Programme-specific appendix to the TER 2017-2018

For the Master of Science programme

Industrial Engineering and Management (IEM)

1. Structure and content of the programme

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   (including the content of the programme, the content of the specializations, and the content of practical exercises)
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c. Other programme-specific characteristics
   (including the nature of the programme and the organization of the programme)
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1 Structure and content of the programme

1.1 Composition of the programme

The programme consists of three components:

1. A set of obligatory courses: the 'core programme' including a set of 'specialization courses'
2. Additional elective courses to fill up the total study load to 90 EC
3. A final (Master's) assignment of 30 EC.

This structure applies to all IEM students.

1.2 Study load and programme

The IEM Master's programme represents a study load of 120 EC.

1.3 The exam formats (TER, article 3.2, par. 2h)

The curriculum overview for the Master programme includes the following categories:
Quarter / Subject code / Subject name / Study load in ECs / Way of testing / Prior knowledge

The assessment components are sorted by category according to subject code. Per course a maximum of two exams are offered. The first attempt is offered at the end of the quartile in which the related education is offered while the resit is offered one quartile later. Exceptions on this role are mentioned in the time table. The overview of assessment components is not presented in chronological order.
Key to exam formats:

S	= written exam
M	= oral exam
PGI	= group practical exercise, including a written group report and (in so far as possible) Individual assessment of the manner in which the student participated in the group exercise
PS	= practical exercise(s), including a written report
PSS	= practical exercise(s), including a written and/or oral report, and a written exam; the student may sit the written exam only after satisfactorily completing the practical exercises and the written and/or oral report
PSM	= similar to PSS, however, an oral exam will be sat
BAHL	= reviewed in a manner to be determined by the graduate professor
BAM	= reviewed in accordance with the procedures laid down in the regulations applicable to the Master's assignment.

The student's work must be eligible for review. More specific details are available via OSIRIS and/or made known in a timely manner by the examiner on Blackboard in accordance with the provisions of article 4, "Rules & Regulations of the Examination Board".

2.1 Final exam: the Master's assignment

The programme concludes with the Master's assignment (or Master's project of Master's thesis), as part of which the student demonstrates his ability in the integrated application of the knowledge and skills gained from the curriculum of the programme. The Master's assignment represents 30 EC and will be finalized with the public colloquium; the colloquium can only be held if all master's programme courses are finished successfully.

The Examination Board of the programme establishes the rules governing:

a. the procedures used to determine a student's eligibility for the Master's project
b. the manner in which the student's Master's curriculum (Master's assignment and subjects) is developed and approved
c. the manner in which the student acquires the Master's assignment
d. the members of the Master's committee
e. the manner in which the Master's assignment will be completed, monitored and evaluated

An appeal against a decision taken in accordance with these regulations may be lodged to the Examination Board of the program.

1.4 Study programme

The programme starts in September and February, see 'Table ***1:*** **MSc in Industrial Engineering & Management 2017-2018'**

				September			2017-2018
In order to graduate students' individual study programme's' must be approved by the specialization coordinator							
Legenda:							
Specializations		**Orientations**					
F = Financial Engineering and Management		F	Financial Engineering and Management				
H = Health Care and Technology Management		H	Health Care and Technology Management				
P = Production and Logistic Management		s	Service logistics		m	Manufactoring	
		t	SCM & transportation		hl	Health logistics	
first year, September							
Quartile/ Code	**Coursename**	**Exam**	**EC**	**Mandatory courses Specialization**	**Mandatory courses Orientation**	**Recom-mended electives**	**Prior knowledge**
1.1, sept							
201700020	IEM Research Orientation	PSS	5	F/P/H			
191506103	Statistics and Probability (+)	S	5		F	P/H	
191860651	Micro Economics	S	5		F		
191820200	Discrete Optimization of Business Processes (1)	PSS	2,5	P/H			
191820210	Simulation (1)	PSS	2,5	P/H			
1.2, nov							
201300060	Mathematical Finance	S	5	F			
191515101	Introduction to Risk Theory	S	5	F			
201400174	Data Science	PSS	5	F/P/H			
191820210	Simulation (2)	PSS	2,5	P/H			
191820200	Discrete Optimization of Business Processes (2)	PSS	2,5	P/H			
191820180	Reverse Logistics & Re-Manufacturing	PSS	5		s/t/m		
201600032	Quality Management in Healthcare	PSS	5		H	hl	
1.3, febr							
191860181	Risk Management	PSS	5		F		
201300062	Structured Products	S	5		F		
191820190	Supply Chain - & Transport Management	PSS	5		t	s/m/hl	
191852630	Reliability Engineering & Maintenance Management	PSS	5		s	t/m/hl	
201700196	Advanced Health Economic Modeling	PSS	5		H	hl	
194121020	Optimization of Healthcare Processes	S	5		hl	P/H	
201600015	Strategic Technology Management and Innovation	PSS	5			F/P/H	
192340101	Implementation of IT in Organizations	PSM	5			F/P/H	
1.4, apr							
201000202	Management Control for Financial Institutions	PSS	5		F		
201100162	Management of Technology for FEM	PSS	5		F		
194105070	Information Systems for the Financial Services Industry	PSS	5			F	
191852620	Advanced Production Planning	S	5		m/hl	s/t/H	
191820120	Warehousing	PSS	5		m	s/t/hl/H	
194122030	New Production Concepts	PSS	5			P	
201700197	Decision Making in Health Care	PSS	5		H	hl	
192360501	E-health Strategies	S	5			hl/H	

