UNIVERSITY OF TWENTE.

Programme-specific part to the Education and Examination Regulations (EER) 2023-2024

For the Master (of Science) programme

Industrial Engineering and Management (M-IEM)

Contents

1. General provisions

1.1. Admission to the programme

The admission request for the programme is assessed by an admission committee that consists of the programme director, 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's degree.

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

1.1.1. Degree of a (Dutch) Research University

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.

Another technical bachelor's degree awarded by a Dutch university: Applicants with a technical bachelor's degree other than IEM awarded by a Dutch university will be admitted to the programme. The applicant will have to finish a 15EC premaster programme unless the admission committee decides otherwise. When required, the applicant must have successfully completed the pre-master programme before being admitted to M-IEM.

A non-technical bachelor's 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 M-IEM. For the conditions of successful completion, see 2.7.

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

A bachelor's degree in a related field awarded by a Dutch University of Applied Science*:* Applicants with a bachelor's degree in a related (technical) field awarded by a Dutch University for 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 M-IEM.

Other 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 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 M-IEM. For the conditions of successful completion, see 2.7.

1.1.3. International bachelor's degree

The admission 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 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's degree in a related field;
- A motivation letter;
- 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; 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's degree in a 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 their 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/.

1.2. Language of the programme

The language of teaching and exams in M-IEM is English.

1.3. Connecting Masters' programme(s)

Not applicable to M-IEM

1.4. Rights, duties and composition of the programme committee

In line with article 9.18 WHW, each programme has a programme committee, which has the duty to advise programme management on improving and safeguarding the quality of the programme. It has a right of consent regarding a number of topics in the Education and Examination Regulations (EER), e.g. the goals and intended learning outcomes of the programme in terms of knowledge, insight and skills that a student should have acquired at the end of the programme; where necessary the layout of practical exercises; the study load of the programme and its study units. In addition, the programme committee evaluates on a yearly basis the manner in wich the EER has been carried out and has the right to advise programme management and the dean – invited or uninvited – on all matters relating to the teaching in the programme.

The composition of the current programme committee can be found here: https://www.utwente.nl/en/iem/programme-committee/

2. Contents and structure of the programme

2.1. Contents and structure of the programme

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 2023-2024

MSc Industrial Engineering and Management Programme 2023-2024			
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

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.

2.1.1. Content of the specialisations

In the first quartile students choose a specialisation within M-IEM. Students can switch from one specialisation to another as long as they finish all mandatory courses of the new specialisation. M-IEM has 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 lead 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.

2.1.2. 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 M-IEM 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.

2.2. Study load

M-IEM represents a study load of 120 ECTS (EC) or 3360 hours (1EC = 28 hour). All M-IEM courses are 5EC with exception of the master thesis, which is 30EC. For an overview of the study load of individual study units see Table 2.

2.3. Programme-specific characteristics

M-IEM is a fulltime study programme.

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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
202300200	Data Science	1+2+3	P	202300200	Data Science	1+2+3	P	202300200	Data Science	1+2+3	P	202300200	Data Science	1+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
202300064	Simulation	1	PW	202300064	Simulation	1	PW	202300064	Simulation	1	PW	202300064	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

IEM HCTM and FEM specialisation							
Code	**Health Care Technology and Management**	Q	Test	Code	**Financial Engineering and Management**	Q	Test
Mandatory per specialisation							
201700020	IEM Research Orientation	1+3	P	201700020	IEM Research Orientation	1+3	P
202300200	Data Science	1+2+3	P	202300200	Data Science	1+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
202300064	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

General information

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:
https://osiris.utwente.nl/student/OnderwijsCatalogusZoekCursus.do

2.4. Honours programme/STAR programme

For excellent students the University of Twente offers three different extra-curricular master's 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 Great Negotiators
- 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 https://www.utwente.nl/en/honours/

Furthermore, students can choose the transdisciplinary master-insert. This programme offers students the opportunity to pursue their own interests and become multi-skilled and open-minded professionals. More information can be found at the website https://www.utwente.nl/en/education/master/programmes/transdisciplinary-master-insert/

2.5. Elective options

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 M-IEM 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[1] and have no overlap with the M-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.

