Mechanical Engineering, 1. cycle academic study programme

1 General description of the programme

The academic study programme of the first cycle “Mechanical Engineering lasts three years. A student has to acquire 180 ECTS points. The study programme is aligned with the Bologna directives. It represents the basis for the master study programme of the second cycle with the same name “Mechanical Engineering”.

The study programme is related to other study programmes in Europe. Three programmes “Mechanical Engineering” from the high-ranked universities according to Shanghai university rankings) were taken for the basis and comparison: 1. Swiss Federal Institute of Technology (ETH) Zürich, Switzerland; Delft University of Technology, The Netherlands and Vienna University of Technology; Austria.

The study encompasses three modules: Power, process and environmental engineering, Design and Manufacturing technologies and systems. Students can select appropriate module in the third, final year, thus they can choose specific professional specialisation.

The academic programme contains a balanced combination of knowledge that is in alignment with the recommendations of the European Society for Engineering Education (SEFI). It is divided into scientific and technological fundaments, applicative and systemic knowledge with practical training, graduation (diploma) work, individual and business knowledge.

A graduate student can understand and apply knowledge for designing and planning of products. He (she) can optimise the product about their shape, the manufacturing route, quality assurance and price. A graduate student possesses the broad theoretical knowledge and specific professional skills. His (hers) competences allow him (her) to work professionally. However, the primary goal is to prepare him (her) for further study and engineering study programmes on the second cycle, especially mechanical engineering. The professional study is finished on the second cycle, and graduates of the second cycle can work independently, they can produce new knowledge and develop new technologies in Slovenia and worldwide economy. They can also continue their studies on Ph.D. study programmes, which are also offered at our faculty.

Several graduates of the first cycle study programme Mechanical Engineering have been continuing their studies on higher-level study programmes at other universities in Slovenia and abroad.

2 Short description of the study modules

2.1 Power, process and environmental engineering

The students of this module will gain the theoretical and applied knowledge necessary for understanding of power and mass transport processes, thermal and hydraulic machinery and devices. In particular, in the area of power engineering this includes study of different types of machines and devices such as internal combustion engines, hydraulic machines, gas and steam turbines, steam boilers and HVAC systems. In the process engineering area, the study focuses on unit operations characteristics, mainly mechanical and thermal diffusion process technology. The environmental engineering focuses on different environmental technologies for the primary emission reduction of harmful substances at its source, elimination of pollutants from gases, water and ground and management of industrial and household waste.

2.2 Engineering Design

The graduates of this study module are equipped with necessary theoretical and practical knowledge required for designing modern structures and machines. They are trained to combine the basic knowledge with modern procedures and methods to design mechanical elements, parts, assemblies, structures and machines. The module is structured to teach the students how to work efficiently as a part of design team using modern CAD equipment and applying intelligent and expert systems to the design process. The students are encouraged to develop new concepts and practical approaches that help to shorten the design processes and thus contribute towards product cost reduction.

2.3 Manufacturing technologies and systems

The delivers the extended knowledge about production processes and production process planning depending on the manufacturing tool and machine choice optimisation in view of production cost reduction. Particular attention is devoted to good understanding of control measurements of manufacturing machines that enable proper estimation of the state of the machine and its production readiness. Computer-aided technologies, production automatization, the introduction of robot technology and other automatic or semi-automatic systems, which fulfil the target functions of the production technologies, are studied in detail. These technologies are the basis of the intelligent manufacturing system development, which will be the manufacturing machines of tomorrow.

The students can expand their theoretical knowledge of operational research system analysis. They learn the essential elements of the complex production system and their connectivity, how to dimension the system components and plan the logistics of material and information. They also learn about new systems of production planning and management, which are often aided by the computer technology. Production management is based on the concepts of process simulation, scientific databases and the results of experimental systems, all of which are addressed in this module.

3 General learning outcomes and competencies of the students

A graduate student of this programme is an expert with theoretical and methodological knowledge for solving problems by planning, managing and implementing complex professional tasks within a wide field of mechanical engineering and at various workplaces. Students have possibilities for obtaining high-quality knowledge during their studies, and also skills and expertise in the areas of mechanical engineering. The individual work with the students enables transferring of professional values and fostering the positive self-esteem of the students, and in combination with profound knowledge, contributes significantly to the work successes of our graduates. Graduates of this study programme can manage the procedures and processes within the field of mechanical engineering. They can design, construct, manufacture and maintain products, machines and plants with great responsibility. They can take into account the professional excellence, social utility, ethical responsibility, commitment to professional ethics and criteria for the environmental integrities of their creations. This programme enables the graduate to obtain a broad knowledge by integrating theoretical concepts with vocational and applied skills. The graduate can also develop his (her) skills for transferring and applying theoretical knowledge in practice for creative solutions of professional work problems.