1.3, sept 2018	Preliminary programme 2018-2019 (under construction)						
second year							Prior knowlegde
2.1 sept 2018					elective or study abroad		
191521800	Game Theory	S	5			F	
191506103	Statistics and Probability (+)	S	5			P/H	
191820160	Purchasing	PSS	5			P	
NEW	Health Care Finance		5		hl/H		
201700089	Sustainable Business Development	PS	5			F/P/H	
201200146	Maintenance Engineering and Management	PS	5			s/t/m	
NEW	Statistical Learning in Health Care		5		H	hl	
	Research Elective		5-10			F/P/H	
2.2, nov							
201200127	Preparation Thesis PLM	BAHL	5	P			
201200128	Preparation Thesis FEM	BAHL	5	F			
201200130	Preparation Thesis HCTM	BAHL	5	H			
201200138	Special topics in Financial Engineering **	PS	5			F	
201400244	Cost Management and Engineering	PSS	5			F/P/H	
195800200	Project Management	PSS	7,5			F/P/H	
	Research Elective		5-10			F/P/H	
2.3 + 2.4							
194100060	Master Thesis	BAM	30	F/P/H			80 EC incl. preparation course

Contact your specialization coordinator for approval of your study program

WARNING If you consider going abroad for a semester mandatory courses should be planned carefully.

How to plan your program

All students join mandatory courses . During this first quartile you discuss your ideas about your individual program with your specialization coordinator. Draft your plan:

1 Write down your mandatory courses

2 Complete your IEM study program up to 120 EC with:

Elective (i.e. equalization) to discuss with the specialization coordinator

a) other technical UT master courses (i.c. IEM)

b) master courses from other (inter)national technical Master program's

3 Discuss your complete study program (and your personal motivation) with your study counselor

4 Get a final approval from your specialization coordinator

Implementation of non-technical or (inter)national courses need approval from the specialization coordinator and the exam committee.

Industrial Engineering and Management	February 2018						
In order to graduate students' individual study programme's' must be approved by the specialization coordinator							
Legenda:							
Specializations		Orientations					
F = Financial Engineering and Management		F	Financial Engineering and Management				
H = Health Care and Technology Management		H	Health Care and Technology Management				
P = Production and Logistic Management		s	Service logistics		m	Manufactoring	
		t	SCM & transportation		hl	Health logistics	
first year, February							
Quartile/ Code	Coursename	Exam	EC	Mandatory courses Specialization	Mandatory courses Orientation	Recom-mended electives	Prior knowledge
1.1, febr	elective or abroad			elective or study abroad			
201700020	IEM Research Orientation	PSS	5	F/P/H			
201400174	Data Science (also offered in November)	PSS	5	F/P/H			
191820190	Supply Chain - & Transport Management	PSS	5		s/t	m/hl	
192340101	Implementation of IT in organizations	PSS	5			F/P/H	
194121020	Optimization of Healthcare Processes	PSS	5		hl/H	s/t	
201600015	Strategic Technology Management and Innovation	PSS	5			F/P/H	
1.2, apr	elective or abroad			elective or study abroad			
195820500	Infrastructure Management	PSS	7,5			P	
192376000	Business Case Development for IT Projects	PSS	5			P	
201100162	Management of Technology for FEM	PSS	5			F	
201000202	Management Control for Financial Institutions	PSS	5			F	
191820120	Warehousing	PSS	5		m	s/t/hl/H	
194105070	Information Systems for the Financial Services Industry	PSS	5			F	
201700197	Decision Making in Health Care	PSS	5		H		
192360501	E-health Strategies	S	5			H	
194122030	New Production Concepts	PSS	5			P	
1.3, sept 2018	Preliminary programme 2018-2019 (under construction)						
201800002	Simulation (5 ec)		5	P/H		F	
201800003	Operations Research Techniques 1		5	P/H		F	
201800001	Supply Chain Finance		5	F/P			
191506103	Statistics and Probability (+)	S	5	F		P/H	
191860651	Micro Economics	S	5		F		
191521800	Game Theory	S	5			F	
NEW	Statistical Learning in HC		5		H	hl	
NEW	Health Care Finance		5		hl/H		
191820160	Purchasing	PSS	5			P/H	
201700089	Sustainable Business Development	PS	5			F/P/H	
201200146	Maintenance Engineering and Management	PS	5			P	
1.4, nov							
201800005	Operations Research Techniques 2		5	P/H		F	
201300060	Mathematical Finance	S	5		F		
191515101	Introduction to Risk Theory	S	5		F		
201200138	Special topics in Financial Engineering	PS	5			F	
201400244	Cost Management and Engineering	PSS	5			F/P/H	
201800008	After Sales Service Logistics		5		s/t	m/hl	
201800009	Advanced Inventory Management		5		s/t	m/hl	
201600032	Quality Management in Healthcare	PSS	5		H	hl	

