Budapest University of Technology and Economics Faculty of Transportation Engineering and Vehicle Engineering

# VEHICLE ENGINEER MASTER TRAINING PROGRAMME

The training programme was adopted by the Senate by Decision № .../2024-2025. (VI.30.), in force for students starting as of Autumn for 2025/2026 academic year.

#### I.

## TRAINING AND OUTCOME REQUIREMENTS

The training and outcome requirements for the training programme as a whole are set out in the Ministerial Communication (hereinafter referred to as the "KKK" or "KKK Communication"). The training programme contains both the requirements of the KKK and the *specific requirements of the curriculum of the training programme as actually implemented (where the KKK allows for deviations or sets limits) or supplemented by the curriculum of the training programme maintained by the Faculty of Transport Engineering and Vehicle Engineering*. (The numbering of each point and sub-point is the same as in the KKK.)

### 1. Basic characteristics of the training programme

1. The name of the master training programme: Vehicle Engineering

2. Level of qualification obtained in the master training programme and indication of the qualification in the diploma:

- level of qualification: master, abbreviaton: MSc

- classificaion: Vehicle Engineer

3. Field of study: engineering

4. Training programmes accepted as prerequisites for entry to the master programme

4.1. Full credit may be awarded for: the vehicle engineer bachelor training programme.

4.2. In addition to the credits specified in point 9.3, the following may also be considered: the BProf vehicle engineering training programme, as well as those bachelor and master training programmes, and programmes established under Act LXXX of 1993 on Higher Education, which are accepted by the credit transfer committee of the higher education institution based on the comparison of the knowledge serving as the basis for credit recognition.

5. Programme duration is terms: 4 terms

6. Number of credits required to obtain the master degree: 120 credits

- orientation of the training programme: balanced (40-60 percent)  $>> 60\%^{1}$ 

- the number of credits allocated to the master thesis: 30 credits

- the minimum number of credits to be allocated to the optional subjects: 6 credits >> 6 credits

7. Classification of fields of study according to the uniform classification of fields of vocational education and training:

European Qualification Frame level: 7

Hungarian Qualification Frame level: 7

# **ISCED-F 2013** classification: 525/0716 Design and manufacturing of motor vehicles, ships and aircraft

8. Training objectives and professional competences of the master training programme The aim of the training programme is to train vehicle engineers who, based on their advanced knowledge in natural sciences, vehicle-specific mechanical engineering, information technology, and economic-management disciplines related to vehicles and mobile machinery, are capable of developing, designing, and manufacturing railway, road, agricultural, waterborne, and airborne vehicles, as well as construction and material handling machinery, and conducting research on the processes occurring within them. They are also capable of ensuring the safe operation, maintenance, diagnostics, servicing,

<sup>&</sup>lt;sup>1</sup> Az orientáció százalékos értéke: a tantervi tantárgyak együttes gyakorlati és laboratóriumi gyakorlati óraszámának, valamint az összóraszámnak a hányadosa. (lásd KKK 1. melléklet 5. bek. c) pontja)

and repair of these vehicles and machines, as well as the transport and machine systems composed of them, while taking into account environmental protection and energy management requirements. They are prepared to pursue studies at doctoral level.

8.1. The professional competences to be acquired

8.1.1. The Vehicle Engineer's

a) knowledge

He/she

- understands and applies the general and specific principles, rules, relationships, and procedures of mathematics, natural and social sciences required for the practice of engineering and specifically related to the vehicle engineering profession.

- possesses comprehensive knowledge of global social and economic processes.

- understands and can extensively apply the established theories, relationships, and terminology of the field of vehicles and mobile machinery.

- knows and understands the fundamental facts and limits of the engineering knowledge and activity system, as well as the expected directions of development and innovation in vehicle technology.

- has a detailed understanding of knowledge acquisition and data collection methods used in engineering, their ethical limitations, and problem-solving techniques.

- knows and understands the terminology, regulations, and considerations of other areas of key importance for the practice of the profession related to vehicles and mobile machines (especially in transport, logistics, management, environmental protection, quality assurance, information technology, law, economics, health and safety, occupational and fire safety, and security technologies).

- knows and understands the information and communication technologies applied in transport and logistics processes involving vehicles and mobile machinery.

- knows and understands the methodology and toolkit of design and research in the field of vehicles and mobile machinery.

