

# **Programme-Specific Appendix to the EER 2020-2021**

For the Master of Science programme

## **Industrial Engineering and Management Science (M-IEM)**

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# 1 Structure and content of the programme

## 1.1 Programme content

The Master's degree programme Industrial Engineering and Management (M-IEM) consists of four components (see Table 1):

1. A set of mandatory IEM courses, including the master thesis assignment;
2. A set of mandatory specialisation courses;
3. A set of mandatory orientation courses;
4. Additional elective courses.

The programme starts in September and February.

Table 1

*Structure of the MSc Industrial Engineering and Management programme 2020-2021*

MSc Industrial Engineering and Management Programme 2019-2020			
M-IEM structure	EC	Specialisations	Orientations
1. Mandatory IEM	45	Production and Logistics Management (PLM)	Service Logistics and Maintenance Management
2. Mandatory per specialisation	15		Supply Chain and Transportation Management
3. Mandatory per orientation	15		Manufacturing Logistics
4. Electives	45		Operations Management in Healthcare
Total ECs	120	Health Care Technology and Management (HCTM)	Health Care Technology and Management
		Financial Engineering and Management (FEM)	Financial Engineering and Management

For detailed information about the content of the specialisations and orientations, see Table 2 and Section 1.3. As shown in Table 2, most Master courses are assessed with the use of practical exercises combined with a written exam. Examples of practical exercises are: preparing a literature review, paper, or design project, delivering a public presentation, participating in a workshop on the international classroom, and writing a thesis or paper. The structure of the practical exercise(s) is described in general terms in Osiris.

## 1.2 Study load

The M-IEM programme represents a study load of 120 ECTS (EC) or 3360 hour (1EC = 28 hour). All M-IEM courses are 5EC with exception of the Master thesis, which is 30EC.

## 1.3 Programme-specific characteristics

### 1.3.1 Profile of the programme

The IEM programme is aimed at educating students to become highly qualified industrial engineers and managers. IEM is about improving operational processes, in which multiple (sometimes conflicting) objectives need to be considered such as improving quality and service, managing risks, increasing productivity, and reducing cost. Modelling and quantitative analysis are used, grounded in an understanding of the technology that is used in processes. Human behaviour is an important factor as well as an open mind for the environment of the organisation, including competitors, market structures, regulation and government policy.

Table 2  
Overview of the mandatory courses per specialisation and research orientation including the following categories: course code, course name, the quartile in which the course is offered (Q) and the test format.

