Assessment plan Bachelor Industrial Engineering and Management (IEM) 2023-2024

Introduction

This assessment plan is a systematic description of the type of assessment used in the various modules of the Bachelor's degree programme Industrial Engineering and Management. This assessment plan fits within the assessment policy of the Faculty of Science and Engineering 1, and the protocol used by the Board of Examiners of the degree programme 2.

The assessment plan is based on:

1. The (appendices of the) Teaching and Examination regulations of the degree programme;
2. The description of the various modules of the degree programme in the digital course catalogue *Ocasys*, including:
   - Objective of the module
   - Course content
   - Lecturers and examiners
   - Assessment method used
   - Lecture format

Assessment plan

The assessment plan contains the following items:

1. Mission and objectives of the degree programme
2. Learning outcomes of the degree programme
3. An overview of examiners and assessment type used for all modules in the IEM master's programme. The following types of assessments are distinguished in this scheme:
   - *Written exam with open questions (WE)*
   - *Written exam with multiple-choice questions (MC)*
   - *Oral exam (OR)*
   - *Report (R)*
   - *Presentation (P)*
   - *Interim test (IT)*
   - *Assignment (AST)*
   - *Practical work (PR)*
4. A list of lecturers qualified to supervise IEM Bachelor's thesis (Integration Project).
5. A matrix describing the relation between the various modules of the programme and the specified learning outcomes of the degree programme.

1 FSE Quality Assurance Manual (2018-2019) https://myuniversity.rug.nl/infonet/medewerkers/fse/education/policy-quality-education/documents/quality-assurance-manual-fse.pdf

2 Protocol for the duties and powers of the Board of Examiners of the Faculty of Science and Engineering (2014) https://myuniversity.rug.nl/infonet/medewerkers/fse/education/policy-quality-education/documents/fmns-protocol-board-of-examiners.pdf

Mission and objectives of the degree programme
The mission of the Industrial Engineering and Management bachelor's degree programme is "to educate industrial engineers who innovate with technological solutions for managerial/business problems".

This mission is translated into the following objectives of the Bachelor's degree program Industrial Engineering and Management:

1. The programme aims to teach students the knowledge, skills and understanding in the field of industrial engineering and management to (re)design (elementary) technological processes and products in a managerial/business context, i.e. including implementation of the (re)design and evaluation of the implementation.
2. The programme aims to prepare students in terms of knowledge, skills and understanding, to pursue an appropriate Master's degree programme, especially a master's degree programme in Industrial Engineering and Management
3. The programme aims to give students an academic training with respect to:
   - Autonomous critical thinking and acting;
   - Scientific communication in English.

Learning outcomes of the Bachelor's degree programme Industrial Engineering and Management
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.

Examiners and assessment type of modules in the degree programme

Year 1 - Propaedeutic phase (60 ECTS)

Module	ECTS	Course coordinator/ First examiner	Second examiner	Examination type
Calculus 1 (for IEM) (WBIE003-05)	5	dr. P.M.J. Tibboel	dr. ir. R. Luppes	MC, WE
Global Supply Chain (WBIE005-05)	5	dr. ing. A. Hübl	dr. W.M.C. van Wezel	AST, P, PR, R
Programming, Modelling and Simulation (WBIE008-05)	5	dr. G.K.H. Larsen	dr. M. Taheri	AST, PR, R, WE
Linear Algebra (for IEM) (WBIE009-05)	5	dr. P.M.J. Tibboel	prof. dr. S. Trenn	WE
Organizational Behaviour and Group Dynamics (WBIE012-05)	5	dr. T.A. de Vries	dr. M.P. van der Steen	AST, WE
System Dynamics (WBIE016-05)	5	ir. T.M. Kousemaker	dr. ing. A. Hübl	AST, WE
Calculus 2 (for IEM) (WBIE017-05)	5	dr. P.M.J. Tibboel	dr. ir. R. Luppes	WE
Management Accounting (WBIE022-05)	5	dr. M.P. van der Steen	dr. ir. G.H. Jonker	MC, P, R
Materials and Molecules (WBIE023-05)	5	dr. M. Ahmadi	prof. dr. ir. Bart J. Kooi	AST, WE
Fluid Dynamics (WBIE004-05)	5	dr. D. Parisi	dr. ir. P.D. Druetta	AST, WE
Industrial Marketing (WBIE050-05)	5	dr. M.R. Padigar	dr. J.P. Thomassen	AST, WE
Statistics and Stochastics (WBIE041-05)	5	TBD	dr. W.P. Krijnen	AST, WE

