actions lead in turn to a semi-product (intermediate) or a professional product (the production of both products and services, and also provide control for the corresponding production processes).
The IPD project is closed with a professional symposium where the IPD student teams present their results in the English language and demonstrate their prototype.

Learning objectives

Mandatory Prerequisites
Semester S1 / S2, S3 / S4

Lecture hours
1 day a week on Wednesday

Learning aids
none

Additional Information
Learning agreement for exchange courses in project EC's.
In the Engineering Minor it will be possible to get exemption for the extra hours you worked for the project. The exemption is up to 8 EC's what equates 2 courses of your own choice within the Minor.

Planning
20 weeks working within a Group of 6-8 students

Project week	Topics: Example!	Tasks: Example!
week 0	Registration Project information (on website): - Roles & tasks model - Project descriptions / assignments - How to work in projects - Methodological design - manual(for international groups)	- Read the project manual/information
week C1 Wednes-day	On Wednesday first meeting of group with coach. Standard subjects: Intro , Enrolment, Explanation of roles & tasks if needed, Group's assignment, Tasks to fulfil this week (don't forget the company visit)	- Distribute all the roles amongst group members - Start with creation of your individual 'mini plan(s) of action' (mini-PoA) for every role (templates can be founds elsewhere on this website) - Make an appointment for the first meeting at the company
week C2	- Meeting with company and/or meeting with coach	- Finish writing your personal MiniPoAs. - Everyone should contribute to the creation of the overall 'project plan'
week C3	- Presentation/discussion of the overall 'project plan' - 1st meeting with consultant, for discussion and agreements on mini PoA regarding 'professional role(s)' (and email your mini_PoA regarding 'process role(s)' to your coach, to be discussed in week 4).	- Invite the principal on time for Audit 1
week C4	- Meeting with coach (topic: mini_PoAs regarding 'process roles') Mini Course: reporting, 8th and 9th hour by Mrs Plegt	- Write Audit 1 report [MR-1, in English] and send it to coach and principal when finished
week C5	- Meeting with consultant (this is 1st and last but one scheduled)	- Prepare for the presentation of Audit 1
week C6	- Audit 1. At the end of the audit there should be an agreement between the group and the principal about the specifications - And/or meeting with coach	
week C7		- Prepare for the peer assessments
week C8	- Meeting with coach - Peer assessments (carried out by the project leader) <possible conflicts with exams>	
week C0	<restricted activities in parallel with exams>	- peer assessments(??) [-p.m.: Prepare yourself IN ADVANCE for Audit 2]
week C1	- Meeting with consultant?? [This is just a reminder.] - Final ordering	- Send first concept of the project description to the coach - Prepare for Audit 2: - >write report MR-2 incl. new (detailed)

		planning, and send it to coach and principal - >invite principal - >prepare presentation - Do final ordering
week C2	- Audit 2. At the end of this audit there should be an agreement between the principal and the group about the design proposal of the prototype - Coach gives feedback on the performance of the students and the group	- Finish Project Description - Do final ordering (if delayed)
week C3	- Audit 2 (if delayed)	
week C4	- Meeting with coach	
week C5	- Meeting with consultant?? [This is just a reminder.]	
week C6	- Meeting with coach	- SSD-ers: Finish your Subsystem Design Report including the subsystem's specifications, 'design' documents and the test plan and deliver it to the consultant (we prefer English versions)
week C7		- Finish your individual project (technical) role report(s) and deliver it (them) to the consultant (we prefer English versions) - Preparation of demonstration of working final product
week C8	- Meeting with coach - The group will have to give a demonstration of the (working) product to consultants. Based on this demo consultants should give a go / no go per individual role. - Finishing final report - Peer assessments?	- The final report (in English) has to be delivered at tutor and client.
week S1	- (Final) Peer assessments	- Finish video for presentation
week S2		- Prepare final presentation (in English)
week S3	- Audit 3/ Symposium - Final evaluation, grading and delivery of results to principal.	- Reparation of work if necessary - Group's evaluation and delivery of the product (to principal)

Testing / assessment and grading

Additional remarks:

- All reports have to be handed in on Monday of that week planned before 13.00 hrs.
- The audit-reports MR1 en MR2 are in English at max 6 pages with the following subjects: project status (only most important issues), detailed planning to next milestone/audit, expected problems and solutions or ways to prevent them.
  As enclosures the finished role reports.
- Reports hand in too late: related person (reporter) gets a warning or (yellow/red) card
- For all roles: 1 student is responsible but all members will contribute in order to reach a high level result.
- Consultant meetings: all students of that cluster are present and will present their work (oral) according planning agreed with consultant.
- Marks will be put on the assessment documents available for each role.
- When handing in a document always attach the assessment document (as available via this site)

Final judgement: individual marks (see Project site)

Additional Information

Learning Agreement Engineering Minor

In the Engineering Minor it will be possible to get exemption for the extra hours you worked for the project. The exemption is up to 8 EC's what equates 2 courses of your own choice within the Minor.

The Engineering minor is now structured as follows (Strike out what does not apply):

Course	Code	EC	hours
Project (research)	MNPROJ	10	280
Extra project hours 1		4	112
Extra project hours 2		8	224
Electro Magnetic Compability	MNEMC	4	112
System Identification	MNSYI	4	112
Vision	MNVSN	4	112
Business Economics	MNHE4	4	112
Customer Oriented Innovation	MNHE20	4	112
Lean	MNPM10	4	112
Drive Technique	MNCM6	4	112
Dynamic Behaviour	MNCM7	4	112
Total		30	840

The student declares that he has carried out project work for… hours. This is equal to… ECs.

Town, Date:
Student:
Studentnumber:
Signature:

The examination board on behalf:

Town, Date:
Name:
Function:
Signature:

7. Module descriptions Theory

7.1. CM6 Module description 'Drive Technics'

Module identification

Module name:	Drive Technics	
Module code:	CM6	
Semester:	S6	
Workload in ECTS:	4 ECTS	
Module coordinator:	H. Geraerdts	Room ER 0.15
Email:	hgm.geraedts@fontys.nl	
Lecturer(s)s:		

Content description

In the drive technics, we look at the design of the driving structure between the source (motor or other actuator) and the load (driven system). This link can take place in different ways. A direct link or via special transmission systems such as 4-rod mechanisms or towing clutch systems. Of importance is natural what does the load need to function and which drive source should we use for this. We differentiate between kinematic considerations (velocities and speed differences) and kinetic considerations (large capacities versus small capacities as used in mechatronic systems). An important starting point is the theory of dynamics that is the starting point of reasoning for choosing the right transmission in important dimensions.

Learning objectives

Obtaining insight into and calculating and designing drive systems of all kinds. Special attention is paid to the mechanics and dynamics of a number of multi-component driven mechanisms.

Mandatory prerequisites
CM1 t/m CM4

Lecture hours
14 weeks for two hours

Learning aids

Planning
(provisional)

Practical sessions
At the end of semester 6 there is a written exam. At the end of semester 7 there is a resit. The student is given the opportunity to take a number of handwritten, non-copied A4 with him during the examination. The exam will be drawn up with open questions that contain a strong context of professional practice.

7.2. CM7 Module description ‘Dynamic Behaviour‘

Module identification

Module name:	Dynamic Behaviour	
Module code:	CM7	
Semester:	S6	
Study load (ECTS):	4 ECTS	
Module coordinator:	Geraedts	Room ER 0.15
Email	HGM.Geraedts@fontys.nl	
Lecturer(s):		

Course description

In this module, the dynamic behaviour is treated as a consequence of the coupling of an actuator (a drive form as treated in the "Drive Technology" module) to a mechanism with a certain mass and stiffness distribution. To be treated: general vibration learning, reduction methods mass spring systems, and achievable dynamic accuracies. Learning objectives

Mandatory Prerequisites
CM1 t/m CM4

Lecture hours
14 weeks for two hours

Learning aids

Planning overview
Subjects
Theory:

Practical

Testing / assessment and grading
Regular test in June. Resit in January
Permitted tools in consultation with Lecturer

Schedule of lessons, practical’s and/or project activities

7.3. EMC Module description 'Electromagnetic Compatibility'

Module-identification

Module name:	Electromagnetic compatibility	
Module code:	EMC	
Semester:	S6	
Study load in ECTS:	4 ECTS	
Module coordinator:		ER Room 0.73C
Email:	p.slenders@fontys.nl	08850 77661
Teacher(s):	P. Slenders	

Course description
The EMC course covers the basics during the design process needed to bring a circuit or an electrical system to get that/it satisfactory. The phenomena covered by the term Electromagnetic Compatibility takes place both on a chip on a board like this and continues to systems and installations. The requirements set out by the users or customers of the products, play a very important role in the harmonization of these requirements written down in the guidelines of the EEC.

