

Assessment plan for the curriculum of the Bachelor's degree programme in Industrial Engineering & Management, 2024-2025

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Date advice Board of Examiners: 20-06-2024

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 improvementsBoth 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. Multidisciplinary: 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 multidisciplinary, 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 multidisciplinary 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 <i>Holders of a Bachelor's degree in Industrial Engineering and Management have:</i>
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	WE, AST	Yes		dr. C. Karakurt	dr. ir. R. Luppés
1	1a	WBIE005-05	Global Supply Chain	5	MC, R, P, AST	Yes		dr. A. Hübl	dr. W. van Wezel
1	1a	WBIE008-05	Programming, Modelling and Simulation	5	WE, PR	Yes		dr. G.K.H. Larsen	dr. M. Taheri
1	1b	WBIE009-05	Linear Algebra (for IEM)	5	WE, AST	Yes		dr. P. Kilicer	dr. E. Ozman
1	1b	WBIE012-05	Organizational Behaviour and Group Dynamics	5	WE, AST	No		dr. T. de Vries	dr. M.P. van der Steen
1	1b	WBIE016-05	System Dynamics	5	WE, AST	Yes		ir. T. M. Kousemaker	dr. A. Hübl
1	2a	WBIE017-05	Calculus 2 (for IEM)	5	WE, AST	No		dr. C. Karakurt	dr. ir. R. Luppés
1	2a	WBIE022-05	Management Accounting	5	MC, R, P	Yes		dr. M.P. van der Steen	dr. ir. G.H. Jonker
1	2a	WBIE023-05	Materials and Molecules	5	WE, AST	Yes		prof. dr. ir. B.J. Kooi	prof. dr. M. Kamperman

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	2b	WBIE004-05	Physical Transport Phenomena	5	WE, AST	No		dr. D. Parisi	dr. ir. P.D. Druetta
1	2b	WBIE050-05	Industrial Marketing	5	WE, AST	No		dr. J.P.R. Thomassen	A. Stepanova
1	2b	WBIE041-05	Statistics and Stochastics	5	WE, AST	Yes		prof. dr. J.P. Trapman	dr. W.P. Krijnen
2	1a	WBIE059-10	Design of Complex Systems	10	MC, OE, P, R	Yes		dr. M. Taheri	dr. ir. G.H. Jonker
2	1a	WBIE007-05	Operations Research	5	WE	No		prof. N. Monshizadeh Naini	prof. C. de Persis
2	1a	WBIE013-05	Outlining and Implementing Innovation Strategy	5	WE, AST	Yes		prof. dr. P.M.M. de Faria	prof. F. Noseleit
2	1b	WBIE035-05	Dynamics of Engineering Systems	5	WE, P, AST	Yes		prof. A. Vakis	ir. T.M. Kousemaker
2	1b	WBIE014-05	Production Planning and Quality Control	5	WE, MC, R, P, A	Yes		dr. W.M.C. van Wezel	ir. T.M. Kousemaker
3	2a	WBIE019-05	Design Science	5	AST, P, R	Yes		dr. M. Taheri	dr. ir. G.H. Jonker
PTL track									
2	2a	WBIE024-05	Mechanics for IEM	5	WE, AST	No		dr. F. Maresca	dr. L. Cheng
2	2a	WBIE025-05	Modelling and Analysis of Complex Networks	5	WE, R	No		prof. dr. ir. M. Cucuzzella	dr. S. Ahmed
2	2a	WBIE030-05	Signals and Systems	5	WE, PR	No		dr. S. Ahmed	prof. dr. ir. B. Jayawardhana
2	2b	WBIE033-05	Computer Aided Design and Manufacturing	5	R, P, PR, A	No		dr. M.I. Acuautila Meneses	dr. B. Haghighat

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
2	2b	WBIE034-05	Control Engineering	5	WE	No		prof. dr. C. de Persis	prof. N. Monshizadeh Naini
2	2b	WBIE040-05	Production Techniques	5	AST, PR, WE	No		prof. Y. Pei	dr. F. Maresca
3	1a+b		Minor	30					
3	2a	WBIE018-05	Design and Construction for IEM	5	MC, R, P	Yes		M. Mohebbi, MSc	dr. M. Muñoz Arias
3	2a	WBIE057-05	Mechanical Craftsmanship	5	MC, R, PR, AST	No		dr. M. Muñoz Arias	M. Mohebbi, MSc
3	2a+b	WBIE902-15	Integration Project IEM (PTL)	15	PR, P, R	Yes		various	various
SPE track									
2	1a	WBIE051-05	Industrial Biotechnology (for IEM)	5	WE, R, AST	Yes		prof. dr. ir. M.J.E.C. van der Maarel	dr. E. Jurak
2	1a	WBIE029-05	Reactor Engineering	5	AST, WE	Yes		prof. dr. ir. H.J. Heeres	dr. ir. J.G.M. Winkelman
2	1a	WBIE031-05	Technical Thermodynamics (IEM)	5	WE, AST	Yes		dr. D.M. Morales	prof. dr. J.G.M. Winkelman
2	1b	WBIE058-05	Applied Transport Phenomena for Sustainable Processes	5	WE, R, P, AST	Yes		dr. ir. P.D. Druetta	dr. D. Parisi
2	1b	WBIE036-05	Gas-Liquid Mass Transfer	5	WE	No		prof. dr. ir. H.J. Heeres	dr. ir. J.G.M. Winkelman
2	1b	WBIE039-05	Process Design and Equipment	5	AST, R, WE			dr. P. Karka	dr. ir. G.H. Jonker
3	1a+b		Minor	30					
3	2a	WBIE046-05	Capita Selecta SPE	5	R, P	No		dr. D. Parisi	prof. F. Picchioni
3	2a	WBIE028-05	Product Technology (IEM)	5	AST, WE			prof. dr. F. Picchioni	dr. R.K. Bose