second year							Prior knowlegde
2.1, febr							
191860181	Risk Management	PSS	5		F		
201300062	Structured Products	S	5			F	
201800010	Transport and Traffic	PSS	5		t	s/m/hl	
201700196	Advanced Health Economic Modeling	PSS		H		hl	
191852630	Reliability Engineering & Maintenance Management	PSS	5		s/t	m/hl	
	Research elective		5-10			F/P/H	
2.2, apr							
201000202	Management Control for Financial Institutions	PSS	5			F	
201100162	Management of Technology for FEM	PSS	5			F	
201800007	Planning and Scheduling	S	5		m/hl	s/t/H	
191820120	Warehousing	PSS	5		m	s/t/hl/H	
192360501	E-health Strategies	S	5			H	
201200128	Preparation Thesis FEM	BAHL	5	F			
201200127	Preparation Thesis PLM	BAHL	5	P			
201200130	Preparation Thesis HCTM	BAHL	5	H			
	Research Elective		5-10			F/P/H	
2.3 + 2.4							
194100060	Master Thesis	BAM	30	F/P/H			80 EC incl. preparation course

(+) Students who already finished this MSc course before the master, have to contact the specialization coordinator

** Students who study abroad during the second years first semester, are exempted from this obligatory course.
Contact the specialisation coordinator for approval of your study program

WARNING If you consider going abroad for a semester mandatory courses should be planned carefully.

How to plan your program

All students join mandatory courses . During this first quartile you discuss your ideas about
your individual program with your specialization coordinator. Draft your plan:

1 Write down your mandatory courses

2 Complete your IEM study program up to 120 EC with:

Elective (i.e. equalization) to discuss with the specialization coordinator

a) other technical UT master courses (i.c. IEM)

b) master courses from other (inter)national technical Master program's

3 Discuss your complete study program (and your personal motivation) with your study counselor

4 Get a final approval from your specialization coordinator

Implementation of non-technical or (inter)national courses need approval from the specialization coordinator
and the exam committee.

1.4 Transfer programmes (pre-master and transfer minor)

The transfer programme can be taken as a separate pre-Master's programme, or as a special transfer minor ("doorstroomminor") agreed upon with a Dutch university of applied sciences (HBO). Students with a technical programme from a Research University, admitted to one of the premaster programmes, have to take up to 15EC of courses. Students with a technical study programme from a University of Applied Science or a student with a Social Science Programme from a Research University, admitted to one of the premaster programmes, have to take up to 30EC of courses. The premaster courses depend on the chosen specialization. Students with mathematics proficiency on pre-university level Mathematics B (equal to the Dutch VWO wiskunde B) and a programme with a strong technical orientation will be admitted after successfully completing the 'doorstroomminor'. For more information visit the website

www.utwente.nl/doorstroom.
The entire transfer programme has to be completely finished within one academic year. No more than two attempts are permitted to sit the corresponding exam. If the student fails to successfully complete the entire transfer programme within these two attempts per unit, he will not be admitted to the Master's programme. Per specialization below you find the premaster programmes.

Research University : Technical Programmes

Technical WO BSc

PLM/HCTM			
code	name	EC	kw
191530420	Statistics & probability for premaster IEM	5	1
201500012	OR models for premaster IEM	10	1
		15	

FEM			
code	name	EC	kw
191530420	Statistics & probability for premaster IEM	5	1
201500020	Financial Engineering for premaster IEM	10	1
		15	

Research University : Social Science Programmes and University of Applied Science (HBO)

Applied studies and Social Sciences (Obligatory VWO Mathematics B)

Specialization

*** Production and Logistics Management (PLM)**
*** Health Care and Technology Management (HCTM)**

	First Quartile (Sept-Oct)			***Second quartilew (Nov-Febr)***		
Course code	***Course name***	***EC***	***Course code***	***Course name***	***EC***	
191512001	Calculus A (191512001)	4	191530420	Statistics & probability for premaster IEM	5	
201500014	Academic skills for premaster IEM	1	201500014	Academic skills for premaster IEM	4	
			201500015	Excel/VBA	3	
201500012	OR models for premaster IEM	10	201400317	Operations Strategy*	3	
			201500019	Project OM for premaster IEM (3 EC)		
		15			15	30

*** Financial Engineering and Management (FEM)**

Course code	***Course name***	***EC***	***Course code***	***Course name***	***EC***	
191512001	Calculus A (191512001)	4	*191530420*	Statistics & probability for premaster IEM	5	
201500014	Academic skills for premaster IEM	1	201500014	Academic skills for premaster IEM	4	
			201500015	Excel/VBA	3	
201500020	Financial Engineering for premaster IEM	10	201400317	Operations Strategy*	3	
			201500019	Project OM for premaster IEM (3 EC)		
		15			15	30
*	students with prior knowledge on this topic will have to do Project OM for premaster IEM instead					

In the education catalogue Osiris you can find course descriptions:
https://osiris.utwente.nl/student/OnderwijsCatalogusKiesCursus.do

2 Other programme-specific characteristics

2.1 Content of the specializations

The Master's programme Industrial Engineering and Management differentiates the following specializations (tracks).