IEM Production and Logistic Management research orientations															
Code	Service Logistics and Maintenance Management	Q	Test	Code	Supply Chain and Transportation Management	Q	Test	Code	Manufacturing Logistics	Q	Test	Code	Operations Management in Healthcare	Q	Test
Mandatory per specialisation															
201700020	IEM Research Orientation	1+3	P	201700020	IEM Research Orientation	1+3	P	201700020	IEM Research Orientation	1+3	P	201700020	IEM Research Orientation	1+3	P
201400174	Data Science	2+3	P	201400174	Data Science	2+3	P	201400174	Data Science	2+3	P	201400174	Data Science	2+3	P
202001464	Thesis Preparation	--	P	202001464	Thesis Preparation	--	P	202001464	Thesis Preparation	--	P	202001464	Thesis Preparation	--	P
194100060	Master Thesis	--	PO	194100060	Master Thesis	--	PO	194100060	Master Thesis	--	PO	194100060	Master Thesis	--	PO
201800003	Operations Research Techniques 1	1+3	W	201800003	Operations Research Techniques 1	1+3	W	201800003	Operations Research Techniques 1	1+3	W	201800003	Operations Research Techniques 1	1+3	W
201800004	Operations Research Techniques 2	4	P	201800004	Operations Research Techniques 2	4	P	201800004	Operations Research Techniques 2	4	P	201800004	Operations Research Techniques 2	4	P
191820210	Simulation	1	PW	191820210	Simulation	1	PW	191820210	Simulation	1	PW	191820210	Simulation	1	PW
Mandatory per orientation															
201800008	After-Sales Service Logistics	2	PW	201800010	Transportation and Logistics Management	3	PW	201800007	Planning & Scheduling	4	PW	201800007	Planning & Scheduling	4	PW
191852630	Reliability Eng. & Maintenance Mngt	3	W	201800009	Advanced Inventory Management	2	PW	201800009	Advanced Inventory Management	2	PW	191506103	Statistics & Probability	1	W
201800009	Advanced Inventory Management	2	PW	201800008	After-Sales Service Logistics	2	PW	191820120	Warehousing	4	W	194121020	Optimization of Healthcare Processes	3	P
<b>IEM HCTM and FEM specialisation</b>								<b>General information</b>							
Code	Health Care Technology and Management	Q	Test	Code	Financial Engineering and Management	Q	Test	Key to test formats: W = written exam O = oral exam P = practical assignment  Stochastic Models for Operations Management (191530881) is: - mandatory for PLM and HCTM students who did a pre-master; - possibly mandatory for international students in case of a deficiency.  Statistics & Probability (191506103) may be mandatory for international PLM and HCTM students in case of a deficiency.  All course content can be found with the course code in the Course Catalogue of Osiris on this website: <a href="https://osiris.utwente.nl/student/OnderwijsCatalogusZoekCursus.do">https://osiris.utwente.nl/student/OnderwijsCatalogusZoekCursus.do</a>  Name changes in 2020 201700196 Advanced Simulation for Health Economic Analysis (was Advanced Health Economic Modeling) 201800005 Applied Statistical Learning (was Statistical Learning in Health Care)							
Mandatory per specialisation															
201700020	IEM Research Orientation	1+3	P	201700020	IEM Research Orientation	1+3	P								
201400174	Data Science	2+3	P	201400174	Data Science	2+3	P								
202001464	Thesis Preparation	--	P	202001464	Thesis Preparation	--	P								
194100060	Master Thesis	--	PO	194100060	Master Thesis	--	PO								
201800003	Operations Research Techniques 1	1+3	W	191506103	Statistics & Probability	1	W								
201800004	Operations Research Techniques 2	4	P	191860651	Micro Economics	1	PW								
191820210	Simulation	1	PW	201300060	Mathematical Finance	2	W								
Mandatory per orientation															
201700196	Advanced Simulation for Health Economic Analysis	3	PW	191515101	Introduction to Risk Theory	2	W								
201700197	Decision Making in Health Care	4	PW	191860181	Risk Management	3	PW								
201800005	Applied Statistical Learning	1	P	201300062	Structured Products	3	W								

IEM is applied in a variety of fields such as manufacturing, finance, logistics, telecommunications and health care. The IEM scope does not only involve products, but also 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 organisations, financial institutions, social insurance organisations, Defence and governmental water management and infrastructure projects. IEM students are prepared for these various contexts by giving them considerable freedom in focusing their programme on areas they are specifically interested in.

In the M-IEM programme, students learn to work on more complex challenges in the field of Industrial Engineering and Management and with less professional guidance compared with the B-IEM programme. M-IEM graduates are specialised 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.

### 1.3.2 Content of the specialisations

In the first quartile students choose a specialisation within the M-IEM. Students can switch from one specialisation to another as long as they finish all mandatory courses of the new specialisation. The M-IEM differentiates the following three specialisations:

**Production and Logistics Management (PLM):** This specialisation 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 modelling, analysis and 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 organisations, 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.

This PLM specialisation offers four orientations (see Table 1). An orientation represents a scientific research area. Within this specialisation students choose one orientation. The specialisation and chosen orientation leads them through the programme with mandatory courses and the topic of the Master thesis.

**Financial Engineering and Management (FEM):** The FEM specialisation focuses on designing methods for the financial sector. 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.

The FEM specialisation offers one orientation, but students will get acquainted with all IEM orientations. The specialisation itself leads them through the programme with mandatory courses and the topic of the Master thesis.

**Health Care Technology and Management (HCTM):** The HCTM specialisation focuses on managing organisations in the health care sector. Health care processes are analysed and optimised in the context of health care organisations, such as hospitals. The track pays explicit attention to the specific health care context of these organisations, 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 optimisation 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.

The HCTM specialisation offers one orientation, but students will get acquainted with all IEM orientations. The specialisation itself leads them through the programme with mandatory courses and the topic of the Master thesis.

### 1.3.3 Coherence and didactical concept

A wide variety of teaching methods is used in this programme. 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 M-IEM 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 life cases. Within the courses 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 thesis. Most often, this work on a real issue has an applied nature: undertaking a project, conducting research, and writing a report in a company/organisation. 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: the students are required to make use of scientific knowledge, and to provide well-founded support for solutions and recommendations.