4 The primary subject-specific learning outcomes and competencies of the students

The main subject-specific competencies that can be obtained by the academic study programme of MECHANICAL ENGINEERING.

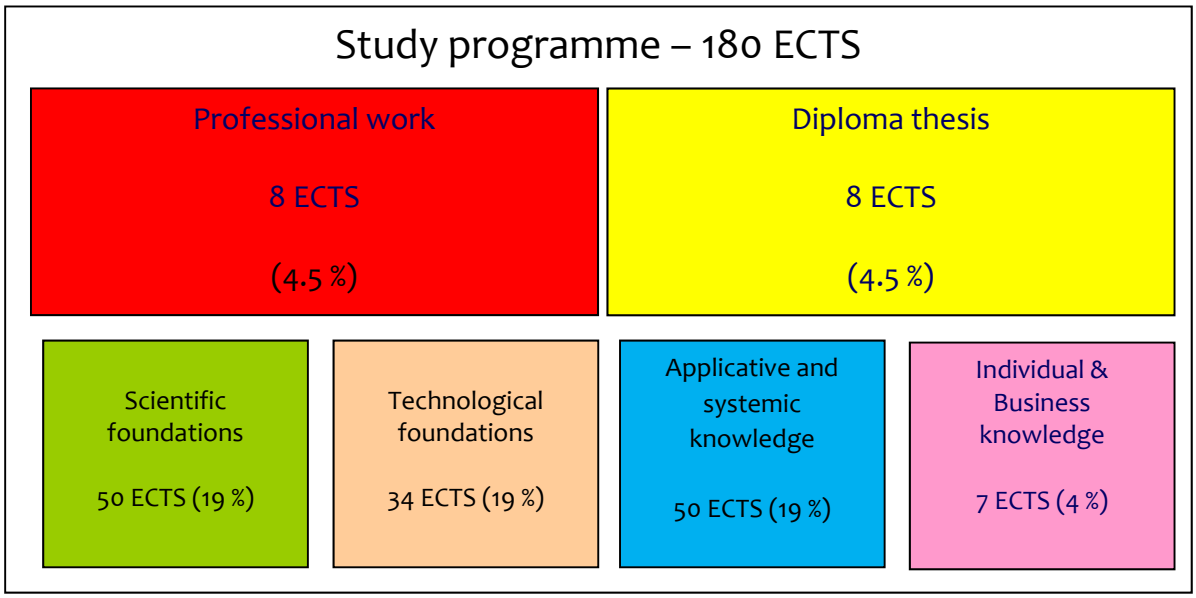
- an ability to design mechanical elements, devices and machines
- an ability to apply and develop computer-aided design
- an ability to apply and develop processes and tools for modelling, optimisation and simulation of processes, machines, devices, manufacturing methods, products and production facilities
- an ability to design and develop machines, devices and facilities for the power, process and environmental engineering
- an ability to devise, develop and apply the modern production technologies, production automatization and new production concepts,
- an ability to managing with information, material and energy flows by devising, designing, assembly, disassembly and maintenance of products.
- an ability for managing the current production methods and technologies, as well as analysing, evaluating and judging of existing production methods and technologies
- an ability to organise and manage a production process
- an ability to provide a convenient quality of products by applying appropriate measurements and quality assurance.
- an ability to conduct measures of flawless functioning, maintenance, and environmental correctness of products during their total lifetime.
- an ability for interdisciplinary understand the activities in the production systems,

- an ability to permanently develop skills by application of knowledge on the particular professional area,
- an ability to apply modern computer, information and communication technologies on the particular professional area,
- knowledge and understanding of the historical development of mechanical engineering and its disciplines

5 General curriculum

The academic-level diploma study programme of Mechanical Engineering is divided into the following two parts:

Part	Part of study	Duration	ECTS credits
1	Joint courses	two years (4 semesters)	120
2	Module courses	one year (2 semesters)	60
	Total:	**3 years**	**180**