Mandatory prerequisites
- EMC in general, specific EMC techniques of existing products
- Knowledge of static electric and magnetic fields and screening principles
- Parasitic components for PCB's, components and cables.
- Ground bounce, Layout properties and design examples
- Transmission line theory, single ended and balanced signals
- Differential and Common mode chokes and line filters
- LT spice to simulate EMC examples
- Short introduction in standing waves related to antenna principles
- Transfer impedance of a cable and shielding effects

Learning aids
Hand-outs

Contact Hours
14 weeks for two hours. Total 6 hours for a practical assignment class D amplifier at EMC level. Two homework assignments.

Testing / assessment and grading

The final assessment for the subject of EMC is a combination of the results of the homework, practical and the final exam. The final test is a mix of multiple choice and essay questions to test your gained knowledge.

The final test lasts 100 minutes.

Re-sit: There will be a re-sit of the final exam. The grading of the re-sit will be 90 points plus 10 points for filling in your student number and name. The home-work will only be included in the grading of the original exam and not in the grading of the re-sit.

7.4. HE4T Module Description Business Economics

Module-identificatie

Module name:	Business Economics	
Module code:	HE4T	
Semester:	S6	
Study load in ECTS:	4 ECTS	
Module coordinator:		ER Room 0.15
	Email: m.haasnoot@fontys.nl	08850 79289
Teacher(s):	M. Haasnoot	

Content of the module

The student is able to:

- Identify the purpose of a business and discuss the ways in which a business may be organized and managed
- Discuss the issues to be considered when setting the financial aims and objectives of a business.
- Explain the role of management accounting
- Define and distinguish between relevant costa, outlay costs and opportunity costs
- Identify and quantify the costs that are relevant to a particular decision.
- Distinguish between fixed cost and variable cost and use this to explain the relationship between cost, volume and profit.
- Prepare a break-even chart and deduce the break-even point for some activity.
- Discuss the weaknesses of break-even analysis.
- Deduce the Full (absorption) cost of a cost unit in a single-product environment
- Deduce the Full (absorption) cost of a cost unit in a multi-product environment
- Discuss the problems of deducing full (absorption) cost in practice
- Discuss the principles and practicalities of activity-based costing.
- Explain how new developments such as total life-cycle costing and target costing can be used to manage product costs.
- Define a budget and show how budgets, strategic objectives and strategic plans are related
- Explain the budgeting process and the interlinking of the various budgets within the business
- Undertake variance analysis and discuss possible reasons for the variances calculated
- Discuss the role and limitations of budgets for performance evaluation and control.
- Explain the nature and importance of investment decision making
- Make a decision analysis and calculate the net present value.
- Deal with risk in a best and worst case decision calculation.
- Explain how management accounting information can help a business gain a better understanding of its competitors and customers.
- Explain how the balanced scorecard can help monitor and measure progress towards the achievement of strategic objectives.
- Discuss the potential advantages and disadvantages for a business of adopting a divisional structure.

- Identify the major methods of measuring the performance of operating divisions and divisional managers and assess their usefulness
- Describe the problems of determining transfer prices between divisions and outline the methods used in practice.
- Identify the main elements of working capital.
- Discuss the purpose of working capital and the nature of the working capital cycle
- Explain the importance of establishing policies for the control of working capital.

Organization

1 Semester, weekly 2 hours theory class. See schedule.

Prerequisite requirement.