## 1.4 Honours programmes

For excellent students the University of Twente offers three different extra-curricular Masters honours programmes of 15EC. Each of these programmes has a distinctive profile, which allows the student to develop in one of three roles: as an organiser, 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/>.

## 1.5 Pre-master programmes (bridging programmes – transfer minor)

Students who are not directly admissible (see Section 4.1) but have mathematics proficiency on pre-university level mathematics B (equal to the Dutch VWO wiskunde B) and a programme with a strong related technical orientation, will be admitted after successfully completing a pre-master programme. A pre-master programme can be taken as a separate master programme, or as a special 'bridging 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 pre-master programmes, have

to take up to 15EC of courses. Students with a technical study programme from a University of Applied Science or students with a Social Science programme from a Research University, admitted to one of the pre-master programmes, have to take up to 30 EC of courses. The courses depend on the chosen specialisation (see Table 3 and Table 4). For more information visit the website <https://www.utwente.nl/en/education/master/>.

Table 3

*Pre-master programmes per specialisation for students from technical programmes of a Research University, offered in the first quartile (Sept-Oct).*

Research University, technical programmes		
Pre-master for PLM and HCTM		
Code	Course Name	EC
202001176	Statistics and Probability Theory for premaster IEM	5
202000450	OR models for premaster IEM	10
<b>Total EC</b>		<b>15</b>
Pre-master for FEM		
Code	Course Name	EC
202001176	Statistics and Probability Theory for premaster IEM	5
202000454	Financial Engineering for premaster IEM	10
<b>Total EC</b>		<b>15</b>

Table 4

*Pre-master programmes, per specialisation, for students from social science programmes of a Research University or from a programme of a University of Applied Science (HBO), offered in the first and second quartile (Sept-Feb).*

Research Universities, social science programmes, or Applied Science (HBO) programmes					
First quartile (Sept-Oct)			Second quartile (Nov-Feb)		
Pre-master for PLM and HCTM					
Code	Course name	EC	Code	Course name	EC
202001172	Calculus A for pre masters	4	202001176	Statistics and Probability Theory for premaster IEM	5
202000451	Academic skills for premaster IEM	1	202000451	Academic skills for premaster IEM	4
202000450	OR models for premaster IEM	10	202000452	Excel/VBA	3
			201400317	Operations Strategy*	3
		15			15
<b>Total EC</b>					<b>30</b>
Pre-master for FEM					
Code	Course name	EC	Code	Course name	EC
202001172	Calculus A for pre masters	4	202001176	Statistics and Probability Theory for premaster IEM	5
202000451	Academic skills for premaster IEM	1	202000451	Academic skills for premaster IEM	4
202000454	Financial Engineering for premaster IEM	10	202000452	Excel/VBA	3
			202000397	Operations Strategy*	3
		15			15
<b>Total EC</b>					<b>30</b>

\* Students with prior knowledge on this topic will have to do Project OM for premaster IEM (course code 201500019) instead.

The entire pre-master programme has to be completely finished within one academic year. No more than two attempts are permitted per course, to successfully finish the corresponding tests. If a student fails to successfully complete the entire programme under these conditions, the student will not be admitted to the IEM Master programme.

## 2 Goals and final qualifications

### 2.1 Aim of the programme

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

### 2.2 Intended learning outcomes (ILOs)

The ILOs (or the so called Final Qualifications) of the M-IEM programme correspond to the requirements formulated by comparable programmes in the Netherlands and abroad, and by professional practice. We distinguish two groups of competences: domain-specific and general competences. The general competences have a specific operationalization: reflection, working in (multidisciplinary) teams, the preparation of students lifelong learning, ethics and philosophy of science and Corporate Social Responsibility. Table 5 outlines the ILOs.

