Assessment plan for the curriculum of the Bachelor's degree programme in Industrial Engineering & Management, 2026-2027

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Date approval Faculty Board:

1. Vision on assessment

1. Deep learning - academic attitude: IEM assessment aims to ensure an academic attitude that we believe is closely linked to deep learning. Students are encouraged to fully understand the fundamentals as a basis for further expanding their subject knowledge. With deep learning, IEM materials can promote academic attitudes: students internalize methods and tools, which are materialized in in-depth discussions (higher Bloom levels) about applications and improvements in modules and course elements.
2. Engineering approach: In the assessment, IEM modules, projects and course(elements) are aligned with two typical characteristics of engineering:
   - Methods, tools and attitudes to design safe, reliable, robust and feasible structures and procedures.
   - Stimulate creativity for innovation and improvements

   Both characteristics each require a different approach and can sometimes be seen as contradictory terms, although they are beginning to converge in senior (keystone) courses and projects.
3. Multidisciplinarity: In IEM design processes, the insights and methods of different disciplines all contribute to a better design result, ranging from mathematics to management tools and techniques. To this end, the assessment procedures are evaluated and improved to promote the multidisciplinary nature of IEM, such as careful selection of where in-depth considerations contribute to a better understanding and application of a general overview (Stanford T-Model). Further, the IEM program believes that group work is essential to truly understand multidisciplinarity, leading to the recommendation to adopt cooperative and collaborative learning methods.

2. Assessment guidelines

1. Formative feedback to monitor learning process: The learning process is best promoted and facilitated by just-in-time adequate feedback, with the challenge of effective teaching and learning. The program should be carefully planned for those times when formative feedback works best in the student's learning process and best supports the teacher to anticipate during the course.
2. Summative assessment as the final top result: All summative assessments aim to be applied at the best time to assess the student's outcome on what they can actually achieve. That means student gambling should be kept to a minimum as it also promotes superficial learning.
3. Fair and meaning evaluation of group work performance: The multidisciplinarity features of the IEM program are best expressed in group work. Cooperative and collaborative learning are potentially very valuable and effective teaching methods. Since fair and reliable testing of group work performance is difficult in nature, the degree program management promotes and supports assessment (development) programs for testing group performance.
4. Multimethod assessment: Assessment is the evaluation of the student's performance and understanding, but also a promise for further application to new projects or new areas of knowledge and skills. Each assessment should be aligned with the program intent and follow-up

modules, courses and projects. A combination of different forms of assessment such as written exam, oral, project report, essay promotes optimal test learning objectives.

5. Checks on assessment reliability and robustness: With regard to developments in the field of opportunities for (unconscious) cheating as well as the promotion of deep learning, the program has developed a checklist:
    - Always expect every student to use AI bots to improve their results: formulate how your assessment will ensure that the student's own abilities are tested
    - Evaluate your way of assessing for effectiveness, time spent assessing without feedback is a not effective from a learning perspective (but sometimes unavoidable)
    - Achieving grades should depend substantially on higher Bloom levels, so insight questions are preferable to memorization

3. Learning outcomes of the degree programme

	Learning Outcome *Holders of a Bachelor's degree in Industrial Engineering and Management have:*
1	The required knowledge to describe elementary technological products and processes within a business context.
2	The required understanding to determine and assess the functionality and performance of these products and processes in a multidisciplinary way (e.g. from technological and business perspectives as well as those of a variety of stakeholders).
3	The required skills to design, redesign, implement and subsequently validate these products and processes.
4	The required knowledge, understanding and skills for 'Life-Long Learning' (including finding information and using IT applications) to function largely autonomously.
5	The required knowledge and understanding of technology, business studies, mathematics and natural sciences to successfully complete a Master's degree programme in Industrial Engineering.
6	An academic attitude, i.e. the required knowledge, understanding and skills to conduct elementary academic research.
7	The required skills to communicate effectively about ideas and solutions with both engineers and managers.
8	Basic knowledge in the field of leadership, socially and ethically responsible behaviour in order to apply technology.

4. Overview of assessment methods, test moments for course units, and examiners

This table shows all the course units for each year of the programme and assessment methods.