- knows the measurement technology and measurement theory solutions related to research in the field of vehicles and mobile machinery.

- knows and understands the tools and methods of computer modelling and simulation relevant to the field of vehicles and mobile machines.

- is familiar with widely applicable problem-solving techniques required for research and scientific work.

- knows the organizational tools and methods related to management, as well as the legal regulations required for professional practice.

- knows and effectively applies the specific methods and technologies of the chosen specialization.

b) skills

He/She

- is capable of applying acquired general and specific mathematical, natural and social science principles, rules, relationships, and procedures to solve problems arising in the field of engineering.

- is capable of applying the theories of the specific technical field and the related terminology in an innovative way when solving problems.

- is capable of examining and analyzing the methods used in the field of vehicles and mobile machinery, and of evaluating and documenting the results.

- is capable of processing, organizing, analyzing information collected during the implementation of vehicle and mobile machinery systems and processes, and of drawing appropriate conclusions.

- is capable of recognizing the interrelationships and mechanisms of systems and

processes involving vehicles and mobile machines, and of evaluating and managing them with a systems-oriented approach.

- is capable of creative participation in solving research and development tasks related to vehicles and mobile machines.

- is capable of enriching the knowledge base of the field with original ideas.

- is capable of applying integrated knowledge from the fields of transportation, mobile machinery, process theory, industrial production processes, electronics, and information technology.

- is capable of globally designing complex systems based on systems-oriented and process-oriented thinking.

- is capable of applying and further developing procedures, models, and information technologies used in the design, implementation, and operation of vehicle and mobile machinery systems.

- is capable of ensuring the quality of vehicle and mobile machinery systems, and of solving measurement and process control tasks.

- is capable of performing condition assessments, developing evaluations and proposals based on them, and of developing, designing at a high level, organizing, and managing complex vehicle and mobile machinery systems, depending on the chosen specialization.
- is capable of the complex planning and management of the use of technical, economic, environmental, and human resources.

- is capable — after gaining sufficient practical experience — of taking on leadership roles.

- is capable of engaging in publication activities and conducting negotiations in their native language and in at least one foreign language within their professional field.

c) attitude

He/she

- is open and receptive to learning about, accepting, and authentically conveying

professional and technological developments and innovations in the field of vehicles and mobile machines.

- embraces and upholds the professional and ethical values associated with the engineering field.

- strives to contribute to the development of new methods and tools related to vehicles and mobile machines. Demonstrates a deep sense of professional vocation.

- strives to observe and enforce ethical principles of workplace and organizational culture as well as quality standards.

- aims to enforce the requirements of sustainability, environmental awareness, health protection, and energy efficiency.

- strives to carry out work using a complex approach based on systems thinking and process-oriented mindset.

- seeks to continuously improve both their own and their colleagues' knowledge through self-directed learning and professional development.

- aims to acquire broad and comprehensive general knowledge.

d) autonomy and responsibility

He/she

- takes initiative in solving professional tasks and independently selects and applies relevant problem-solving methods.

- makes decisions independently and with due diligence, in consultation with representatives of other disciplines (primarily legal, economic, energy, and environmental fields), assuming full responsibility.

- demonstrates responsibility in matters of sustainability, health protection, and

environmental awareness.

- takes into account and applies principles of environmental protection, quality assurance, consumer protection, product liability, equal access, workplace health and safety, technical, economic and legal regulations, as well as the fundamental requirements of engineering ethics in making decisions,

- assumes responsibility for the work and activities of subordinates and for the processes carried out under their supervision.

9. Characteristics of the master training programme

9.1. Professional characteristics

9.1.1. The disciplines and specialisations leading to the qualification, from which the degree is drawn:

- natural science knowledge 20-35 credits; >> 20 credits

- mathematical knowledge 10 credits

- electronic and electrotechnic knowledge 5 credits
- material science knowledge 5 credits
- economic and social science knowledge 10-20 credits; >> 11 credits
  - management knowledge 5 credits
  - other economic and social science knowledge 6 credits
- vehicle engineering professional knowledge 15-44 credits, of which >> 22 credits

- simulation and optimisation methods 5-15 credits, >> 8 credits

- vehicle and mobile machinery construction theory 5-15 credits, >> 5 credits
- specific professional fields 5-25 credits. >> 9 credits

9.1.2. Taking into account the elective specialisations, specific knowledge can be acquired in areas of specialisation appropriate to the needs of the profession of vehicle engineer: >>

- aerospace vehicle engineer
- automotive engineer
- naval vehicle engineer
- railway vehicle engineer
- vehicle manufacturing and repairing engineer

- lifetime planning engineer

The specialisation recommended by the training institution within the training as a whole including the master thesis be 40-60 credits. >> 58 credits

9.2. Requirements for the traineeship

The traineeship must last at least four weeks and must be organised in a work placement. The traineeship is a criterion requirement.