Table 5

*Intended Learning Outcomes of the Master Industrial Engineering and Management programme.*

<b>A. Professional Academic Qualifications</b>	
	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: <ul style="list-style-type: none"> <li>• Production and logistics;</li> <li>• Finance and accounting;</li> <li>• Health care</li> </ul>
<b>A1</b>	Has a thorough overview of the <u>structure of research and design</u> processes and is able to: <ul style="list-style-type: none"> <li>• Identify the various steps in performed research and design;</li> <li>• Properly break up own research and design activities into sub-processes.</li> </ul> <p><i>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.</i></p>
<b>A2</b>	Has an overview of quantitative and qualitative <u>empirical research methods</u> and is able to: <ul style="list-style-type: none"> <li>• Critically analyse performed research as to the methodological aspects;</li> <li>• Select an appropriate method and justify this choice for research to be performed;</li> <li>• Apply this method in relatively complex cases.</li> </ul>
<b>A3</b>	Has a thorough overview of quantitative <u>modelling techniques</u> for operational processes in this domain, and is able to: <ul style="list-style-type: none"> <li>• Critically analyse the results of modelling activities;</li> </ul>



	<ul style="list-style-type: none"> <li>• Select appropriate modelling techniques and justify this choice;</li> <li>• Apply these techniques in relatively complex cases.</li> </ul>
A4	<p>Is able to <u>integrate</u> existing knowledge, modelling techniques, and research results for designing, validating, and selecting solutions in relatively complex cases.</p> <p><i>This is challenging, because existing knowledge may not fully apply to a specific situation, models are always stylised, empirical research always has limitations, and some aspects have been left out of scope from the beginning anyway.</i></p>
A5	<p>Has an overview of <u>implementation methods</u> and processes and is able to:</p> <ul style="list-style-type: none"> <li>• Critically analyse ongoing or finished implementation processes;</li> <li>• Plan globally an implementation process in a relatively complex case.</li> </ul>
A6	<p>Has an overview of <u>evaluation methods and techniques</u> and is able to:</p> <ul style="list-style-type: none"> <li>• Critically analyse the results of performed evaluations;</li> <li>• Select appropriate evaluation methods and justify this choice;</li> <li>• Carry out an evaluation in relatively complex cases.</li> </ul>
A7	<p>In order to be able to meet these competencies, the graduate must have mastered a set of core disciplines in the specialisation domain.</p>
A8	<p>Is able to contribute to the development of the academic profession by identifying generic consequences and implications from professional cases (for example, general presentations, write papers about design solutions).</p>
<b>B. General Academic Qualifications</b>	
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 concretise effectively his own learning process in the context of "lifelong learning"

### 3 Exam and interim examinations

#### 3.1 Exam

The Master IEM is completed successfully if all the exams of the study units, including the master thesis, have been completed successfully.

##### 3.1.1 Final examination: the master thesis assignment

The programme concludes with the final assignment: the master thesis. The student demonstrates his abilities in the integrated application of the knowledge and skills gained from the curriculum of the programme. The subject of the master thesis assignment must be related to the chosen specialisation (PLM, HCTM or FEM). The master thesis assignment is evaluated on an individual basis. A committee, consisting of at least two examiners, is assembled for each master thesis assignment to assess the thesis.

The master thesis assignment is 30EC and has to be finished (receive 'Green light'<sup>1</sup>) within the nominal study time (20 weeks). Extra graduation project time can only be authorised by the programme director

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<sup>1</sup> The thesis is regarded by the supervisors to be of sufficient quality to pass with a sufficient grade. 'Green light' is given to finish the report and prepare the end presentation (colloquium).

with a maximum of 50% (10 weeks). The programme director may consult the examiners and/or study adviser before reaching a decision. Reasons for delay can be:

- Insufficient level of and/or progress by the student;
- Insufficient (level of) supervision in the specific research topic;
- Special circumstances.

If a *Green light* has not been obtained within the new time set, the assignment may be graded as insufficient. The student then has to do a new assignment. The student can file an appeal at the Examination Board against the decision of the programme director.

More information regarding the master thesis assignment can be found on the IEM Programme Information Canvas site.

### 3.2 Assessment formats

A unit of study is assessed with an exam. An exam can be of a type as referred to in the EER, paragraph 4.1 sub 2. The exam formats of the mandatory courses offered in the programme are shown in Table 2.

### 3.3 Required sequence of exams / prerequisites

Individual courses may require prior knowledge, this is stated in the course descriptions in Osiris. Further prerequisites in the IEM programme are restricted to the graduation phase:

- Prerequisite for the Master Thesis course (start execution of the project): 80EC of the approved individual IEM study programme, including the Thesis Preparation course.
- Prerequisites for *Green light* for colloquium: 90EC, including all courses of the approved individual IEM study programme.