[1] Including a (one) course from a social science programme is allowed only with approval from the specialisation coordinator.

More information about this process can be found on the IEM Programme Information Canvas site. Some suggestions for interesting electives from UT programmes are published on Canvas. 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**.**

2.5.1. 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 Table 2). 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.

2.5.2. Additional Specialisations

Instead of choosing freely, students can take a specified package of courses for a total of 30 EC on specific topics. 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.

Table 3

Additional Specialisations of M-IEM (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
202300064	Simulation **	1	202300064	Simulation **	1
Elective courses					
201800004	Operations Research Techniques 2	4	201800004	Operations Research Techniques 2	4
201800007	Planning & scheduling	4	201700196	Advanced Sim. for Health Econ. 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 Mgmt. & Inn	3

** 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 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.).*

Code	**Financial Engineering**	Q	Code	Sustainability in IEM	Q
Mandatory courses			Mandatory courses		
191506103	Statistics & Probability	1	201700089	Circular Sustainable Business Development	1
201300060	Mathematical Finance	2	Elective courses		
Elective courses			202200057	Sustainable Transportation Infrastructure (CEM) *	1
191860651	Micro Economics	1	202200263	Optimisation of Sustainable Energy Systems	2
191515101	Introduction to Risk Theory	2	201800126	Distributed Energy Management for Smart Grids (EMSYS)	2
191860181	Risk Management	3	201800060	Sustainable Transport (CEM)	2
201000202	Mngt Control for Financial Institutions	4	202100125	Sustainable Engineering & IWM (CEM)	2
201300062	Structured Products	3	202001505	Energy Conversion: People, Planet, Prosperity (EE)	4
201100162	Applied Financial Engineering	4	202200310	Introduction to Humanitarian Engineering (ME)	4
191521800	Game Theory	1	191102010	Life-cycle Strategy (ME) *	4
201400244	Cost Management and Engineering	2	** Due to partial overlap the student can choose only 1 of these courses*		
201200138	Special Topics for Financial Engineers	2			

Table 4

Additional Specialisations of other UT-programmes (only for M-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	*Maintenance*	Q	Code	*Water Management*	Q
201200146	Maintenance Engineering and Management	1	201800120	Capita Selecta 'Introduction Water Management' *	1/2
201300038	Failure Mechanisms & Life Prediction	2	201800017	Water Footprint Assessment	1
201800008	After-Sales Service Logistics (IEM)	2	201800018	Hydrology **	1
201800009	Advanced Inventory Management (IEM)	2	201800019	Hydrological Modelling and Forecasting	2
191852630	Reliability Engineering & Maintenance Management (IEM)	3	202100125	Sustainable Engineering and Integrated Water Management	2
201500235	Design for Maintenance Operations (IDE)	3	201900034	Urban Resilience in a Changing Climate	3
201300039	Structural Health & Condition Monitoring	3	202200043	Circular Systems Engineering	3
191155730	Tribology	3	201800033	Water and Climate	4
201800034	Infrastructure Asset Management	4	201800039	Building with Nature	4
191102010	Life-cycle Strategy	4			
Industrial Design Engineering			**Civil Engineering and Management**		
Code	*Management and Design*	Q	Code	*Transport Engineering*	Q
192850910	Packaging Design and Management	1	201800064	Traffic Operations	1
192850840	Sources of Innovation	1	201800045	Construction Supply Chain and Digitization	1
192850740	Product Life cycle	2	201800070	Public Transport Modelling	2
202100156	Conceptual Design Methods	3	201800060	Sustainable Transport	2
201200137	Design Histories	3	201800068	Network Modelling and Forecasting	3
192850750	Product Life Cycle Management	3	201800065	Traffic Management	3
201700008	Design and Behaviour Change	4	201800010	Transportation and logistics Management (IEM)	3
Business Information Technology			202001463	Mathematical Optimization in Transport	4
Code	*Information Systems & Management*	**Q**	**Social Science: Business Administration*** **		
201400277	Enterprise Architecture	1	**Code**	***Technology Venturing and Innovation Management***	**Q**
192376500	Business Process Integration Lab	2	201500083	CMC	1
192320501	Electronic Commerce	2	201600012	Management and Governance of Innovation and Creativity	1
202000027	Enterprise Security	2	201600011	International Entrepreneurship	1
192340101	Implementation of IT in Organizations	3	201600002	ELROD	1
192360021	ICT Management	3	192320501	Electronic Commerce	2
201100051	Information Services	3	201600155	Entrepreneurial Finance	3
192376000	Business Case Development for IT Projects	4	201000087	Global Strategy and Business Development	3
202000028	Smart Industry Systems	4	201600015	Strategic Tech. Management and Inno.	3