9.3. Minimum admission requirements to the master training programme for holders of degrees specified in Section 4.2

9.3.1. For applicants holding a degree as specified in Section 4.2 — except for those with a BProf degree in vehicle engineering as defined in Section 4.2 — admission to the master programme requires that the student has obtained at least 40 credits out of the 70 credits specified below during their undergraduate studies:

- natural sciences knowledge (mathematics, chemistry and materials science, mechanics, thermodynamics and fluid mechanics, electrical engineering): 20 credits

- economic and human sciences knowledge (economics and management, environmental protection, quality assurance, occupational safety, social sciences): 10 credits

- field-specific knowledge (structure, components, and operation of vehicles and mobile machinery; transportation systems, logistic systems, plant transport systems, computer technology, engineering drawing, vehicle and drive elements, stuctural materials and technologies of vehicle manufacturing, repairing and maintenance, heat engines and fluid machines, control theory, vehicle dynamics and drive techniques, transportation knowledge): 40 credits

Any missing credits from the above fields must be obtained in accordance with the study and examination regulations of the higher education institution during the master's programme.

9.3.2. For students with a BProf degree in vehicle engineering, the minimum number of credits required for admission to the master programme is 60 credits from the following fields:

- natural sciences knowledge (mathematics, physics, fluid mechanics): 10 credits

- economic and human sciences knowledge: 2 credits

- field-specific knowledge (structure and operation of vehicles and mobile machinery, transportation systems, logistic systems, plant transport systems, computer technology, engineering drawing, vehicle and drive elements, stuctural materials and technologies of vehicle manufacturing, repairing and maintenance, heat engines and fluid machines, control theory, vehicle dynamics and drive techniques, transportation knowledge): 48 credits

In order to obtain the master degree, the student must acquire the full 60 credits in the specified fields concurrently with the master level education, within the duration of the training programme, and in accordance with the code of studies of the higher education institution.

#### II. SPECIFIC CHARACTERISTICS OF THE TRAINING PROGRAMME

- **1.** The comprehensive organisational unit responsible for the training programme Faculty of Transportation Engineering and Vehicle Engineering
- 2. The person responsible for the programme Dr. Árpád VERESS (lecturer ID: 71958375749)

#### 3. Curricular requirements and prerequisite system:

### 3.1. Prerequisite of subject registering:

The system of prerequisites for the subjects expresses the interrelationship between the subjects. There is an indicative system of pre-requisites for the subjects, which characterises the depth of the links between the subjects.

In the absence of strong and weak prerequisites, the subject is not recommended for enrolment. In the case of co-requisite, a subject linked to a prerequisite may be taken concurrently with the subject it is building on in the same semester. The recommended prerequisite subject reflects a looser connection between the subjects, and the learning outcomes of the subsequent subject can be achieved with some additional time.

# **3.2.** General conditions for choosing specialisations and modules and for taking up specialisation subjects:

There are no specific conditions for choosing specialisation and for taking up specialisation subjects.

# **3.3.** General conditions for admission to the subjects "Master thesis" in all specialisations:

The prerequisite for enrollment in the Master thesis 1. course are the completion of compulsory courses covering all the basic natural scientific knowledge in the recommended curriculum and the collection of a minimum of 55 credits.

The prerequisite for enrollment in the Master thesis 2. course are the completion of compulsory courses covering all the basic natural scientific knowledge included in the recommended curriculum and the collection of a minimum of 84 credits. The Master thesis 1. course can be enrolled simultaneously as corequisite, in which case the above cumulative acquired credits must be achieved by completing another subjects according to the recommended curriculum. A further condition is the completion of the 4-week traineeship in case of full time master study.

#### **3.4.** Evaluation and assessment

The evaluation and assessment methods, procedures and rules are set out in the subject descriptions (subject datasheet) in force, in accordance with the current Code of Studies.