6 Detailed curriculum

1. year							
Subject	1st semester			Cont. hours	Individ. work	Hours	ECTS
	L	S	T				
Mathematical Analysis	50	0	30	80	100	180	6
Mechanics I	50	0	25	75	105	180	6
Materials I	25	0	15	40	50	90	3
Fundamentals of Classical Physics	25	0	24	49	71	120	4
Engineering Informatics	25	0	25	50	70	120	4
Technical Documentation	35	5	20	60	60	120	4
Foreign language (ENGLISH) or Foreign language (GERMAN)	35	5	0	40	50	90	3
Together semester:	245	10	139	394	506	900	30

Subject	2nd semester			Cont. hours	Individ. work	Hours	ECTS
	L	S	T				
Linear Algebra	25	0	12	37	53	90	3
Mechanics II	50	0	25	75	105	180	6
Materials II	25	0	15	40	50	90	3
Thermodynamics	40	0	25	65	85	150	5
Waves and Material Structure	25	0	24	49	71	120	4
Production Technologies I	40	0	12	52	68	120	4
Engineering Tools I	15	10	40	65	85	150	5
Together semester:	220	10	153	383	517	900	30
Together year:	**455**	**20**	**289**	**764**	**1036**	**1800**	**60**

2. year							
Subject	3rd semester			Cont. hours	Individ. work	Hours	ECTS
	L	S	T				
Vector Analysis	50	0	25	75	105	180	6
Differential Analysis	25	0	12	37	53	90	3
Mechanics III	50	0	25	75	105	180	6
Fluid Mechanics	40	0	25	65	85	150	5
Machine Elements	50	0	37	87	123	210	7
Production Technologies II	25	5	10	40	50	90	3
Together semester:	240	5	134	379	521	900	30

Subject	4th semester			Cont. hours	Individ. work	Hours	ECTS
	L	S	T				
Heat Transfer	25	0	15	40	50	90	3
Electrical Engineering	24	0	16	40	50	90	3
Industrial Engineering	25	0	12	37	53	90	3
Metrology and Quality	30	0	10	40	50	90	3
Fundamentals of Process and Environmental Engineering	25	0	15	40	50	90	3
Powerplant Technology	40	0	12	52	68	120	4
Fundamentals of Engineering Design	25	0	12	37	53	90	3
Transport Systems and Logistics	25	5	10	40	50	90	3
Engineering Tools II	21	0	44	65	85	150	5
Together semester:	240	5	146	391	509	900	30
Together year:	**480**	**10**	**280**	**770**	**1030**	**1800**	**60**

3. year – modul Power, process and environmental engineering							
Subject	5th semester			Cont. hours	Individ. work	Hours	ECTS
	L	S	T				
Technical Cybernetics	25	0	25	50	70	120	4
Management in Production	25	10	15	50	70	120	4
Mass Transfer	25	0	12	37	53	90	3
Experimental Methods	25	5	10	40	50	90	3
Heat Systems and Devices	25	5	10	40	50	90	3
Internal Combustion Engines I	25	5	10	40	50	90	3
Process and Environmental Engineering	25	0	15	40	50	90	3
Hydraulic Machinery I	25	0	15	40	50	90	3
An elective subject	25	10	15	50	70	120	4
Together semester:	225	35	127	387	513	900	30

Subject	6th semester				Cont. hours	Individ. work	Hours	ECTS
	L	S	T	K				
Professional Work	-	-	-	-	0	200	200	8
Diploma Work	-	-	-	35	35	205	240	8
Elective subjects	100	25	50	-	175	245	420	14
Together semester:	100	25	50	35	210	650	860	30
Together year:	**325**	**60**	**177**	**35**	**597**	**1163**	**1760**	**60**
Together 3 years:	**1270**	**90**	**749**	**35**	**2144**	**3216**	**5360**	**180**

L – lectures, S – seminar; T – tutorial; K - consultation

3. year – module Engineering Design							
Subject	5th semester			Cont. hours	Individ. work	Hours	ECTS
	L	S	T				
Technical Cybernetics	25	0	25	50	70	120	4
Management in Production	25	10	15	50	70	120	4
Physical Modelling of Technical Systems	25	10	5	40	50	90	3
Engineering Computer Simulations	12	0	25	37	53	90	3
Engineering Design Methods	12	12	12	36	54	90	3
Computer Aided Design	12	10	15	37	53	90	3
Engineering Structures	25	0	12	37	53	90	3
Joining of Materials	25	0	12	37	53	90	3
An elective subject	25	10	15	50	70	120	4
Together semester:	186	52	136	374	526	900	30