Year 2, semester 1 – Base programme (30 ECTS)

Module	ECTS	Course coordinator/ First examiner	Second examiner	Examination type
Operations Research (WBIE007-05)	5	dr. N. Monshizadeh Naini	prof. dr. C. De Persis	WE
Outlining and Implementing Innovation Strategy (WBIE013-05)	5	prof. dr. P.M.M. de Faria	prof. dr. F. Noseleit	AST, WE
Research and Design Methodology (WBIE015-05)	5	dr. M. Muñoz Arias	M. Mohebbi, MSc	MC, AST
Dynamics of Engineering Systems (WBIE0-05)	5	prof. dr. A. Vakis	ir. T.M. Kousemaker	WE, AST, IT, P
Production Planning and Quality Control (WBIE014-05)	5	dr. W.M.C. van Wezel	ir. T.M. Kousemaker	AST, IT, WE
Sustainable Engineering Design (WBIE052-05)	5	dr. ir. G.H. Jonker	dr. G.K.H. Larsen	IT, R, WE

Year 2, semester 2 – PTL track (30 ECTS)

Mechanics for IEM (WBIE024-05)	5	dr. F. Maresca	dr. A. Giuntoli	WE, AST
Modelling and Analysis of Complex Networks (WBIE025-05)	5	dr. S. Ahmed	prof. dr. ir. M. Cao	WE. R
Signals and Systems (WBIE030-05)	5	dr. S. Ahmed	prof. dr. ir. B. Jayawardhana	WE, IT

Computer Aided Design and Manufacturing (WBIE033-05)	5	dr. M.I. Acuautla Meneses	dr. B. Haghighat	AST, P, PR, R
Control Engineering (WBIE034-05)	5	prof. dr. C. De Persis	dr. N. Monshizadeh Naini	IT, PR, WE
Production Techniques (WBIE040-05)	5	prof. dr. Y. Pei	Dr. F. Maresca	AST, IT, PR, WE

Year 2, semester 2 - SPE track (30 ECTS)

Module	**ECTS**	**Course coordinator/ First examiner**	**Second examiner**	**Examination type**
Industrial Biotechnology (for IEM) (WBIE051-05)	5	dr. E. Jurak	dr. M.J.E.C. van der Maarel	PR, WE, R
Reactor Engineering (WBIE029-05)	5	prof. dr. ir. H.J. Heeres	dr. ir. J.G.M. Winkelman	AST, WE
Technical Thermodynamics (IEM) (WBIE031-05)	5	dr. ir. J.G.M. Winkelman	prof. dr. F. Picchioni	WE
Applied Transport Phenomena for Sustainable Processes (WBIE058-05)	5	dr. ir. P.D. Druetta	dr. ir. G.H. Jonker	AST, R, WE
Gas-Liquid Mass Transfer (WBIE036-05)	5	dr. ir. J.G.M. Winkelman	prof. dr. ir. G.F. Versteeg	WE
Process Design and Equipment (WBIE039-05)	5	dr. P. Karka	dr. ir. G.H. Jonker	AST, R, WE

Year 3, semester 1 - PTL minor package (30 ECTS)

Module	**ECTS**	**Course coordinator/ First examiner**	**Second examiner**	**Examination type**
Nanoscience and Nanotechnology (WBIE045-05)	5	dr. A.G.P. Kottapalli	prof. dr. Y. Pei	IT, WE
Numerical Methods (for IEM) (WBIE049-05)	5	dr. ir. R. Luppes	prof. dr. C.A. Bertoglio	PR, WE
Entrepreneurship for Engineers (WBIE047-05)	5	dr. A.J. Frederiks	dr. W.G. Biemans	AST, WE
Mechatronics (WBIE011-05)	5	dr. S. Ahmed	prof. dr. J. M. A. Scherpen	WE, IT
Principles of Measurement Systems (WBPH029-05)	5	dr. A.K. Biegun	dr. J.S. Blijleven	AST, IT, WE
Optional management module FEB	5	Various		Various