### 3.5. Term designated for student mobility:

The student has the possibility to participate in international student mobility in the term designated for this purpose in the recommended curriculum, provided that the conditions set out in the Code of Studies are met, the subjects completed in the framework of mobility will be recognised as being the subjects due for the term of the recommended curriculum which the student would have been entitled to take.

# **3.6.** Conditions for obtaining the leaving certificate and for entering the final examination:

The conditions for obtaining a leaving certificate are set out in the Code of Studies, within the legal framework. Within this framework, it is necessary to fulfil all the following criteria:

Completion of all the subjects set out in the recommended curriculum, including the elective subjects (minimum 120 credits), all the curricular criteria (4 weeks of traineeship) and the submission of the master thesis.

### 3.7. Choice of subjects for the final examination, order of the final examination:

The final examination in front of the Final Examination Board consists of the defence of the bachelor thesis and an oral examination in three final examination subjects (or subject groups). The final examination subjects or subject groups shall be selected by the Department responsible for the specialisation. The subjects shall be chosen partly from the core professional curriculum and partly from the specialisation subject area, so that each subject is worth at least 3 credits and the total of the three subjects (groups) is worth at least 15 credits.

### 3.8. Recommended curriculum, compulsory and elective subjects, curriculum code:

The recommended curriculum is a distribution of the subjects and criteria requirements in the curriculum into terms that a student who wishes to progress at an average pace can follow by meeting the indicative prerequisites for the admission of all subjects, so that he/she can complete his/her study requirements within the programme duration specified in the training and outcome requirements; to be admitted and completed in the terms of training.

The compulsory elective subjects in economics and human sciences, the specialised compulsory elective subjects and the elective subjects set out in the curriculum and announced in the current term are available in the study system.

As part of the training programme, students must complete one major compulsory elective subjects. The student may choose the subjects at his/her discretion from among those announced in the current semester. The Faculty offers at least eight major compulsory elective subjects in the framework of the training programme. The current list of subjects is available on the Faculty website: https://transportation.bme.hu/

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The indicative subject prerequisites are displayed on the subject datasheets.

Code of the model curriculum in the study system: xxx

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1	Adva	nce	d ma	ther	natio	s				Advand	ed ma	terials	and pro	oductio	n techno	ologies	Measur	ement	t metho	ods				Qualit	y, safet	y and h	omolog	gation		
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### Recommended curriculum of the training programme (start in spring)

 BK
 basic knowledge

 PK
 professional knowledge

 MA
 major compulsory elective course

 CE
 compulsory elective economics and natural science course

 EC
 elective course

 SP
 specialization

- MI minor elective course
- CR criteria requirement
- term for student mobility

## Recommended curriculum of the training programme (start in autumn)

1./autumn	2./spring	3./autumn	4./spring
1 Advanced materials and production technolog	ies Advanced mathematics	Measurement methods	Quality, safety and homologation
2 3 4			GJT K IIT
5 1 2 0 v 5 G	T 2 1 0 m 5 TTK	1 1 2 e 5 SZT VJJT	2 1 0 m 5 SZTRHT
6 Major compulsory elective course	Project management	Elective course 1.	Elective course 2
7			
8 1 1 0 m 3 SZT		2 0 0 m 3 SZV	2 0 0 m 3 SZV
9 Engineering calculations		Compulsory elective economics and human science	Master thesis 2.
10	2 2 0 m 5 GJT	course 1.	
11 0 1 1 m 3 R	T Technical modeling and simulations	2 0 0 m 3 KV GTK	
12 System integration		Compulsory elective economics and human science	
13		course 2.	
14		2 0 0 m 3 KV GTK	
15 1 1 1 е 4 к	Т 1 1 1 е <sup>5</sup> VJЛ	Spec	
16 Computational fluid dynamics	Electrics and electronics M		
17			
<sup>-18</sup>		102 e 4 SP	
19 <mark>-19</mark> -		Spec	
20 1 2 1 e 5 R	IT 2 1 0 e <sup>5</sup> KJIT		
21 Spec	Spec		
22		1 0 2 e 4 SP	
23		Master thesis 1.	
24			
25 2 0 2 m 5 SP	2 0 2 m 5 SP	-	
20 Spec	spec		
28			
29			
30 2 0 2 e 5 SP	202e5SP	0 4 0 m 8 ÖP	0 12 0 m 22 ÖP
31	Traineeship		
	4weeks 0 0 s 0 KR	]	