As the test moments of courses are not included in the Course Unit Assessment Overview and cannot reliably be taken from last year's schedule, the programme is unable to provide detailed information in the test moment(s) column. To ensure that the assessment moments of the compulsory courses do not all fall in the same period the programme will ask all course coordinators to fill in a spreadsheet in which they indicate in which weeks their assessment falls. This way the course coordinators can see when the assessment moments of the other courses in the programme are. In case there are several deadlines in the same week, the programme can contact the course coordinators to see whether some activities can be shifted.

Year	Period	Course code	Course	EC	Assessment methods	Does (part of the) assessment have a formative function?	Test moment(s) (e.g. mid-term, continuous assessment, exam week, etc)	First examiner	Second examiner
Core IEM programme									
1	1a	WBIE003-05	Calculus 1 (for IEM)	5	AST, M, WE	No	End, Halfway	prof. dr. Jaap Top	dr. Jaap Eising
1	1a	WBIE005-05	Global Supply Chain	5	AST, P	No	End, Halfway, Start	dr. A. Hübl	dr. W. van Wezel
1	1a	WBIE008-05	Programming, Modelling and Simulation	5	AST, OR, RV, R, WE	Yes	End, Halfway, Start	dr. G.K.H. Larsen	dr. M. Taheri
1	1b	WBIE009-05	Linear Algebra (for IEM)	5	AST, M, WE	No	End, Halfway, Start	dr. P. Kilicer	dr. E. Ozman
1	1b	WBIE012-05	Organizational Behaviour and Group Dynamics	5	WE, AST, P, R	No	end	dr. T. de Vries	dr. M.P. van der Steen
1	1b	WBIE016-05	System Dynamics	5	WE, AST, PR	Yes	continuous	ir. T. M. Kousemaker	dr. A. Hübl

Year	Period	Course code	Course	EC	Assessment methods	Does (part of the) assessment have a formative function?	Test moment(s) (e.g. mid-term, continuous assessment, exam week, etc)	First examiner	Second examiner
1	2a	WBIE017-05	Calculus 2 (for IEM)	5	AST, M, WE	Yes	End, Halfway	dr. C. Karakurt	dr. ir. R. Luppes
1	2a	WBIE022-05	Management Accounting	5	AST, MC, P	Yes	End, Halfway	dr. M.P. van der Steen	dr. ir. G.H. Jonker
1	2a	WBIE023-05	Materials and Molecules	5	AST, R, WE	Yes	End, Halfway	prof. dr. ir. B.J. Kooi	prof. dr. M. Kamperman
1	2b	WBIE061-05	Physical Transport Phenomena	5	AST, M, WE	No	End, Halfway	dr. D. Parisi	dr. ir. P.D. Druetta
1	2b	WBIE050-05	Industrial Marketing	5	AST, WE	Yes	End, Halfway	dr. J.P.R. Thomassen	dr. A. Stepanova
1	2b	WBIE041-05	Statistics and Stochastics	5	AST, M, WE	Yes	End, Halfway	prof. dr. J.P. Trapman	dr. W.P. Krijnen
2	1a+b	WBIE059-10	Design of Complex Systems	10	AST, OR, P, R	Yes	End, Halfway, Start	dr. M. Taheri	dr. ir. G.H. Jonker
2	1a	WBIE013-05	Outlining and Implementing Innovation Strategy	5	AST, P, WE	Yes	End, Halfway	prof. dr. P.M.M. de Faria	prof. dr. F. Noseleit
2	1a	WBIE035-05	Dynamics of Engineering Systems	5	AST, P, WE	Yes	End, Halfway, Start	prof. dr. A. Vakis	ir. T.M. Kousemaker
2	1b	WBIE007-05	Operations Research	5	WE	No	End, Halfway	prof. dr. C. de Persis	dr. H. Kloosterman
2	1b	WBIE014-05	Production Planning and Quality Control	5	AST, P, WE	Yes	End, Halfway	dr. W.M.C. van Wezel	ir. T.M. Kousemaker