Year 3, semester 1 – SPE minor package (30 ECTS)

Module	**ECTS**	**Course coordinator/ First examiner**	**Second examiner**	**Examination type**
Circular Economy for Process Industry (WBIE053-10)	10	dr. P. Karka	dr. ir. G.H. Jonker	AST, P, R
Chemical Process Development and Design (WBCE007-05)	5	prof. dr. ir. G.F. Versteeg	dr. ir. J.G.M. Winkelman	R
Entrepreneurship for Engineers (WBIE047-05)	5	dr. A.J. Frederiks	dr. W.G. Biemans	AST, WE
Special Process Equipment (WBCE012-05)	5	dr. ir. J.G.M. Winkelman	prof. dr. F. Picchioni	WE
Optional management module FEB	5	Various		Various

Optional management modules Faculty of Economics and Business – specialization packages both tracks

Module	ECTS	Course coordinator/ First examiner	Examination type
Digital Transformation in IB (EBB632B05)	5	dr. E. Smailhodzic	AST, WE
Fundamentals of Finance for IB (EBB631C05)	5	dr. H. Gonenc	AST, MC, WE
Health Economics (EBB120A05)	5	dr. L. Viluma	WE
Junior Business Research and Consulting (EBB123A05)	5	prof. dr. J. Riezebos	AST
Macroeconomics for EOR (EBB027B05)	5	dr. G.H. Kuper	AST, WE
Purchasing & Supply Chain Management (EBB742B05)	5	dr. ir. S. Boscari	AS, WE
Teamwork - Theories, Design and Dynamics (EBB110A05)	5	dr. H.J. van de Brake	ASR, MC, WE
Introduction to Science Education (WBEC002-05)*	5	ir. J.E. van der Laan	R, OR

* Not a Faculty of Economics and Business course, but may also be chosen as an elective in the minor package.

Year 3, semester 1 – ME minor package (30 ECTS)

Module	ECTS	Course coordinator/ First examiner	Second examiner	Examination type
Dynamics and Vibrations (WBIE054-05)	5	prof. dr. M. Ghandchi Tehrani	prof. dr. ir. E. van der Giessen	WE
Numerical Methods (for IEM) (WBIE049-05)	5	dr. ir. R. Luppes	prof. dr. C.A. Bertoglio	PR, WE
Solid Mechanics (for IEM) (WBIE055-05)	5	dr. F. Maresca	prof. dr. ir. E. van der Giessen	AST, WE
Materials Science and Engineering (WBPH071-05)	5	dr. ir. V. Ocelik	prof. dr. ir. B.J. Kooi	WE
Mechatronics (WBIE011-05)	5	dr. S. Ahmed	prof. dr. J. M. A. Scherpen	WE, IT
Principles of Measurement Systems (WBPH029-05)	5	dr. A.K. Biegun	dr. J.S. Blijleven	AST, IT, WE

Year 3, semester 2 PTL track (30 ECTS)

Module	ECTS	Course coordinator/ First examiner	Second examiner	Examination type
Design Science (WBIE019-05)	5	dr. M. Taheri	dr. ir. G.H. Jonker	AST, P, R
Integration Project IEM (PTL) (WBIE902-15)	15	dr. G.K.H. Larsen	various	PR, P, R
Design and Construction for IEM (WBIE047-05)	5	M. Mohebbi, MSc	dr. M. Muñoz Arias	MC, R, P
Mechanical Craftsmanship (WBIE057-05)	5	dr. M. Muñoz Arias	M. Mohebbi, MSc	MC, R, AST, P

Year 3, semester 2 SPE track (30 ECTS)

Module	ECTS	Course coordinator/ First examiner	Second examiner	Examination type
Design Science (WBIE019-05)	5	dr. M. Taheri	dr. ir. G.H. Jonker	AST, P, R
Integration Project IEM (SPE) (WBIE901-15)	15	dr. G.K.H. Larsen	Various	PR, P, R