* 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

2.6. Joint/double degrees and/or international cooperation and agreement(s)

M-IEM is designed to give students the option to study abroad. 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, https://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/ and the BMS Study Abroad Canvas site.

2.7. Pre-master's programme

Students who are not directly admissible (see Section 1.1) 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 pre-master programme, as a minor (for UT students) 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 5 and Table 6). For more information, visit the website https://www.utwente.nl/en/education/master/.

Table 5
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
Total EC		**15**
Pre-master for FEM		
Code	Course Name	EC
202001176	Statistics and Probability Theory for premaster IEM	5
202000454	Financial Engineering for premaster IEM	10

Total EC	**15**

Table 6

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	**202300167**	Data Analysis and Programming	3
			201400317	Operations Strategy*	3
		15			15
Total EC					**30**
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	**202300167**	Data Analysis and Programming	3
			202000397	Operations Strategy*	3
		15			15
Total EC					**30**

- Students with prior knowledge to this course (UT IBA students) will be exempted for this course. The EC's will be deducted in the pre-master programme

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 M-IEM. A student is allowed to finish the pre-master in consecutive years, but in this situation the completion of the pre-master is not to be considered successful and therefore will never provide admittance to M-IEM. A student who failed to successfully complete the pre-master programme may again apply for the (pre-)master under these conditions:

1) The student has not followed a pre-master's course in the last three academic years
2) The content of the pre-master for this student is up to the programme management and will be determined on an individual basis

3. Programme objectives and intended learning outcomes

3.1. Programme objectives

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.

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.

3.2. Intended learning outcomes

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 operationalisation: reflection, working in (multidisciplinary) teams, the preparation of students lifelong learning, ethics and philosophy of science and Corporate Social Responsibility. Table 7 outlines the ILOs.

Table 7
Intended Learning Outcomes of the Master Industrial Engineering and Management programme.

	Professional Academic Qualifications MSc
	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; • Finance and accounting; • Health care
A1	*The student has a thorough overview of the **structure of research and design** processes.* The student 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.
A2	*The student has an overview of quantitative and qualitative **empirical research methods**.* The student 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	*The student has a thorough overview of **quantitative modelling techniques** for operational processes in this domain.* The student is able to: • Select appropriate modelling techniques and justify this choice • Apply these techniques in relatively complex cases • Critically analyse the results of modelling activities
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	*The student has an overview of **implementation methods and processes.*** The student is able to: • Critically analyse ongoing or finished implementation processes • Plan globally an implementation process in a relatively complex case
A6	*The student has an overview of **evaluation methods and techniques**.* The student 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** a set of **core disciplines** in the specialisation domain.*
A8	*The student 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).*
	General Academic Qualifications MSc
B1	*The student is able to **work autonomously and is self-reliant*** The student: • Is able to work on complex assignments and conduct research projects without clear boundaries • Can apply effective time management and is self-reinforcing
B2	*The student is able to work in **multidisciplinary teams*** The student:

	• Can form a team to work with based on what is required for the project or assignment • Understands decision-making techniques and how to effectively organise meetings • Can effectively make use of a supervisor and organise feedback
B3	*The student is able to **communicate properly** (in oral and written form) with various stakeholders from different backgrounds* The student: • Can write an academic text, based on clear questions or hypotheses. • Is capable of designing, conducting and digesting interviews and other means of oral input and can identify argumentation fallacies and the like • Is able to organise the preconditions for co-production of knowledge and interaction • Can balance appropriate body language, content, and the use of audio-visual means on the basis of a good understanding of the audience
B4	*The student is able to conduct a **bibliographic search** and knows how to reference correctly* The student: • Can select and judge relevant scientific literature for projects and exams and has a pro-active attitude regarding acquiring and updating knowledge • Is able to properly use quotation and paraphrases and compile a relevant reference lists in APA-style
B5	*The student is able to reflect on **ethical and societal** aspects of the IEM domain and work field* The student: • Can reflect on his behaviour in a professional context • Can detect General Data Protection Regulation and confidentiality issues and analyse ethical implications of using research methods and technologies
B6	*The student is able to reflect on and direct **personal and professional behaviour and development*** The student: • The student is able to manage and concretize his own learning process in the context of "lifelong learning" • Can create an innovative learning portfolio by selecting and describing learning and development goals he wants to pursue
B7	*Has sufficient knowledge and competencies to pursue a PhD or EngD, and work in the IEM domain.*

4. Assessment/examination

4.1. Final examination

The programme concludes with the final assignment: the master thesis. The student demonstrates the obtained 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) and is executed externally, at a company or organisation. In specific cases the programme management can allow a student to do a research assignment at a university, e.g., to prepare for a PhD.

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 must be finished (receive *'Green light'*[2]) within the nominal study time (20 weeks). Extra graduation project time can only be authorised by the programme director with a maximum of 50% (10 weeks). The programme director may consult the examiners and/or academic counsellor 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.

4.2. Assessment format examinations/tests

Most master courses are assessed with the use of practical exercises combined with a written test. 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.

4.3. Period of validity of test results

A unit of study is assessed with an exam that can be compiled of several tests. An exam can be of a type as referred to in the EER, Section 3. The exam formats of the mandatory courses offered in the programme are shown in Table 2.

All test results of a study unit will expire at the end of the academic year if the unit is not finished, unless the teacher indicates differently.

Online-remote testing will only be allowed in individual cases when other options are not available and with permission of the Programme Management team and the Examination Board.

[2] 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).

4.4. Maximum number of attempts for tests/examinations

Not applicable for the M-IEM programme

4.5. Specific pass-fail regulations

Not applicable for the M-IEM programme

4.6. Prerequisites / required sequence of examinations

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.

4.7. Examination board

The examination board is the body that determines in an objective and expert manner whether a student meets the conditions set under the Education and Examination Regulations (EER) concerning the knowledge, insight and skills required to obtain a degree. Members of the examination board are appointed by the dean of the faculty.

More information, including the most up-to-date composition of the examination board can be found at its website: examination boards BMS. All information for students, examiners and educational support staff about the examination boards of BMS is published there, including their Rules and Guidelines, and the procedures and conditions for submitting a request.

5. Transitional arrangements

Not applicable to M-IEM

6. Other topics

6.1. (Binding) recommendation on continuation of studies

Not applicable to M-IEM

6.2. Graduation with distinction

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;
- 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.

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.

6.3. Arrangements for taking two masters at the same time

It is possible to do a second master programme while doing M-IEM. In case of combining multiple master programmes, it is allowed to use courses from other programmes in the elective space for IEM, given the requirements for elective courses specified in 2.5 and with a maximum of 30EC. A full, 30EC thesis is always required to finish the IEM programme. To be allowed to combine two master programmes, students need to adhere to the requirements for the study programme (see Section 2), and have approval of the IEM specialisation coordinator. Students need to contact their academic counsellor when considering taking two masters at the same time.