None

Schedule

Week	Subject	Description
1	Ch 1 introduction	Introduction to management accounting
2	Ch 2 Relevant costs	Relevant costs for decision making
3	Ch 3 Cost volume	Cost volume profit analysis
4	Ch 4 Full costing	Single and Multi product business costing
5	Ch 4 Full costing	Cost centre costing
6	Ch 5 Costing and pricing	Costing and pricing in a competitive environment
7		
8	Ch 6 Budgetting	Budgets link with strategic plans and objectives
9	Ch 7 Accounting	Accounting for control
10	Ch 8 Capital invest	Making capital investment decisions
11	Ch 9 Strategic	Strategic management accounting
12	Ch 10 Performance	Measuring performance /balanced scorecard
13	Ch 11 Working capital	Managing working capital
14	Questions	Test examination
EXAM		

Study material

Books and readers to be purchased by the student:

Title	**Author(s)**	**ISBN**
Management Accounting for Decision Makers Access to (MyAccountingLab not required)	Peter Atrill and Eddie Mc Laney	ISBN 10: 1292072431 or ISBN 13: 9781292072432 Eight edition, Prentice Hall
Also allowed:		

Management Accounting for Decision Makers	Peter Atrill and Eddie Mc Laney	ISBN 10: 0-273-76226-5 or ISBN13: 9780273762263 Seventh edition, Prentice Hall

Sheets will be made available weekly after the class on N@tschool.

A**ssessment method**

The Business Economics theory will be assessed by a written exam of 100 minutes. The final mark must be ≥ 55 points.

It is an open book examination: book, sheets and notes on paper are allowed. No digital devices, except a regular calculator, are allowed during examination.

7.5. HE20 Module description 'Customer Oriented Innovation'

Module-identification

Module name:	Customer Oriented Innovation	
Module code:	HE20	
Semester:	S6, Spring 2018	
Study load:	4 ECTS	
Module coordinator	P. van Kollenburg e-mail: p.vankollenburg@fontys.nl	Room ER 0.75 08850 75483
Teacher(s)	P. van Kollenburg	

Course description
You do want to know more about innovation in industry. One way is to read about the many different ways of developing new products, creating ideas and exploring how customers are involved in this process. A different method is to do research by going into the field and find out what customer involvement means for innovation. In this module you are going to find the pro's and con's of the different ways of product innovation by doing research in the industry in a small group. One of the focus points will be the involvement of customers in this innovation process. By carrying out this research you will learn to have a critical view on product innovation; all this by studying theory, articles, papers and hands on research work in industry.

Learning objectives
- Get to know the many different ways of product innovation
- Find out the pro's and con's of customer involvement in the innovation process
- Meet and explore companies who are working in this field of product development
- Get familiar with product innovation and the relation within the development process and the steering of such a processes
- Get experience in translating theoretical information into a product
- Get experience in setting up and carrying out a research project
- Get experience in writing an article
- Get experience in making conclusions available for a wider public by producing a YouTube video based on the research results

Mandatory prerequisites
For this module no other modules are prerequisite.

Learning aids
- Module workbook (will be handed over as PDF-file)
- scientific papers (will be handed over as PDF-file)
- dropbox account (you will be invited for this during the first meeting)

Lecture Hours
14 x 2 hours

Testing /assessment and grading
Credits will be given when the student has been given a sufficient mark (≥ 5.5) for the course. The grade of the course is made up by:

- 30 % average of the mini examines (individual mark)
- 50% for the Paper and defending the paper (must be ≥ 5.5), group mark
- 20% for the Video, group mark
- Individual reflection is required
- Resit: redo that part which is insufficient (all individual)

7.6. PM10 Module description 'Lean Production'

Module identification

Module name:	Lean Production	
Module code:	PM10	
Semester:	S6	
Study load:	4 ECTS	
Module coordinator	R. Hutten e-mail: remco.hutten@fontys.nl	Room ER 0.15 08850 74456 06 13111082
Teacher(s)	Remco Hutten	

Course description

To widen the opportunities of the Fontys Engineering School engineers to practical work situations this course provides knowledge and insights of modern production operations. The focus will be not be limited to the organisation of production activities, designing production processes and lay outing a manufacturing facility. It will be extended to supply chain management – basically one of the success factors of the local High Tech Systems industry – up to sustainability and quality thinking and acting. Of course, a lot of attention will be put on 'continuous improvement', by introducing and experiencing 'lean' principles, practices and tools. This will lead to insights in reducing wastes, losses and inefficiencies, improvement of 'throughput' time and time-to-market, improvement of operations and costs effectiveness and in listening to the voice of the customer. Therefor we do not skip the more conventional 'MRP' and 'ERP' based production organisations, in order to have not only an overview of current approaches but also getting insight into the differences with 'lean'. Of course – as being engineers – the focus will be on technically oriented production, including assembly and product & process design. Further, as producing and marketing of products is not only a technical issue, also the 'service component' and industrial engineering principles will not be avoided.