## 4 General information

### 4.1 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 for admission, IEM distinguishes three types of education:

- Research Universities (primarily responsible for research-oriented programmes);
- Universities of Applied Sciences (prepare students particularly for the practical professions);
- International Bachelor degree.

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

#### 4.1.1 Degree of a (Dutch) Research University

**A Bachelor degree in Industrial Engineering & Management or related awarded by a Dutch university:**

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

**Another technical Bachelor degree awarded by a Dutch university:** Applicants with technical Bachelor degree other than IEM awarded by a Dutch university will be admitted to the programme. The applicant

will have to finish a 15EC pre-master programme, unless the admission committee decides otherwise. When required, the applicant must have successfully completed the pre-master programme before being admitted to the Master IEM programme.

**A non-technical Bachelor degree awarded by a Dutch university:** Applicants will only be admitted if their prior educational profile is related to this programme and their mathematics proficiency is at pre-university level equal to the Dutch 'VWO Wiskunde B'. Additionally, the applicant 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 pre-master programme before being admitted to the Master IEM programme.

#### 4.1.2 Degree of a (Dutch) University of Applied Science (HBO)

**A Bachelor degree in a related field awarded by a Dutch University of Applied Science:** Applicants with a Bachelor degree in a related (technical) field awarded by a Dutch University of Applied Science can be admitted to a pre-master programme if:

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

Additionally, the applicant will have to finish a 30 EC pre-master programme. The admission committee determines the content of the pre-master programme. The applicant must have successfully completed the pre-master programme before being admitted to the Master IEM programme.

**Other Bachelor 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 the specialisation 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 pre-master programme before being admitted to the Master IEM programme.

#### 4.1.3 International Bachelor degree

The admission committee assesses international applicants with a Bachelor degree awarded by a non-Dutch Research University or University of Applied Science on an individual basis. The assessment of all applicants' skills is based on academic background and the possibility for students to finish the Master programme in 2 years. The assessment is based on:

- A Bachelor degree in a related field;
- A motivation letter;
- An academic IELTS overall band score of at least 6.5 (see also [www.ielts.org](http://www.ielts.org)) or a TOEFL internet-based (TOEFL-iBT) score of at least 90; Cambridge CAE-C (CPE). In addition, Chinese nationals need a Nuffic certificate;
- Mathematics proficiency at VWO level (Wiskunde B);

- Course descriptions of the courses that address mathematical topics and a reference list of literature of these courses;
- GRE or GMAT. For candidates who received their Bachelor degree in an non EEA (European Economic Area) a GMAT or GRE test result/the required percentile rank should at least meet the minimum score as mentioned below to process your application:
  - Verbal reasoning: at least 25%
  - Quantitative reasoning: at least 60%
  - Analytical writing: at least 25%
- Any additional information required by the admission committee.

For more information on admission requirements, see <https://www.utwente.nl/en/education/master/programmes/industrial-engineering-management/admission/>

## 4.2 Language of teaching and exams

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

## 4.3 International agreements

The M-IEM programme is designed to give students the option to study abroad (see Section 4.4.1). Students can use the international exchange programme contacts from all over the world, to find their most suitable fit to gain the required knowledge and experiences. Arrangements for study abroad at non-partner universities are subject to special procedures and requirements as specified on the UT study abroad website, [www.utwente.nl/en/study-abroad](http://www.utwente.nl/en/study-abroad). Detailed information on Faculty level can be found on the website <https://www.utwente.nl/en/bms/education/study-abroad/y> and the BMS Study Abroad Canvas site.

## 4.4 Elective programme space

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 courses, or courses offered by other technical Master of Science programmes of the University of Twente or other Research Universities, provided that they are of a sufficient level, have a technical orientation and have no overlap with the IEM programme courses. The student composes a study plan and hands it in for approval at the specialisation coordinator. To do so the student takes the following steps:

- Fill in the mandatory courses in the study programme form (available on the IEM Programme Information Canvas site);
- Select engineering courses as electives, taking prerequisites and the exceptions stated below into account (consult with the study advisor if needed);
- Add the selected courses to the study programme, making sure the elective courses add up to 45EC and the total programme to 120EC;
- Discuss the study programme with the specialisation coordinator for approval.