PTL track									
2	2a	WBIE024-05	Mechanics for IEM	5	AST, WE	No	End, Halfway, Start	prof. dr. F. Maresca	dr. L. Cheng
2	2a	WBIE040-05	Production Techniques	5	WE	No	End, Halfway	prof. dr. Y. Pei	prof. dr. F. Maresca
2	2a	WBIE030-05	Signals and Systems	5	WE	No	End	dr. S. Ahmed	prof. dr. ir. B. Jayawardhana
2	2b	WBIE033-05	Computer Aided Design and Manufacturing	5	AST, P, R	No	End, Halfway	prof. dr. M.I. Acuautla Meneses	dr. B. Haghighat
2	2b	WBIE034-05	Control Engineering	5	WE	No	End	prof. dr. C. de Persis	prof. dr. N. Monshizadeh Naini
2	2b	WBIE025-05	Modelling and Analysis of Complex Networks	5	R, WE	No	End	prof. dr. ir. M. Cucuzzella	dr. S. Ahmed
3	1a+b		Minor	30					
3	2a	WBIE018-05	Design and Construction for IEM	5	AST, OR, P, R	Yes	End, Halfway, Start	M. Mohebbi, MSc	dr. M. Muñoz Arias
3	2a	WBIE057-05	Mechanical Craftsmanship	5	MC, R, PR, AST	No	continuous	dr. M. Muñoz Arias	M. Mohebbi, MSc
3	2a+b, also 1a+b	WBIE901-20	Integration Project IEM	20	PR, AST, P, R	Yes		various	various
SPE track									
2	2a	WBIE051-05	Industrial Biotechnology (for IEM)	5	AST, R, WE	No	End	prof. dr. ir. M.J.E.C. van der Maarel	prof. dr. ir. G.J. Euverink
2	2a	WBIE029-05	Reactor Engineering	5	AST, WE	No	End, Halfway	prof. dr. ir. H.J. Heeres	dr. ir. A. Hommes
2	2a	WBIE031-05	Technical Thermodynamics (IEM)	5	AST, WE	No	End, Halfway	dr. D.M. Morales Hernández	prof. dr. J.G.M. Winkelman

2	2b	WBIE058-05	Applied Transport Phenomena for Sustainable Processes	5	AST, M, RV, P, R, WE	Yes	End, Halfway, Start	dr. ir. P.D. Druetta	dr. D. Parisi
2	2b	WBIE036-05	Gas-Liquid Mass Transfer	5	WE	No	End	dr. ir. A. Hommes	dr. ir. J.G.M. Winkelman
2	2b	WBCE002-05	General Process Equipment	5	See assessment plan Chemical Engineering				
3	1a+b		Minor	30					
3	2a	WBCE020-05	Separation Processes	5	See assessment plan Chemical Engineering				
3	2a	WBIE028-05	Product Technology (IEM)	5	AST, WE	No	End, Halfway	dr. P. van den Tempel	dr. R.K. Bose
3	2a+b, also 1a+b	WBIE901-20	Integration Project IEM	20	PR, AST, P, R	Yes		various	various
Electives									
3	1a	WBIE045-05	Nanoscience and Nanotechnology	5	M, MC, WE	Yes	End, Halfway	prof. dr. A.G.P. Kottapalli	prof. dr. Y. Pei
3	1a	WBIE049-05	Numerical Methods (for IEM)	5	AST, M, WE	Yes	End, Halfway	dr. M. Meier	prof. dr. C.A. Bertoglio
3	1a	WBIE054-05	Dynamics and Vibrations	5	AST, WE	No	End, Halfway	dr. L. Cheng	prof. dr. A. Vakis
3	1b	WBIE047-05	Entrepreneurship for Engineers	5	AST, M	No	End, Halfway	dr. A.J. Frederiks	dr. W.G. Biemans
3	1b	WBIE011-05	Mechatronics	5	WE	No	End	dr. S. Ahmed	prof. dr. ir. B. Jayawardhana
3	1b	WBIE055-05	Solid Mechanics	5	AST, WE	No	End, Halfway, Start	prof. dr. F. Maresca	dr. L Cheng
P	2b	WBIE056-05	Literature Thesis ME	5	AST, P, R	No	End, Halfway, Start	dr. L. Cheng	prof. dr. M. Ghandchi Tehrani

The abbreviations for the relevant teaching methods are explained in the legend of the table.

- *Written Exam (WE)*
- *Multiple Choice (MC)*
- *Oral Exam (OR)*
- *Report (R)*
- *Presentation (P)*
- *Practical Work (PR)*
- *Assignment (AST)*
- *Peer review (RV)*
- *Midterm (M)*

5. Relationship between course units and details of the learning outcomes

From the second year there are two tracks within the Bachelor's degree programme IEM: Production Technology and Logistics (PTL) and Sustainable Process Engineering (SPE). In order to specify the learning outcomes of the programme for these tracks, we distinguish four competence areas (general academic skills are assimilated into these competence areas).