- **Production and Logistics Management (PLM)**

This track focuses on the design and management of logistics processes and processes in the supply chain, from procurement of the raw materials to delivering the end product to the customer (and back: reverse logistics). The courses explore the theory and practice of these processes, covering topics such as design and planning of manufacturing processes, warehousing, distribution logistics, transportation, project management, and maintenance projects, and include the use of software tools for the simulation of business processes. Most courses are based on the application of Operations Research techniques in solving problems in production and logistics. Next to the industrial sector, attention is also paid to application of these methods in solving operational problems in service organizations, with an emphasis on hospitals (in collaboration with the HCTM track). The application of procurement strategies to the public sector is another topic of interest.

- **Financial Engineering and Management (FEM)**

The FEM track applies methods taught in the IEM Master's programme to the area of banking, insurance, and pensions. It also introduces concepts from the financial world into more traditional production areas. The increasing complexity of financial contracts, the growing overlap between providers of financial products (such as the merging of banks and insurance companies), and the emerging markets for "new" products (such as electricity, milk quota or emission rights) have resulted in a demand for quantitative instruments for risk management. This track teaches how to analyse and manage financial risks using financial products and modifying business processes.

- **Health Care Technology and Management (HCTM)**

The HCTM track focuses on managing organizations in the health care sector. Health care processes are analysed and optimized in the context of health care organizations, such as a hospital. The track pays explicit attention to the specific health care context of these organizations, including systems for reimbursement and insurance in health care, and new developments in health care technology. The track introduces quantitative and qualitative methods to support health care management in its optimization of health care delivery to patients. These methods facilitate the effective introduction and application of new health care technology, and the efficient planning of health care processes.

2.2 Coherence and didactical concept

In the MSc IEM programme, students learn to work on more complex challenges in Industrial Engineering and Management. MSc IEM graduates are specialized in a particular field of IEM and are also able to translate domain problems into scientific questions and vice versa, and to undertake scientific research in this domain. The specialization is achieved by following specific tracks.

We have chosen to use a wide variety of teaching methods. Different competences and knowledge domains require diverse teaching and study approaches, and a variation in study activities enhances the motivation of students.

The structure of the first 1.5 year of the MSc programme is focused on teaching and learning activities. For example, students experience lecture classes, tutoring in small groups, individual assignments, and group work on real cases. Students are stimulated to gather new knowledge and to take initiatives to follow their own curiosity and interests. The last semester contains the graduation project of 30 EC. A student spends the complete final semester on research and writing the Master's Graduation Project report. Most often, this work on a real issue has an applied nature: undertaking a project, conducting research, and writing a report in a company/organization. It is a challenging and difficult project: the student applies his knowledge and skills in an environment with high professional standards. It is also scientific: it is required to make use of

scientific knowledge, and to provide well-founded support for solutions and recommendations. The student works as a professional in the environment of the organization.

2.3 Profile of the programme

The Industrial Engineering and Management programme is aimed at educating students to highly qualified industrial engineers and managers.

Industrial Engineering and Management (IEM)[1] is about improving operational processes, in which multiple (sometimes competing) objectives need to be considered such as: improve quality and service, manage risks, increase productivity, and reduce cost). Industrial Engineering & Management uses modeling and quantitative analysis, is grounded in an understanding of the technology that is used in processes, considers human behavior and has an open mind for the environment of the organization for example: competitors, market structures, regulation, or government policy).

IEM is applied in a variety of fields such as: manufacturing, finance, logistics, telecommunications, healthcare). IEM does not only apply to products, but also to services, processes, and projects. Customers may be consumers or other companies in the private sector. IEM is also relevant for the public sector (such as: health care, taxation and social insurances, defense, water management and financing and project management of infrastructure projects). We respect this broadness of IEM applications by giving students considerable freedom in focusing their programme on areas they are specifically interested in.

In the MSc IEM programme, students learn to work on more complex challenges in Industrial Engineering and Management and with less professional guidance compared with the BSc TBK programme. MSc IEM graduates are specialized in a particular field of IEM and are also able to translate domain problems towards scientific questions and vice versa, to undertake scientific research in this domain.

The MSc programme consists of a set of '*core courses'*, including specialization courses', 'elective courses' and the final assignment. In the *core courses* some topics are covered which every IEM graduate should master, and in depth courses of his specialization. The specialization courses and elective courses provide the opportunity to create a personal profile. This may vary from even more in-depth specialization in a certain scientific domain to a more broad professionalization in e.g. design methodologies, modeling techniques, IEM in health care etc. The elective courses offered may vary, depending on the available staff expertise and the research activities of the various departments. Various clusters and electives are offered. From the available courses and electives, every student makes up a personal IEM examination programme. To guarantee a proper covering of the final qualifications, such an individual programme has to be approved by, or on behalf of, the Examination Board.