 BK
 basic knowledge

 PK
 professional knowledge

 MA
 major compulsory elective course

CE compulsory elective course EC elective course SP specialization MI minor elective course

CR criteria requirement term for student mobility

# Recommended curriculum of specialisations

#### Aerospace vehicle engineer specialisation

Adva	anced f	flight	theo	ry				Aircraf	ft desig	n and p	oroducti	on 2.			Analys	is of air	crafts 2				
															1	0	2	e	4	SP	RHT
2	0	0	2	e	5	SP	RHT	2	0	2	m	5	SP	RHT	Aeros	ace vel	hicle er	ngineer	resear	ch proje	ect
Airc	raft des	signa	and pr	oductio	on 1.			Analys	is of ai	rcrafts	1.										
															1	0	2	e	4	SP	RHT
2	0	D	2	m	5	SP	RHT	2	0	2	e	5	SP	RHT							

#### Automotive vehicle engineer specialisation

Proje	ect plan (	automo	otive)				Design	and m	odel pi	reparati	on (aut	omotiv	e)	Build a	nd inte	egrate (	automo	tive)		
														1	0	2	e	4	SP	GJT
2	0	2	e	5	SP	GJT	2	0	2	m	5	SP	GJT	Testing	g and va	alidatio	n (auto	motive	)	
Requ	irement	definit	ion and	collect	t design	n	Simula	tion ar	nd verif	ication	(autom	otive)								
requ	irements	auton	notive)																	
10.050		0.000000												1	0	2	e	4	SP	GJT
														×						
2	0	2	m	5	SP	GJT	2	0	2	e	5	SP	GJT							

#### Naval vehicle engineer specialisation

Ship th	neory an	d prop	ulsion				Ship de	esign						Design	ofplea	asure cr	afts			
1	0	2	m	4	SP	RHT														
Ship m	otions													1	1	2	e	5	SP	RHT
							2	1	1	m	6	SP	RHT	Ship h	ydrody	namics	calculat	ions		
							Ship st	regth												
														1	0	1	е	3	SP	RHT
3	1	1	e	6	SP	RHT	2	1	1	e	4	SP	RHT							

#### Railway vehicle engineer specialisation

Tra	ction	unit s	ystems	5				Railwa	iy vehic	le desi	gn 2.				Railwa Iabora	<b>y vehic</b> tory	le mea	sureme	ent tech	niques	and
															1	0	2	e	4	SP	TILV
З	3	1	0	e	5	SP	TILA	1	0	3	m	5	SP	TILA	Tractio	n mech	nanics a	nd ene	rgetics		
Rail	lway	vehic	le desig	gn 1.				Railwa	y vehic	le syst	em dyna	amics									
															1	2	0	e	4	SP	TILV
1		0	3	m	5	SP	TLLV	3	1	0	e	5	SP	TITA							

#### Vehicle manufacturing and repairing engineer specialisation

Vel	nicle	manu	facturin	ng techi	nology	project		Design	of veh	icle ma	anufactu	iring sy	stems 1	ι.	Design	of veh	icle ma	nufactu	iring sy	stems 2	2.
															1	0	2	e	4	SP	GJT
2	2	0	2	m	5	SP	GJT	2	0	2	m	5	SP	GJT	Measu	remen	t syster	ns in ve	hicle n	nanufac	turing
Sur	face	engin	eering					Fixing	and sea	aling te	chnolog	ies									
															1	0	2	e	4	SP	GJT
2	2	0	2	e	5	SP	GJT	2	0	2	e	5	SP	GJT							

#### Lifetime planning engineer specialisation

Sta	atistic	al basi	ics of li	fetime	planniı	ng		Analy	thical m	nethods	of lifet	ime pla	anning		Design	theory	'				
															1	2	0	e	4	SP	TILV
	2	2	0	е	5	SP	TITA	2	2	0	m	5	SP	TITA	Measu	rement	t metho	ods and	data p	rocessii	ng
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	2	2	0	m	5	SP	TILV	2	2	0	e	5	SP	TILA							

## III. SUBJECT DATASHEETS

The currently valid subject catalogue is available on the faculty website: https://transportation.bme.hu/