More information about this process can be found on the IEM Programme Information Canvas site. Some suggestions for interesting electives from UT programmes are mentioned in Table 6. Exceptions:

- **Stochastic Models for Operations Management (191530881) is:**
  - not allowed for students with an UT IEM-BSc background;

- mandatory for PLM and HCTM students who did a pre-master;
- possibly mandatory for international students in case of a deficiency.
- **Stochastic Models in Production Logistics (191531830)** is not allowed, the related course Applied Queueing Models 201800171 is allowed.
- **Statistics & Probability (191506103)** may be mandatory for international students in case of a deficiency.
- **Design of Production and Inventory Systems (191124720)** is not allowed.

Table 6

*Suggested elective courses per research orientation.*

PLM recommended electives					
Code	Service Logistics and Maintenance Management	Q	Code	Supply Chain and Transportation Management	Q
201800007	Planning & Scheduling	4	201800007	Planning & Scheduling	4
201200146	Maintenance Engineering & Management	1	191820120	Warehousing	4
191506103	Statistics & Probability	1	201800065	Traffic Management	3
191820120	Warehousing	4	201800064	Traffic Operations	1
Code	Manufacturing Logistics	Q	Code	Operations Management in Health Care	Q
201800010	Transportation and Logistics Management	3	191820120	Warehousing	4
191820160	Purchasing Management	1	194122030	New Production Concepts	4
194121020	Optimization of Healthcare Processes	3	201700196	Advanced Simulation for Health Economic Analysis	3
194122030	New production Concepts	4	201600025	Finance and Healthcare Purchasing	2
HCTM and FEM recommended electives					
Code	Health Care Technology and Management	Q	Code	Financial Engineering and Management	Q
194121020	Optimization of Healthcare Processes	3	201000202	Management control for Financial Institutions	4
191506103	Statistics & Probability	1	201100162	Applied Financial Engineering	4
201600032	Quality Management in Healthcare	2	201200138	Special Topics in Financial Engineering	2
191820120	Warehousing	4	201400244	Cost Management and Engineering	2

*Note: name change in 2020 for 201100162 Applied Financial Engineering (was Management of Technology FEM)*

#### 4.4.1 Electives abroad

Students can choose to fill in part of their elective space abroad. Exchange courses from international Universities may be incorporated in the programme if they are of a sufficient level and technical orientation with no overlap in the IEM programme courses (see Section 4.3). Exchange courses need approval by the programme director with mandate of the Examination Board. On behalf of the programme director, the specialisation coordinator has to approve the individual study programme. If a student follows a part of their elective courses abroad and, due to unavoidable overlap in schedules, is unable to do a mandatory course, the specialisation coordinator can approve to replace one mandatory course (preferably) by a comparable course at the host University.

#### 4.4.2 Additional Specialisations

Instead of choosing freely, students can take a specified package of courses for a total of 30 EC on specific topics. A student cannot choose a course for his package if this course is already mandatory in his study programme. Finalizing a package will be mentioned on the diploma supplement as ‘Additional Specialisation’ with the name of the specialisation added. At most one Additional Specialisation can be mentioned on the diploma supplement. The three IEM specialisations are available as an Additional Specialisation for all Engineering students, including M-IEM students who would like to do a second IEM specialisation (see Table 7). The other six packages have been compiled in cooperation with other UT-programmes and are only available to M-IEM students (see Table 8). Students who are interested in doing an Additional Specialisation have to contact the programme coordinator and take the following steps:

- Select courses from the package of preference and check the required prior knowledge. Courses that are mandatory for the student’s IEM specialisation and/or orientation are not allowed as package courses;
- Add the selected courses to the study programme (forms are available on the IEM Programme Information Canvas site). Make sure the courses for the Additional Specialisation add up to **30EC**;
- Add other electives so the study programme adds up to 120 EC;
- Discuss the study programme with the specialisation coordinator for approval (with a confirmation email to the programme coordinator).