2.4 Content of practical exercises

A practical exercise is an academic unit or a component of an academic unit in which the emphasis is on the activity of the student, such as:

- preparing a literature review, paper or design project, thesis, article, or position paper, or delivering a public presentation;
- a design or research assignment, tests and experiments, practical exercises, skills practice;
- work placement, fieldwork or excursions;
- participation in other required learning activities aimed at achieving the desired skills.

Practical exercises are generally part of an academic unit for which there is a responsible examiner. The structure of the practical exercise(s) is described in general terms in OSIRIS, and in more detail on Blackboard at the start of the programme.

[1] In Dutch: Technische Bedrijfskunde, in German: Wirtschaftsingenieurwesen

2.5 Master's assignment

The Master's assignment (or Master's project or Master's thesis) is 30EC and has to be finished (green light for colloquium) within the nominal study time (20 weeks). Extension of the nominal study time is only allowed after approval of the supervisor and programme director with a maximum of 50%. For more information about the execution of these rules we refer to our Blackboard site 194100060 Master Thesis IEM', Master Thesis Syllabus.

A single responsible instructor does not supervise the assignment; instead, a Master's committee is assembled for each assignment. The Master's project is evaluated on an individual basis. The Master's project tests the student's competence in the integrated application of the knowledge, comprehension and skills covered in the study units. The Examination Board prescribes an evaluation checklist to help ensure the quality of the evaluation. More practical information on the Master's assignment is found in the Master's Thesis Syllabus.

2.6 Honours programmes

For excellent students the University of Twente offers three different extra-curricular Master's honours programmes of 15 EC. Each of these programmes has a distinctive profile, which allows the student to develop himself in one of three roles: as an organizer, designer or researcher. These programmes are:

- MSc Change Leaders
- MSc Design Honours
- MSc Research Honours

More information about these programmes and the corresponding selection procedure can be found at the UT honours programmes website http://www.utwente.nl/excellentie/en/

The programme offers an extra 'in depth' Talent programme. More information about these programmes and the corresponding selection procedure can be found on the Blackboard Organization 'IEM Programme Information'.

3 Aims and final attainment targets

3.1 Aims of the programme

The graduates of the MSc IEM programme are able to analyse problems and define required improvements for the design and control of operational processes (the IEM domain) at an academic level. Moreover, they are able to implement such improvements. The MSc graduates are able to perform these activities in complex situation.

3.1 Final attainment targets

The first group of qualifications (A) is related to the professional academic activities of an IEM graduate; the second group (B) reflects the general academic level.

Table 1: **Final qualifications MSc IEM**

Academic qualifications	
The graduate is able to quickly identify, thoroughly comprehend, critically assess, correctly apply, and creatively integrate existing scientific knowledge that can be used for analysing problems and designing solutions, in one of the domains of: production and logistics; financial engineering; health care and technology management. This implies the following competencies in the domain chosen	
A1	Has a thorough overview of the structure of research and design processes and is able to - identify the various steps in performed research and design - properly break up own research and design activities into sub-processes These processes are intertwined: Research is needed for producing knowledge that is used for designing solutions in a specific context. Such knowledge is produced in a purposeful and methodical way (using

	scientific research methods). It may or may not be generalizable knowledge
A.2	Has a thorough overview of quantitative and qualitative empirical research methods and is able to - critically analyse performed research as to the methodological aspects - select an appropriate method and justify this choice for research to be performed - apply this method in relatively complex cases
A3	Has a thorough overview of quantitative modelling techniques for operational processes in this domain, and is able to - critically analyse the results of modelling activities - select appropriate modelling techniques and justify this choice - apply these techniques in relatively complex cases.
A4	Is able to integrate existing knowledge, modelling techniques, and research results for designing, validating, and selecting solutions in relatively complex cases This is challenging, because existing knowledge may not fully apply to a specific situation, models are always stylized, empirical research always has limitations, and some aspects have been left out of scope from the beginning anyway
A5	Has an overview of implementation methods and processes and is able to - critically analyse on going or finished implementation processes - plan globally an implementation process in a relatively complex case
A6	Has an overview of evaluation methods and techniques and is able to - critically analyse the results of performed evaluations - select appropriate evaluation methods and justify this choice - carry out an evaluation in relatively complex cases
A7	In order to be able to meet these competencies, the graduate must have mastered level 3 of a set of core disciplines in the specialization domain.
A8	Is able to contribute to the development of the academic profession by identifying generic consequences and implications from professional cases (for example, general presentations, and write papers about design solutions).
General academic qualifications	
B1	Is able to work autonomously and self-reliant
B2	Is able to work in multidisciplinary teams.
B3	Is able to communicate properly (in oral and written form) with various stakeholders
B4	Is able to conduct a bibliographic search and knows how to reference correctly
B5	Is able to reflect on professional behaviour and ethical and societal aspects of work
B6	Is able to reflect on and direct personal and professional development
B7	Is able to manage and concretize effectively his own learning process in the context of “lifelong learning”