Learning objectives

This course is oriented on providing basic insights and tools to investigate and design industrial production & development organisations and processes, thus offering a basic set of knowledge and experiences, supporting engineers aiming for a career in any industrial environment. Application of these insights and tools will be exercised by means of exercises, cases and video impressions.
[nog nader specificeren, SMART doelstellingen]

Mandatory Prerequisites

No specific knowledge other that provided in the basic Engineering programs (first two years) is necessary. Basic knowledge from mathematics and statistics will be applied for calculation and understanding, especially with respect to decision making tools and statistical process control (SPC and Six Sigma). Additionally basic use of spreadsheets is necessary, for these will be used in the exercises.
Examples and cases are based on a wide range of organisations, products and process, applying different disciplines, making the program applicable for all Engineering students. Main base for joining this program is a high interest in the functioning of (technical, production oriented) businesses.

Lecture hours

This course will be offered in 14 x 2 classroom lessons.
Additionally it is necessary - and thus compulsory – to perform homework on a weekly base, so to study the literature, to do exercises and work out cases. Within the program also one or two company visits are foreseen (not yet sure), which will most likely be planned aside of the contact hours (out of regular lesson times).

Planning overview
(The program is under construction, thus contents and order of the subjects may alter before and during the program)

- Introduction to operations and productivity, the global environment and operations strategy
- Product design and sustainability
- Quality management, TQM, Statistical Process Control, Six Sigma
- Process design, capacity planning, forecasting, throughput times
- Layout decision and workplace design
- Supply chain management, supply chain modelling
- Materials Requirements Planning (MRP) and Enterprise Resource Planning (ERP)
- Lean principles and operations, the Toyota Production System, flow, voice of the customer
- Lean and Six Sigma tools for production operations

The course will not only provide theory. Students will individually and collectively work on exercises, cases and eventually workshops. In order to have interactive lessons it is necessary to study the set literature, cases and videos and perform the exercises in front.
Literature and connected online tools (MyOMLab®) are chosen to support the continuous learning experience.
If possible one or two company visits will be organised. For reasons of scheduling limitations they will probably be organised aside of the current lessons, e.g. in the evening. Alternatively the course participants will be challenged to arrange company visits in small groups.
Short presentations of participants to present the working out of a case or assessment of a company are part of the program. Of course also in that case the language will be English.

Learning aids
Basic literature will be the next book:

Heizer, Jay and Render, Barry
Operations Management, with MyOMLab® with Pearson eText, Global Edition
Pearson, 11 ed., 2013, ISBN10 0273788302 = ISBN13 9780273788300
Remark: please make sure that you include MyOMLab® in your order.

Additionally other texts, cases, information and eventually assignments will be offered through N@tschool.

Testing / assessment and grading
Assessment of the theory is done by a final written examination (100 minutes). The examination will be possible in English as well as in Dutch.
Remark: intermediate assessment by means of written or online exercises, case examination, workshops, presentations etc. will not be part of the final assessment score. They will be used to support the learning process. Presence in the lessons, preparation of the 'homework' and participation in the intermediate assessments is therefore compulsory.

7.7. VSN module description 'Vision'

Module-identification

Module name:	Vision	
Short description:	Introduction to machine vision	
Module code:	VSN6	
Semester:	S6	
Workload in ECTS:	4 ECTS	
Module coordinator:	Randy Kerstjens	Room ER 0.63
	r.kerstjens@fontys.nl	08850 73123
Lecturer(s):		

Course description
Machine Vision is a subfield of engineering that incorporates computer science, optics, mechanical engineering, and industrial automation.
Machine vision is machine-based image processing and requires also digital input/output devices and computer networks to control other manufacturing equipment such as robotic arms.