General competence area's (applicable for all tracks):
N: Industrial engineering, mathematics, and natural sciences (outcomes 1, 4, 5, 6, 7)
M: Managerial and business sciences (outcomes 5,8)

Competence area per track:
T: Production Technology and Logistics (PTL) (outcomes 2, 3)
P: Sustainable Process Engineering (SPE) (outcomes 2, 3)

The specification of the learning outcomes of the programme for each competence area is as follows:

<u>Industrial engineering, mathematics, and natural sciences (N)</u>
In the area of engineering, mathematics, and natural sciences students have:

N1. Knowledge and understanding of (basic) concepts in mathematics, physics, chemistry and computing science
N2. Knowledge and understanding of (basic) design and engineering theories.
N3. Skills to apply mathematical, natural sciences and engineering concepts for solving (basic) theoretical and practical problems.
N4. Skills to apply mathematical, natural sciences and engineering concepts for solving (simulated) real-life engineering problems.
N5. Skills to justify and communicate about their problem solving approach from a multidisciplinary point of view.

Managerial and business science (M)

In the area of managerial and business sciences students have:

- M1. Sufficient knowledge and understanding of managerial and business sciences to enter a master programme in Industrial Engineering (and related fields) according to ABET standards.
- M2. Skills to choose and apply organizational (including information), psychological/social, financial, or marketing methods and concepts for solving basic theoretical and practical problems.
- M3. Skills to choose and apply organizational (including information), psychological/social, financial, and/or marketing methods and concepts for adequately solving (simulated) real-life business problems.
- M4. Skills to implement, justify, and communicate about their problem solving approach from a multidisciplinary point of view.

Production technology and logistics (T)

In the area of production technology and logistics students have:

- T1. Basic knowledge and understanding of discrete product engineering, production technology and logistical engineering to enter master programs in Industrial Engineering and Management in discrete product engineering, production technology (of discrete products) and logistical engineering.
- T2. Skills to analyse, (re)design, and implement (innovative) solutions for (elementary) discrete products and production system problems, taking into account realistic industrial constraints (economic, safety, manufacturability, sustainability etc.).
- T3. Skills to effectively operate as junior employee (technologist, market analyst/developer, manager) in the discrete product engineering, production engineering and logistical engineering business; both at commercial production and support (services) level.

Sustainable Process Engineering (P)

In the area of product and process technology students have:

- P1. Basic knowledge and understanding of (bio) chemical engineering, chemical product engineering and biotechnology to enter master programs in Industrial Engineering (chemical technology) and (Bio) Chemical Product Design and Engineering or Biotechnology according to EFCE standards.
- P2. Skills to analyse (elementary) real-life industrial chemical process and product design problems and to develop (innovative) solutions on the basis of the scientific fundamentals used in these disciplines.
- P3. Skills to effectively operate as junior employee (technologist, market analyst/developer, manager) in the chemical processing and production businesses; both at commercial production and support (services) level.

		Learning outcomes of the degree programme														
		N1	N 2	N 3	N 4	N 5	M 1	M 2	M 3	M 4	T 1	T 2	T 3	P 1	P2	P3
Period	**Course**	**Year 1 –compulsory courses**														
1a	Calculus 1	X		X												
1a	Global Supply Chain					X					X	X	X			
1a	Programming, Modelling and Simulation	X			X	X										
1b	Linear Algebra	X		X	X											
1b	Organizational Behaviour and Group Dynamics						X	X	X	X						
1b	System Dynamics			X			X	X	X	X						
2a	Calculus 2	X		X	X											
2a	Management Accounting						X	X	X	X						
2a	Materials and Molecules	X		X										X	X	
2b	Physical Transport Phenomena	X	X	X	X											
2b	Industrial Marketing						X	X	X	X						
2b	Statistics and Stochastics	X		X	X											
Period	**Course**	**Year 2 compulsory courses**														
1a+b	Design of Complex Systems		X			X			X	X		X	X			X