3.2 Level of the programme

Table 2: Relationship between Final Qualifications and the Criteria for Academic Bachelor’s and Master’s Curricula of the 3TU

	Competent in one or more scientific disciplines	Competent in doing research	Competent in designing	A scientific approach	Basic intellectual skills	Competent in co-operating and communicating	Takes account of the temporal and social context
A1		x	x				
A2		x			x		
A3				x	x		
A4			x	x			
A5							
A6			x				
A7	x				x		
A8							
B1						x	
B2						x	
B3						x	
B4				x			
B5							x
B6							x
B7	x						

4 Examination and exams

4.1 Examination

The programme has one examination, the Master's examination end of the second year. The Master's examination is deemed to have been successfully completed if the exams of the units of study, including the Master's thesis, have been taken successfully.

4.2 Exam formats and the number and sequence of exams and practical exercises

A unit of study is completed with an exam. An exam can comprise one of the following formats:
- a written exam
- an oral exam
- a series of tests
- the assessment of practical exercises as meant in art. 1 (Glossary)
- a combination of the above

The exam formats of each of the courses offered in the programme is shown in Table 1.

4.3 Required sequence of exams / Prerequisites

Prior knowledge prerequisites in the MSc are restricted to the phase where the student starts the Master's project. See the table 1 for the prerequisites per course.

5 General information

5.1 Admission to the programme

The admission request for the programme is assessed by an admission committee that consists of the programme director of the programme, the specialisation coordinator and the programme coordinator.

In addition to the general criteria, Industrial Engineering & Management distinguishes two types of (inter)national education;
1. Research Universities (primarily responsible for research-oriented programmes)
2. Universities of applied sciences (prepares students particular for more practical professions)

The admission committee has specific requirements depending on the degree. All applicant will be judged on an individual basis.

1. Degree of (a Dutch) Research Universities

a. A Bachelor's degree in Industrial Engineering & Management or related awarded by a Dutch university

Applicants with a Bachelor's degree in Industrial Engineering & Management awarded by a Dutch university will be admitted to the programme.

b. Another Bachelor's degree awarded by the University of Twente

Applicants with "technical' Bachelor's degree other than IEM awarded by *the University of Twente* will be admitted to the programme. If necessary the applicant will have to finish a small (15EC) pre-master programme.

Applicants with a " non-technical' Bachelor's degree awarded by *the University of Twente* will only be admitted If their prior educational profile is suitable and their mathematics proficiency is at pre-university level equal to the Dutch 'VWO Wiskunde B'.
The student will have to finish a 30EC pre-master programme. The admission committee determines the content of the pre-master programme. The applicant must have successfully completed the entire pre-master programme within a period of 12 months from the start[2] and within two exam attempts per premaster course.

[2] Idem (as previous note)

2. Degree of (a Dutch) University of Applied Science (HBO)

a. A Bachelor's degree in a related field awarded by a Dutch University of applied science

Students with a Bachelor's degree in a related (technical) field awarded by a Dutch University (college) for applied science be admitted to a pre-Master's programme:

- If their mathematics proficiency is at pre-university level equal to the Dutch 'VWO Wiskunde B'.
- If their prior educational profile is suitable
- If their 'General Personal Average Score' is clearly above average
- If they express a clear motivation in English for the programme and their chosen specialization
- If their English proficiency is at VWO level

b. Another Bachelor's degree awarded by a (Dutch) University of applied science

Applicants with mathematics proficiency on VWO level Mathematics B and a degree in a non-related field are judged on an individual basis. In specific cases and on the recommendation of a specialization coordinator, the admission committee may grant exemptions, entirely or partly, from the domain-specific part of the pre-master programme. The applicant must have successfully completed the entire pre-master programme before being admitted to the Master's degree programme.

3. International Bachelor's degree

The admissions committee assesses international applicants with a Bachelor's degree awarded by a non-Dutch Research University or University of applied science on an individual basis. The assessment of the applicant's skills is based on:

- a NUFFIC credential evaluation;
- A Bachelor's degree in a related field
- a letter of motivation;
- an academic IELTS overall band score of at least 6.5 (see also www.ielts.org) or a TOEFL internet-based (TOEFL-iBT) score of at least 90
- mathematics proficiency is at VWO level (Wiskunde B)
- any additional information required by the admissions committee.

The assessment of all applicants' skills is based on academic background and the possibility for students to finish the Master programme in 2 years.

5.2 Language of teaching and exams

The language of teaching and exams in the Master's programme is English.