Learning objectives
- To gain insight in the basics of machine Vision
- Build simple machine vision applications using LabView (practical part)

Mandatory Prerequisites
Semester 1 – Semester 4 of an Engineering Bachelor of Fontys Engineering Eindhoven.
Knowledge of Labview is an advantage and some programming experience is recommended.

Learning aids
Slides, assignments and reference materials (available through n@tschool)

Planning

Week	Theory	Practical training
1	Introduction and overview	Introduction to LabView, Vision Assistant and assignment 1: Thresholding (filter)
2	Lighting, lenses and sensors	Introduction to LabView, Vision Assistant and assignment 1: Thresholding (filter)
3	Lighting, lenses and sensors	Introduction to LabView, Vision Assistant and assignment 1: Thresholding (filter)
4	Image processing	Assignment 1: Thresholding (filter)
5	Image processing	Assignment 2: Convoluting images (filter)
6	Inspection (detection, matching)	Assignment 2: Convoluting images (filter)
7	Wrap-up + state-of-the-art	Assignment 3: Filtering and measuring
8		Assignment 3: Filtering and measuring
9		Assignment 4: Pattern matching
10		Assignment 4: Pattern matching
11		Assignment 5: Wayfinding
12		Assignment 5: Wayfinding
13		Assignment 6: Inspection
14		Assignment 6: Inspection

Learning aids

- Sheets week 1: Introduction and overview
- Sheets week 2: Lighting, lenses and sensors
- Sheets week 3: Lighting, lenses and sensors
- Sheets week 4: Image processing
- Sheets week 5: Image processing
- Sheets week 6: Inspection (detection, matching)
- Sheets week 7: Wrap-up + state-of-the-art
- Introduction to LabView
- NI Vision Assistant
- NI LabView
- NI LabView Vision acquisition software
- Practical Assignment Descriptions (with resources if necessary)

Practical

This module has a significant practical part based on Labview from National Instruments. Students work in groups of 2.

Testing / assessment and grading

The overall grade for the course will be determined by the following components:

Grading is based on the quality of the practical assignments. The 6th and last practical assignment will be used as input for the final mark (>=5.5), provided that the first 5 practical assignments have been handed in (must be passed, determined by your teacher) and that all the practical and theoretical lessons have been attended. Otherwise, the mark will be insufficient (<5.5).

The following applies if the criteria described above are not met:

- If the grade of the sixth assignment is insufficient (<5.5) and a maximum of one practical assignment has not been handed in there will be one additional assignment.
- Students are allowed to miss one theory lesson provided that they write a short essay about the subjects of that particular lesson. If the essay is marked sufficient by the lecturer the final grade will still be awarded.

If you cannot attend your lesson for any reason, please make sure you notify your teacher in advance!

Scheduling / educational activities

Activity	Week number	Hours per week	room type	Maximum class size
Lecture	Q1 1-7	2	Room with beamer	32
Laboratory	Q1 1-7; Q2 1-7	3	Computer Laboratory	32

! The exact content of the vision module is subject to change. These changes will be communicated during the lectures. !

7.8. SYi Module description 'System Identification'

Module-identification

Module name:	System Identification	
Short description:	System identification in the frequency domain	
Module code:	SYI	
Semester:	S6	
Workload in ECTS:	4 ECTS	
Module coordinator:	A. Aslan	Room ER 0.63
	Email: n.vanlierop@fontys.nl	08850 89830
Lecturer(s):	Albert Aslan a.aslan@fontys.nl,	

Course description

Within this course participants will learn the basics of system identification theory in the frequency domain as well as gain practical experience with the methods. This course has a significant added value to the modelling and control courses within the engineering department of Fontys. With the gained knowledge of this course it is possible to directly measure the dynamical behaviour of a system. This gives a valuable validation method and an addition to the model based approach. Especially in high tech systems it can enable higher performance and/or better insights into the dynamical behaviour.
This course is the first mutually developed course under the cooperation treaty between ASML and Fontys Engineering. The theoretical part of the course is given by Fontys and the practical part is given by ASML. This module has a practical component based on a fourth order electro-mechanical Quanser set-up.
The final practical assignment involves a reticle masking unit (REMA) of an actual ASML machine. This unit is available during the last weeks of the course. The REMA unit acts as a shutter for the reticle that contains the patterns for the chip production during the scanning process of a wafer. This has to be done quickly and accurately in synchronization with the stages in the wafer scanner. The dynamical behaviour of the REMA unit must be identified accurately in closed loop by the students. This practicum is executed on an actual industrial problem.