Capita Selecta SPE (WBIE046-05)	5	dr. D. Parisi	prof. dr. F. Picchioni	R
Product Technology (IEM) (WBIE028-05)	5	prof. dr. F. Picchioni	dr. R.K. Bose	AST, WE

List of Integration Project supervisors

Title	Initials	Last Name	Research group/ Department	Research Institute
dr.	M.I.	Acuautla Meneses	Discrete Technology and Production Automation	ENTEG
prof. dr.	D.	Bauso	Optimization and Decision Systems	ENTEG
dr.	R.M.J.	Benders	Energy and Environment	
prof. dr. ir.	M.	Cao	Discrete Technology and Production Automation	ENTEG
dr.	A.K.	Cherukuri	Optimization and Decision Systems	ENTEG
prof. dr.	C.	De Persis	Smart Manufacturing Systems	ENTEG
dr.	P.J.	Deuss	Chemical Technology	ENTEG
dr. ir.	P.D.	Druetta	Product Technology	ENTEG
prof. dr. ir.	M. van	Duin	Product Technology	ENTEG
prof. dr.	G.J.W.	Euverink	Products and Processes for Biotechnology	ENTEG
prof. dr. ir.	H.J.	Heeres	Chemical Technology	ENTEG
dr.	W.L.J.	Hinrichs	Pharmaceutical Technology and Biopharmacy	GRIP
dr.	A	Hübl	Design Group	
prof. dr.	B.	Jayawardhana	Discrete Technology and Production Automation	ENTEG
dr. ir.	G.H.	Jonker	Design group	
dr. ing.	H.	Kloosterman	Design group	
prof. dr. ir.	B.J.	Kooi	Nanostructured Materials and Interfaces	ZIAM
dr.	A.G.P.	Kottapalli	Advanced Production Engineering	ENTEG
dr.	W.P.	Krijnen	Undergraduate school of Science	
dr.	J.	Krooneman	Products and Processes for Biotechnology	ENTEG
dr.	A.O.	Krushynska	Computational Mechanical and Materials Engineering	ENTEG
dr.	G.	Lange, de		ESRON
dr.	G.K.H.	Larsen	Design Group	
prof. dr.	M.J.E.C.	Maarel, van der	Aquatic Biotechnology and Bioproduct- technology	ENTEG
dr.	F.	Maresca	Computational Mechanical and Materials Engineering	ENTEG
MSc	M.	Mohebbi	Design Group	
dr.	N.	Monshizadeh Naini	Smart Manufacturing Systems	ENTEG
dr.	M.	Muñoz Arias	Design Group	
prof. dr. ir.	P.R.	Onck	Micromechanics	ZIAM
prof. dr.	Y.	Pei	Advanced Production Engineering	ENTEG
dr.	P.P.	Pescarmona	Product Technology	ENTEG
prof. dr.	F.	Picchioni	Product Technology	ENTEG
prof. dr. ir.	J.	Post	Advanced Production Engineering	ENTEG
drs.	W.A.	Prins	Advanced Production Engineering	ENTEG
dr.	P.	Raffa	Product Technology	ENTEG
prof. dr.	J.	Riezebos	FEB Operations	SOM
prof. dr. ir.	J.M.A.	Scherpen	Discrete Technology and Production Automation	ENTEG
dr. ir.	T.H.J.A.	Sleutels	Products and Processes for Biotechnology	ENTEG

dr.	R.	Smedinga	Software Engineering	JBI
dr.	N.B.	Szirbik	Design Group	
dr.	M.	Taheri	Design Group	
dr.	A.	Vakis	Advanced Production Engineering	ENTEG
prof. dr. ir.	G.F.	Versteeg	Applied Chemistry	ENTEG
dr.	W.M.C.	Wezel, van	FEB Operations	SOM
dr. ir.	J.G.M.	Winkelman	Chemical Technology	ENTEG
dr.	J.	Yue	Chemical Technology	ENTEG

Relation between the learning outcomes and course units of the curriculum
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.