5.3 International cooperation

Several student are going abroad during their study period. The programme offers students the possibility to achieve specific personal and professional objectives.
Student can use our international exchange programme contacts from all over the world, to find their most suitable fit to gain the required knowledge and experiences. Some examples of exchange universities are: Swinburne University of Technology – Australia, Tecnológico de Monterrey – Mexico, The University of Manchester – UK, Fachhochschule München / Munich University of Applied Sciences, Technische Universität Berlin - Germany, Università degli Studi di Bologna – Italy, Bogazici University – Turkey, etc.
For more contacts and/or information see the webpage Study Abroad.

5.4 Elective options and requirements related to electives and student's individual choices

Students can use the elective courses to get a better understanding of a specific topic or a broader field. As electives students can join other IEM Master's courses, or Master's courses offered by the UT-faculties CTW, EWI and TNW of the University of Twente. Exchange courses from other (international) universities may also be incorporated in the programme if they are of a sufficient level and technical orientation with no overlap in the IEM programme courses. Exchange courses to need approval by the Programme Director with mandate of the Examination Board.

Studying abroad for one semester is stimulated. Students who use this flexibility need to discuss their complete study programme (and personal motivation) with their study counsellor or specialization coordinator.
Some suggestions for interesting electives are mentioned in the table below.

MSc Industrial Engineering & Management 2017-2018			
Specialisation and recommended (UT) elective courses			
	UNDER CONSTRUCTION		
Code	**Course names**	**EC**	**Quartile (Sept = Q1)**
FEM: mandatory courses			
191860651	Micro Economics	5	1
201200138	Special topics in Financial Engineering	5	2
201300060	Mathematical Finance	5	2
201300062	Structured Products	5	3
191515101	Introduction to Risk Theory	5	2
191860181	Risk Management	5	3
201000202	Management Control for Financial Institutions	5	4
191506103	*Statistics and probability*	*5*	*1*
201100162	Management of Technology for FEM	5	4
201700020	IEM Research Orientations	5	1 and 3
201400174	*Data Science*	*5*	*2 and 3*
201200128	*Preparation thesis*	*5*	*2*
194100060	*Master thesis*	*30*	
FEM additional elective courses			
191521800	Game Theory	5	1
201400244	Cost Management and Engineering	5	2
194105070	Information Systems for the Financial Services Industry	5	4
191820210	Simulation (2x2,5 EC)	5	1-2
PLM: mandatory courses			
191820200	Discrete Optimization of Business Processes (2x2,5 EC)	5	1-2
191820210	Simulation (2x2,5 EC)	5	1-2
191820190	Supply Chain - & Transport Management	5	3
191852620	Advanced Production Planning	5	4
191820120	Warehousing	5	4
201700020	IEM Research Orientations	5	1 and 3
201400174	*Data Science*	*5*	*2 and 3*
201200127	*Preparation thesis*	*5*	*2*
194100060	*Master thesis*	*30*	
PLM additional elective courses			
191506103	Statistics and probability	5	1
191820160	Purchasing	5	1
191102041	Manufacturing Facility Design	5	2
194121020	Optimization of Healthcare Processes	5	3
191852630	Reliability Engineering & Maintenance Management	5	3
191820180	Reverse Logistics & re-manufacturing	**5**	**2**
201200146	Maintenance Engineering & Management	5	1
194122030	New Production Concepts	5	4

HCTM: mandatory courses			
191820200	Discrete Optimization of Business Processes (2x2,5 EC)	5	1-2
191820210	Simulation (2x2,5 EC)	5	1-2
194121020	Optimization of Healthcare Processes	5	3
201700196	Advanced Health Economic Modeling	5	3
201700197	Decision Making in Health Care	5	4
201700020	IEM Research Orientations	5	1 and 3
201400174	*Data Science*	*5*	*2*
201200130	*Preparation thesis*	*5*	*2*
194100060	*Master thesis*	*30*	
HCTM additional elective courses			
191506103	Statistics and probability	5	1
192360501	E-health strategies	5	4
201600032	Quality Management in Healthcare	5	2
192340101	Implementation of IT in organizations	5	3
191820160	Purchasing	5	1
191820120	Warehousing	5	4
	Some study paths		
Course Code	**Course Name**	**EC**	**Quartile (Sept = Q1)**
Information and Technology Management: Courses offered by Master Business Information Technology			
191863960	Foundation of Information systems	5	1
192376500	Business Process Integration Lab	5	1
201100051	Information Services	5	2
192340101	Implementation of IT in organizations	5	3
192376000	Business Case Development for IT Projects	5	4
192320501	Electronic commerce	5	3
192360021	ICT Management	5	3
Technology Venturing and Innovation Management (Courses offered by Business Administration)			
These courses can not be taken separately but only as a package of 30EC			
201600015	Strategic Technology Management and Innovation	5	3
194108040	Business Development in Network Perspective	5	2
201600012	Management and Governance of Innovation and Creativity	5	1
201600011	International Entrepreneurship – a strategic technology perspective	5	1
201600002	Entrepreneurial Leadership & Responsible Organizational Design	5	1
201000087	Entrepreneurial Finance	5	3
Maintenance: Courses offered by Master Mechanical Engineering and Industrial Engineering and Management			
201200146	Maintenance Engineering & Management	5	1
191820180	Reverse Logistics & Remanufacturing	5	2
201300038	Failure Mechanisms & Life Prediction	5	2
191852630	Reliability Engineering & Maintenance Management	5	3
201300039	Structural Health & Condition Monitoring	5	4
	extra		
201400040	Dynamics & Control (links to 201300038)	5	1
191155730	Tribology (links to 201300039)	5	2
201200145	Design for Maintenance (IO)	5	
195820500	Infrastructure Management	7,5	4