Table 7

*Additional Specialisations of Industrial Engineering and Management (packages may be subject to change, consult the IEM Programme Information Canvas site for the most recent version).*

Additional Specialisations for Engineering students					
Code	Logistics Management Engineering	Q	Code	Healthcare Engineering	Q
Mandatory courses					
201800003	Operations Research Techniques 1*	1+3	201800003	Operations Research Techniques 1*	1+3
191820210	Simulation **	1	191820210	Simulation **	1
Elective courses					
201800004	Operations Research Techniques 2	4	201800004	Operations Research Techniques 2	4
201800007	Planning & scheduling	4	201700196	Advanced Simulation for Health Economic Analysis	3
191820120	Warehousing	4	201700197	Decision Making in HC	4
191506103	Statistics & Probability	1	201800005	Applied Statistical Learning	1
201800010	Transportation and logistics Management	3	194121020	Optimization of Healthcare Processes	3
201800008	After-Sales Service Logistics	2	191506103	Statistics & Probability	1
191852630	Reliability Engineering & Maintenance Mngt	3	201700089	Sustainable Business Development	1
201800009	Advanced Inventory Management	2	201600032	Quality Management in Healthcare	2
201700089	Sustainable Business Development	1	191820120	Warehousing	4
194121020	Optimization of Healthcare Processes	3	201600015	Strategic Technology Mngmt & Inn	3
<b>Code</b>	<b>Financial Engineering</b>	<b>Q</b>	* Operations Research Techniques 1 prior knowledge requirements: Basics OR, a programming language, i.e. Delphi, Excel/VBA. MATLAB is sufficient only if you are familiar with programming options (scripts, functions and		
Mandatory courses					
191506103	Statistics & Probability	1			
201300060	Mathematical Finance	2			
Elective courses					

191860651	Micro Economics	1	applications) of the program. Extra material available on Canvas  ** Simulation prior knowledge requirements: Basic statistics (probability distribution functions, standard deviation, mean, confidence intervals, etc.). Basic computer programming (if-then constructs, for-loops, local and global variables, functions, procedures, etc.).
191515101	Introduction to Risk Theory	2	
191860181	Risk Management	3	
201000202	Management Control for Financial Institutions	4	
201300062	Structured Products	3	
201100162	Applied Financial Engineering	4	
191521800	Game Theory	1	
201400244	Cost Management and Engineering	2	
201200138	Special Topics for Financial Engineers	2	

Table 8

*Additional Specialisations of other UT-programmes (only for IEM students). The name that will be registered on the diploma supplement is noted in Italics (packages may be subject to change, consult the IEM Programme Information Canvas site for the most recent version).*

Additional Specialisations for IEM students					
Mechanical Engineering			Civil Engineering and Management		
Code	<i>Maintenance</i>	Q	Code	<i>Water Management</i>	Q
201200146	Maintenance Engineering and Mngmt	1	c.s.	'Introduction Water Management' *	1+2
201500235	Design for Maintenance Operations (IDE)	3	201800017	Water Footprint Assessment	1
201300038	Failure Mechanisms & Life Prediction	2	201800030	Water and Energy	2
201300039	Structural Health & Condition Monitoring	4	201800021	Water Management and Governance	3
201800034	Infrastructure Asset Management	4	201800033	Water and Climate	4
201800008	After-Sales Service Logistics	2	201900034	Urban resilience in a changing climate	3
191852630	Reliability Eng. & Maintenance Mngmt	3	201800018	Hydrology **	1
201800009	Advanced Inventory Management	2	201800019	Hydrological Modelling and Forecasting	2
201800168	Infrastructure Maintenance Machines	4	201800020	Regional Flood Management	3
Industrial Design Engineering			Civil Engineering and Management		
Code	<i>Management and Design</i>	Q	Code	<i>Transport Engineering</i>	Q
192850910	Packaging Design and Management	1	201800065	Traffic Management	3
192850840	Sources of Innovation	1	201800060	Sustainable Transport	4
192850740	Product Life cycle	2	201800064	Traffic Operations	1
192850810	Scenario Based Product Design	3	201800070	Public Transport Modelling	3
201200137	Design Histories	3	201800045	Construction Supply Chain and Digitization	1
192850750	Product Life Cycle Management	3	201800054	Network Equilibrium Analysis	3
201700008	Design and Behaviour Change	4	201800068	Network Modelling and Forecasting	2
Social Science: Business Administration***			Business Information Technology		
Code	<i>Technology Venturing and Innovation Management</i>	Q	Code	<i>Information Systems &amp; Management</i>	Q
201500083	Change Management and Consultancy in a Global Context	1	201400277	Enterprise Architecture	1