		Learning outcomes of the degree programme														
		N1	N 2	N 3	N 4	N 5	M 1	M 2	M 3	M 4	T 1	T 2	T3	P 1	P2	P3
1b	Outlining and Implementing Innovation Strategy					X	X	X	X				X			
1a	Dynamics of Engineering Systems	X	X	X	X											
1b	Operations Research	X					X	X	X							
1b	Production Planning and Quality Control						X				X	X	X			
Period	**Course**	**Year 2 PTL compulsory courses**														
2a	Mechanics for IEM	X	X	X	X						X	X				
2a	Modelling and Analysis of Complex Networks	X		X							X	X				
2a	Signals and Systems	X	X	X	X						X	X				
2b	Computer Aided Design and Manufacturing	X	X	X	X						X	X	X			
2b	Control Engineering	X	X	X	X						X	X				
2b	Production Techniques		X	X	X	X					X	X	X			
Period	**Course**	**Year 3 PTL compulsory courses**														
2a	Design and Construction for IEM		X		X						X					
2a	Mechanical Craftsmanship				X						X	X				
2a+b	Integration Project IEM				X	X	X	X	X	X						

		Learning outcomes of the degree programme														
		N1	N 2	N 3	N 4	N 5	M 1	M 2	M 3	M 4	T 1	T 2	T3	P 1	P2	P3
Period	**Course**	**Year 2 SPE compulsory courses**														
2a	Industrial Biotechnology (for IEM)				X	X								X	X	X
2a	Reactor Engineering		X		X									X	X	X
2a	Technical Thermodynamics (IEM)	X	X	X	X									X	X	
2b	Applied Transport Phenomena for Sustainable Processes	X	X	X	X									X	X	
2b	Gas-Liquid Mass Transfer	X	X	X	X									X	X	X
2b	General Process Equipment													X	X	X
Period	**Course**	**Year 3 SPE compulsory courses**														
2a	Separation Processes													X	X	X
2a	Product Technology (IEM)					X								X	X	X
2a+b	Integration Project IEM				X	X	X	X	X	X						

Appendix 1 - Supervisors Integration Project

Name	Research Institute
dr. S. Ahmed	ENTEG
dr. M. Muñoz Arias	ENTEG
prof. dr. ir. M. Cao	ENTEG
prof. dr. A.K. Cherukuri	ENTEG
prof. dr. M. Cucuzzella	ENTEG
prof. dr. P.J. Deuss	ENTEG
dr. ir. P.D. Druetta	ENTEG
prof. dr. G.J.W. Euverink	ENTEG
prof. dr. ir. H.J. Heeres	ENTEG
dr. W.L.J. Hinrichs	GRIP
dr. ir. A. Hommes	ENTEG
dr. A. Hübl	ENTEG
prof. dr. ir. B. Jayawardhana	ENTEG
dr. ir. G.H. Jonker	ENTEG
dr. P. Karka	ENTEG
dr. ing. H. Kloosterman	ENTEG

prof. dr. ir. B.J. Kooi	ZIAM
prof. dr. A.G.P. Kottapalli	ENTEG
dr. W.P. Krijnen	Lecturers Mathematics
dr. J. Krooneman	ENTEG
prof. dr. A.O. Krushynska	ENTEG
dr. ir. G. Lange, de	SRON
dr. G.K.H. Larsen	ENTEG
M. Mohebbi, MSc	ENTEG
prof. dr. F. Maresca	ENTEG
prof. dr. M.I. Acuautla Meneses	ENTEG
prof. dr. ir. M.J.E.C. Maarel, van der	ENTEG
prof. dr. N. Monshizadeh Naini	ENTEG
prof. dr. ir. P.R. Onck	ZIAM
dr. D. Parisi	ENTEG
prof. dr. Y. Pei	ENTEG
prof. dr. C. De Persis	ENTEG
prof. dr. P.P. Pescarmona	ENTEG
prof. dr. F. Picchioni	ENTEG

prof. dr. ir. J. Post	ENTEG
dr. P. Raffa	ENTEG
prof. dr. J. Riezebos	SOM
dr. ir. C. C. Roossien	ENTEG
prof. dr. ir. J.M.A. Scherpen	ENTEG
dr. S. Solhjoo	ENTEG
dr. N.B. Szirbik	ENTEG
dr. M. Taheri	ENTEG
prof. dr. A. Vakis	ENTEG
dr. W.M.C. Wezel, van	SOM
dr. ir. J.G.M. Winkelman	ENTEG
dr. J. Xie	ENTEG
dr. N. Younas	ENTEG
prof. dr. ir. J. Yue	ENTEG