5.5 Programme Committee (OLC)

Members of the Programme Committee (OLC) are appointed by the Dean of the faculty every (two) year(s) (faculty regulations article 13). The most recent composition of the committee can be found at the webpage www.utwente.nl/bms/en/education/regulations/ of the programme committees. Correspondence with the committee goes through mailing to the members on their Utwente.nl address. For more information contact the secretariat at 3200.

5.6 Examination Board

Members of the Examination Board are appointed by the Dean of the faculty every (two) year(s) (faculty regulations article 12). The recent composition of the Board can also be found at the www.utwente.nl/bms/en/education/regulations/. Correspondence with the Boards goes through examencommissiebms@utwente.nl. For more information contact the secretariat at 3200.

6 Transitional arrangements

Transitional arrangements IEM

IEM general

Per September 2017 some changes will be implemented in the IEM study programme. Students from cohort 2015 and 2016 in general should not be affected in studying the mandatory courses by those changes. If student's face problems in their approved study planning due to rescheduled courses please contact your specialization coordinator or the study counselor. Exam problems are not foreseen.

Common Course:

A new mandatory course is offered. *IEM Research Orientation* is a 5EC course mandatory for all IEM students. The course is offered twice a year; quartile 1 and 3.

PLM specialization:

The content of the courses *191820180 Reverse Logistics & re-manufacturing* and the course *191820190 Supply Chain - & Transport Management*, will change up to 30%. This means that no transitional arrangements are necessary. Students who failed the courses earlier do have to be aware of the changes.

HCTM specialization:

Two new mandatory courses will be offered in the academic year 2017-2018:
Advanced Health Economic Modeling of 5 EC and *Decision Making in Health Care also 5 EC.*

The course: 201600029 Finance and healthcare purchasing if not offered anymore**.** If student's took the course but failed the exam, they can contact the lecturer.

7 Additional subject

7.1 graduation with distinction

1. Industrial Engineering and Management has a regulation for graduating with distinction for the first-degree Master's programme. If upon sitting the Master's examination, the student has given evidence of exceptional capability, 'cum laude' (with distinction) will be recorded on the degree certificate.
2. A student is considered to have exceptional capability if each of the following conditions is met:
   a. the average mark awarded for the study units of the master examination is at least 8.0;
   b. in the determination of this average, the units that were not evaluated with a numerical mark or for which an exemption was granted are not considered

c. no study unit was evaluated as not passing, and no more than one unit was evaluated with a mark of 6;
d. the mark for the final unit (Master's project or Master's thesis) is at least an 8;
e. for the first degree programmes, a two-year Master's programme must have been completed within 30 months.

3. In exceptional cases the Examination Board may grant the designation of „cum laude" if the conditions mentioned in paragraph 2 above have not been fully met. The rules applied by the Examination Board can be found in the Rules & Regulations of the Examination Board.

7.2 Special regulations on the master Thesis

a. The Master's project (or thesis) constitutes a special form of practical exercise as meant in art. 1 (Glossary). Its duration is formally limited by the number of 30 ECs (1 EC= 28 hours) reserved for the project in the respective Master's programme, translated into a corresponding number of weeks: 20. At the end of the period thus established, the project is evaluated using a special Master's thesis evaluation form. The project is concluded by a colloquium, where the student presents and defends the results.
b. During the preparation course the student draws up a time schedule for his individual project, based on the maximum duration as indicated in par. 1. This schedule has to be approved by the primary supervisor (and examiner) of the project. The start of the project is indicated on the registration form of the project in the university's Student Mobility System (SMS).
c. In case of major problems or unsatisfactory performance by the student or the supervisors during the project, the programme director will decide on the continuation of the project. The student can contest the programme director's decision by lodging an objection with the Examination Board.
d. Should the student, in spite of a demonstrably adequate level and quality of the supervision received, not succeed in completing the final thesis within the agreed period of time, he will be granted extra time to do so. The extra time to be granted will be bound by a limit of 50% of the maximum duration of the project. The project's supervisors will give clear indications of the elements of the student's work that need to be remediated and the lines along which this may be done.
e. The programme director will terminate the Master's project if, after the extra time conceded, the student has not yet successfully completed the final thesis or no 'green light' has been given by the supervisors for the colloquium that rounds off the project.
f. After termination of the project as meant in par. 6.b.b., the student must file a motivated request to the Examination Board if he wants to start a new Master's project.
g. Additional stipulations concerning the Master's project are included in the Rules & Regulations of the Examination Board.