Propaedeutic phase	**N1** Mathematics and natural Sciences (K)	**N2** Design and engineering Theories (K)	**N3** Basic theoretical and practical problems (S)	**N4** Engineering problem solving (S)	**N5** Justify and communicate (S)	**M1** Management and business sciences (K)	**M2** Basic theoretical and practical problems (S)	**M3** Real-life problem solving (S)	**M4** Implement, justify and communicate (S)	**T1** Production technology and logistics (K)	**T2** Analysis. design & implement solutions (S)	**T3** Effectively operate in Business (S)	**P1** Chemical (product) engineering (K)	**P2** Analysis. design & implement solutions (S)	**P3** Effectively operate in Business (S)
Calculus 1 (for IEM)	X		X												
Global Supply Chain						X				X	X	X			
Programming, Modelling and Simulation	X			X	X										
Linear Algebra (for IEM)	X		X	X											
Organizational Behaviour and Group Dynamics						X	X	X	X						
System Dynamics			X			X	X	X	X						
Calculus 2 (for IEM)	X		X	X											
Management Accounting						X	X	X	X						
Materials and Molecules			X										X	X	X
Fluid Dynamics	X	X	X	X											
Industrial Marketing						X	X	X	X						
Statistics and Stochastics	X		X	X											

K =knowledge, S = Skills

Post-propaedeutic Year 2	**N1** Mathematics and natural Sciences (K)	**N2** Design and engineering Theories (K)	**N3** Basic theoretical and practical problems (S)	**N4** Engineering problem solving (S)	**N5** Justify and communicate (S)	**M1** Management and business sciences (K)	**M2** Basic theoretical and practical problems (S)	**M3** Real-life problem solving (S)	**M4** Implement, justify and communicate (S)	**T1** Production technology and logistics (K)	**T2** Analysis. design & implement solutions (S)	**T3** Effectively operate in Business (S)	**P1** Chemical (product) engineering (K)	**P2** Analysis. design & implement solutions (S)	**P3** Effectively operate in Business (S)
Dynamics of Engineering Systems	X	X	X	X	X										
Sustainable Engineering Design		X		X	X		X	X	X						
Operations Research	X					X	X	X							
Outlining and implementing innovation strategy					X	X	X	X				X			
Production Planning and Quality Control						X				X	X	X			
Research and Design Methodology					X	X	X	X	X						
Year 2 PTL specialization															
Mechanics for IEM	X	X	X	X						X	X				
Modelling and analysis of complex networks	X		X							X	X				
Signals and Systems	X	X	X	X											
Computer Aided Design and Manufacturing	X	X	X	X						X	X	X			
Control Engineering	X	X	X	X						X	X				
Production Techniques		X	X	X	X					X	X	X			
Year 2 SPE specialization															
Industrial Biotechnology (for IEM)				X	X								X	X	X
Reactor Engineering		X		X									X	X	X
Technical Thermodynamics (IEM)	X	X	X	X									X	X	
Gas-Liquid Mass Transfer	X	X	X	X									X	X	X
Process Design and Equipment													X	X	X
Applied Transport Phenomena for Sustainable Processes	X	X	X	X											

K =knowledge, S = Skills

Post-propaedeutic Year 3	**N1** Mathematics and natural Sciences (K)	**N2** Design and engineering Theories (K)	**N3** Basic theoretical and practical problems (S)	**N4** Engineering problem solving (S)	**N5** Justify and communicate (S)	**M1** Management and business sciences (K)	**M2** Basic theoretical and practical problems (S)	**M3** Real-life problem solving (S)	**M4** Implement, justify and communicate (S)	**T1** Production technology and logistics (K)	**T2** Analysis. design & implement solutions (S)	**T3** Effectively operate in Business (S)	**P1** Chemical (product) engineering (K)	**P2** Analysis. design & implement solutions (S)	**P3** Effectively operate in Business (S)
Year 3 PTL specialization															
Design Science					X	X	X	X	X						
Integration Project IEM (PTL)				X	X		X	X	X						
Design and Construction for IEM		X		X						X					
Mechanical Craftsmanship				X						X	X				
Year 3 SPE specialization															
Design Science					X	X	X	X	X						
Integration Project IEM (SPE)				X	X		X	X	X						
Capita Selecta SPE													X	X	X
Product Technology (IEM)					X								X	X	X

K =knowledge, S = Skills