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
3	2a+b	WBIE901-15	Integration Project IEM (SPE)	15	PR, P, R	Yes		various	various
PTL Minor									
3	1a	WBIE045-05	Nanoscience and Nanotechnology	5	WE, MC	No	Midterm + final exam	prof. dr. A.G.P. Kottapalli	prof. dr. Y. Pei
3	1a	WBIE049-05	Numerical Methods (for IEM)	5	WE, PR	Yes		dr. ir. R. Luppens	prof. C.A. Bertoglio
3	1a		FEB elective	5	various				
3	1b	WBIE047-05	Entrepreneurship for Engineers	5	WE, AST	No		dr. A.J. Frederiks	dr. W.G. Biemans
3	1b	WBIE032-05	Electricity and Magnetism	5	WE, MC, PR	Yes		dr. M. Kavatsyuk	prof. dr. N. Kalantar-Nayestanaki
3	1b	WBIE011-05	Mechatronics	5	WE, PR	No		dr. S. Ahmed	prof. dr. ir. B. Jayawardhana
SPE minor									
3	1a	WBIE053-10	Circular Economy for Process Industry	10	AST, P, R			dr. P. Karka	dr. ir. G.H. Jonker
3	1a		FEB elective	5	various				
3	1b	WBIE047-05	Entrepreneurship for Engineers	5	WE, AST	No		dr. A.J. Frederiks	dr. W.G. Biemans
3	1b	WBCE007-05	Chemical Process Development and Design	5	R			dr. ir. A. Hommes	dr. J. Xie
3	1b	WBCE012-05	Special Process Equipment	5	WE			dr. X. Li	dr. ir. J.G.M. Winkelman
ME minor									
3	1a	WBIE054-05	Dynamics and Vibrations	5	WE, AST	Yes		dr. L. Cheng	prof. dr. ir. E. van der Giessen
3	1a	WBCE014-05	Technical Thermodynamics	5	WE	Yes		dr. V. Kyriakou	dr. ir. J.G.M. Winkelman

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
3	1a	WBIE049-05	Numerical Methods (for IEM)	5	WE, PR	Yes		dr. ir. R. Luppés	prof. C.A. Bertoglio
3	1b	WBPH071-05	Materials Science and Engineering	5	WE	Yes		prof. dr. ir. B. J. Kooi	prof. dr. D. Roest
3	1b	WBIE011-05	Mechatronics	5	WE, PR	No		dr. S. Ahmed	prof. dr. ir. B. Jayawardhana
3	1b	WBIE055-05	Solid Mechanics (for IEM)	5	WE, AST	No		dr. F. Maresca	prof. dr. ir. E. van der Giessen
P	2b	WBIE056-05	Literature Thesis ME	5	R	Yes		prof. M. Ghandchi Tehrani	dr. L. Cheng

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

Examples of assessment methods include:

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

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:

Industrial engineering, mathematics, and natural sciences (N)

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	P 2	P 3
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						

		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	P 2	P 3
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						
1a	Operations Research	X					X	X	X							
1a	Outlining and Implementing Innovation Strategy					X	X	X	X				X			
1b	Dynamics of Engineering Systems	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											

		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	P 2	P 3
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	Design Science					X	X	X	X	X						
2a+b	Integration Project IEM (PTL)				X	X		X	X	X						
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											
2b	Gas-Liquid Mass Transfer	X	X	X	X									X	X	X
2b	Process Design and Equipment													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	T 3	P 1	P 2	P 3
Period	Course	Year 2 SPE compulsory courses														
2a	Capita Selecta SPE													X	X	X
2a	Product Technology (IEM)					X								X	X	X
2a+b	Design Science					X	X	X	X	X						
2a+b	Integration Project IEM (SPE)				X	X		X	X	X						

Appendix 1 - Supervisors Integration Project

Name	Research Institute
prof. dr. D. Bauso	ENTEG
dr. R.M.J. Benders	ESRIG
prof. dr. ir. M. Cao	ENTEG
dr. A.K. Cherukuri	ENTEG
prof. dr. C. De Persis	ENTEG
dr. P.J. Deuss	ENTEG
prof. dr. ir. M. van Duin	ENTEG
prof. dr. G.J.W. Euverink	ENTEG
prof. dr. ir. H.J. Heeres	ENTEG
dr. W.L.J. Hinrichs	GRIP
dr. A Hübl	ENTEG
prof. dr. ir. B. Jayawardhana	ENTEG
dr. ir. G.H. Jonker	ENTEG
dr. ing. H. Kloosterman	ENTEG
prof. dr. ir. B.J. Kooi	ZIAM
dr. A.G.P. Kottapalli	ENTEG

dr. W.P. Krijnen	
dr. J. Krooneman	ENTEG
dr. A.O. Krushynska	ENTEG
dr. G. Lange, de	SRON
dr. G.K.H. Larsen	ENTEG
prof. dr. M.J.E.C. Maarel, van der	ENTEG
dr. F. Maresca	ENTEG
M. Mohebbi, MSc	ENTEG
dr. N. Monshizadeh Naini	ENTEG
dr. M. Muñoz Arias	ENTEG
prof. dr. ir. P.R. Onck	ZIAM
prof. dr. Y. Pei	ENTEG
prof. dr. P.P. Pescarmona	ENTEG
prof. dr. F. Picchioni	ENTEG
prof. dr. ir. J. Post	ENTEG
drs. W.A. Prins	ENTEG
dr. P. Raffa	ENTEG
prof. dr. J. Riezebos	SOM

prof. dr. A.J. Schaft, van der	JBI
prof. dr. ir. J.M.A. Scherpen	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. Yue	ENTEG