Learning objectives

After completing this course the student is able to:

- Describe and apply the meaning of the following terms: sampling, Shannon, aliasing, leakage, Cross/auto Power Spectral Density, correlation and coherence
- Describe the properties of different colours of noise signals and Multisine signals
- Select between and apply the following identification methods: open-loop identification, closed-loop identification using either the 2-point of three-point method.
- Analyse the validity of the identified system data in the frequency domain and adapt the identification method/signals to improve the measurement results.

Mandatory Prerequisites

Semester 1 – Semester 4 of an Electro-technical or Mechatronics Engineering Bachelor of Fontys Engineering Eindhoven.

Learning aids

Material	Title	Author	Edition	Publisher	Price

PowerPoints Practical assignments	Several	LRP, Maarten Kremers, Sven Hol, Roel Merry			
Matlab Help		Matlab			

Planning

Lecture	Subject	Designed by	Docent	ReMa
1	Introduction Recap Laplace	Fontys	Fontys	
2a	Modelling at ASML (physics vs measured, whole machine vs modules)	ASML	ASML	
2b	recap Fourier + bode	Fontys	Fontys	
3	Discrete time: sampling, Shannon, aliasing, leakage, Matlab demo	Fontys	Fontys	
4	Practical: Fourier + Matlab (link to practical examples)	ASML	ASML	Data only
5	Power spectra	Fontys	Fontys	
6	Cross/auto Power Spectral Density (PSD), complex conjugate and correlation	Fontys	Fontys	
7	Open loop transfer function measurement • Relations between time domain, Laplace and Fourier • Superposition	Fontys	Fontys	
8a	Coherence	ASML	ASML	
8b	Description and analysis of noise signals and Multisine signals	Fontys	Fontys	
9	Averaging / Windowing / zero padding	Fontys	Fontys	
10	Practical: open loop measurements / Matlab assignment (working towards tfestimate)	ASML	ASML	Quanser, 4th order systems
11	Practical: coherence + Matlab calculations for practical set-up	ASML	ASML	Data only
12	Closed loop 2-point and 3-point measurements	Fontys	Fontys	
13	Practical: closed loop measurements	ASML	ASML	REMA unit
14	Experiment design + summary/questions	ASML	ASML	

Practical
To gain insight in the practical issues involved with frequency domain identification the students will have to complete a series of practical assignments with several Quanser set-ups in combination with NI Labview. The identification data will be processed in Matlab. Besides the fourth order Quansar setups an industrial REMA unit from ASML will be used for the final assignment.

Required facilities (hardware, software)

Quanser 4th order set-up	The gain practical insight in the identification methods Quanser set-ups will be used in combination with NI Labview to control the set-ups. The identification data will be processed in Matlab.
ASML REMA unit	A reticle masking unit (REMA) of an actual ASML machine is available during the last weeks of the course which is used a final practical assignment in which the students need to show their skills.
Laptop	Own laptop for installing and running NI Labview and Matlab Simulink

Testing / assessment and grading
- Exam SYIT:
  - Type of exam: written
  - Duration: 100 min
  - Minimal passing grade: 5.5

- Resit SYIT:
  - Type of exam: written
  - Duration: 100 min
  - Minimal passing grade: 5.5

- Exam SYIp:
  - Type of exam: practical assignment
  - The practical assignment will be graded with insufficient, sufficient or good.

- Resit SYIp:
  - Type of exam: practical assignment
  - The resit will be in the form of a repair assignment at the end of the SYI course and it will be graded with insufficient, sufficient or good.

The final grade of the SYI course is equal to the grade of the theoretical exam. However, the final grade will only be awarded when the practical component is graded sufficient or good.

- Allowed learning aids during the theoretical exam: 1 A4 of handwritten notes (no worked out assignments) and a calculator.

8. Book list

Check the Fontys site.