201600012	Management and Governance of Innovation and Creativity	1	192376500	Business Process Integration Lab	2
201600011	International Entrepreneurship	1	201100051	Information Services	3
201600002	Entrepreneurial Leadership & Responsible Organisational Design	1	192340101	Implementation of IT in organisations	3
201000087	Entrepreneurial Finance	3	192320501	Electronic commerce	2
201600155	Global Strategy and Business Development	3	192360021	ICT Management	3
201600015	Strategic Technology Management and Innovation	3	192376000	Business Case Development for IT Projects	4
			202000028	Smart Industry	4

\* Capita Selecta: Only and mandatory for students with no CEM-background

\*\* Prior Knowledge for Hydrological Modelling and Forecasting

\*\*\* Only permitted as part of a 30EC package as BA courses are otherwise prohibited in an IEM study programme

#### 4.5 Composition of the Programme Committee

For both the Bachelor and Master programme Industrial Engineering and Management a programme committee (PC) is appointed by the Faculty Board. The committee is the advisory board for the programme director. The PC consists of students and lectures from the programmes on an equal basis. The members of the committee can be found on the website, <https://www.utwente.nl/en/iem/programme-committee/>

Tasks of the PC are:

- Advising (the programme director) on stimulating and ensuring the quality of the degree programme (WHW art 9.18);
- Advising and right of consent on the Education and Examination Regulations (EER);
- Assessing the manner in which the EER is carried out;
- Advising (invited or not invited) on teaching and education issues related to both BSc and MSc programme.

For detailed information we refer to Art. 9.18 of the Higher Education and Research Act.

#### 4.6 Composition of the Examination Board

The Examination Board (EB) Management Science is the body, appointed by the Dean, that determines in an objective and expert manner whether a student meets the conditions set under the EER concerning the knowledge, comprehension and skills required to obtain a degree for the M-IEM programme. The EB's main tasks are described in the common elements of this EER. The members of the EB and contact details can be found on the website: <https://www.utwente.nl/en/bms/examboard/>.

##### 4.6.1 Fraud/plagiarism

The EER includes handling of cases of alleged fraud, which is also covered in the Rules and Guidelines of the Examination Board (see <https://www.utwente.nl/en/bms/examboard/regulations/>). At the programme level, students are instructed about fraud and plagiarism in several ways. For written exams, IEM works with external observers and examiners. For written assignment work, IEM lecturers can use a digital fraud scanner.



Although formally re-using one's own work is not considered fraud, submitting work from earlier years is not allowed in the M-IEM programme. When fraud is detected the Examination Board will assess and rule on the case.

## 5 Transitional arrangements

**Discrete Optimisation of Business Processes (DOBP):** The main content of the course 'Discrete Optimisation of Business Processes' (DOBP) is part of the new course 'Operations Research Techniques 1' (ORT1). If DOBP has been completed successfully, doing ORT1 is not allowed. No exams will be offered for DOBP in 2020-2021. Students for whom DOBP is mandatory and did not pass the course need to take ORT1 and follow the current course schedule.

**Advanced Production Planning (APP):** The course content of APP has been divided over two new courses: Planning and Scheduling (P&S) and Operations Techniques 2 (ORT2). P&S and ORT2 have too much overlap with APP. Therefore, if APP has been completed successfully, doing P&S or ORT2 is not allowed. No exams will be offered for APP in 2020-2021. Students for whom APP is mandatory and did not pass the course need to take P&S and ORT2 and follow the current course schedule.

## 6 Additional subjects

### 6.1 Graduation with distinction (Cum Laude)

If upon sitting the Master examination, the student has given evidence of exceptional capability, 'cum laude' (with distinction) will be recorded on the degree certificate.

A student is considered to have exceptional capability if each of the following conditions is met:

- The unrounded weighted average based on the number of ECs of the study units of the master examination (excluding the Master Thesis) is equal to or larger than 8.0;
- In the determination of this average, the study units not evaluated with a numerical mark or for which an exemption was granted are not considered;
- No more than one study unit was evaluated with a mark of 6.0;
- The mark for the final study unit (Master thesis) is equal to or larger than 8.0;
- The two-year Master programme has been completed within 30 months;
- The student has not committed fraud during the entire duration of the programme, as evidenced by the fraud registry of the examination board management sciences.

In exceptional cases the Examination Board may grant the designation of 'with distinction' if the conditions, as mentioned above, have not been fully met. The rules applied by the Examination Board can be found in the Rules & Regulations of the Examination Board.