Subject	6th semester				Cont. hours	Individ. work	Hours	ECTS
	L	S	T	K				
Professional Work	-	-	-	-	0	200	200	8
Diploma Work	-	-	-	35	35	205	240	8
Elective subjects	100	25	50	-	175	245	420	14
Together semester:	100	25	50	35	210	650	860	30
Together year:	**286**	**77**	**186**	**35**	**584**	**1176**	**1760**	**60**
Together 3 years:	**1231**	**107**	**758**	**35**	**2131**	**3229**	**5360**	**180**

L – lectures, S – seminar; T – tutorial; K-consultation

3. year – module Manufacturing technologies and systems							
Subject	5th semester			Cont. hours	Individ. work	Hours	ECTS
	L	S	T				
Technical Cybernetics	25	0	25	50	70	120	4
Management in Production	25	10	15	50	70	120	4
Cutting Processes	25	5	10	40	50	90	3
Machine Tools and Forming Machines	25	0	12	37	53	90	3
Computer Integrated Manufacturing	25	0	12	37	53	90	3
Production Planning and Control	25	0	12	37	53	90	3
Mechatronic Systems for Machining Tools	25	0	15	40	50	90	3
Assembly Systems	25	0	12	37	53	90	3
An elective subject	25	10	15	50	70	120	4
Together semester:	225	25	128	378	522	900	30

Subject	6th semester				Cont. hours	Individ. work	Hours	ECTS
	L	S	T	K				
Professional Work	-	-	-	-	0	200	200	8
Diploma Work	-	-	-	35	35	205	240	8
Elective subjects	100	25	50	-	175	245	420	14
Together semester:	100	25	50	35	210	650	860	30
Together year:	**325**	**50**	**178**	**35**	**588**	**1172**	**1760**	**60**
Together 3 years:	**1270**	**80**	**750**	**35**	**2135**	**3225**	**5360**	**180**

L – lectures, S – seminar; T – tutorial; K- consultation

6.1 Elective subjects

3. year – module Power, process and environmental engineering – elective subjects -							
Subject	5th semester			Cont. hours	Individ. work	Hours	ECTS
	L	S	T				
Heating, Ventilation, Air Conditioning and Comfort	25	10	20	55	65	120	4
Computer Simulations in Power and Process Engineering	15	10	25	50	70	120	4
Ecology Problems of Vehicle and Internal Combustion Engines	25	12	15	52	68	120	4

3. year – module Power, process and environmental engineering – elective subjects -							
Subject	6th semester			Cont. hours	Individ. work	Hours	ECTS
	L	S	T				
Sensible use of Energy	25	15	25	65	115	180	6
Renewable Energy Sources	38	12	15	65	115	180	6
Thermal Turbomachinery	20	10	20	50	70	120	4
Cooling Technique	25	5	22	52	68	120	4

3. year – module Engineering Design – elective subjects -							
Subject	5th semester			Cont. hours	Individ. work	Hours	ECTS
	L	S	T				
Constructional Materials	25	5	22	52	68	120	4
Lifting Devices	25	10	17	52	68	120	4
Gear Drives	25	5	23	53	67	120	4

3. year – module Engineering Design – elective subjects -							
Subject	6th semester			Cont. hours	Individ. work	Hours	ECTS
	L	S	T				
Dimensioning of Machines and Devices	25	12	12	49	71	120	4
Planetary Drives	25	10	17	52	68	120	4
Welded Structures in Mechanical Engineering	25	10	15	50	70	120	4
Vehicles	40	12	0	52	68	120	4
Virtual Product Modelling	15	10	23	48	72	120	4

3. year – module Manufacturing technologies and systems – elective subjects -							
Subject	5th semester			Cont. hours	Individ. work	Hours	ECTS
	L	S	T				
Forming Tools	25	0	25	50	70	120	4
Work Study and Ergonomics	25	10	15	50	70	120	4
Robotisation	30	0	20	50	70	120	4

3. year – module Manufacturing technologies and systems – elective subjects -							
Subject	6th semester			Cont. hours	Individ. work	Hours	ECTS
	L	S	T				
Forming of Polymer Materials	30	15	5	50	70	120	4
Maintenance	40	5	10	55	65	120	4
Open-Loop Control Technics	25	10	15	50	70	120	4
Engineering Calculations	25	10	15	50	70	120	4
Tools and Devices	25	10	15	50	70	120	4
Product Development	25	10	15	50	70	120	4

3. year – General elective subjects							
Subject	6th semester			Cont. hours	Individ. work	Hours	ECTS
	L	S	T				
Electrical Devices and Drives	25	10	5	40	50	90	3
Asset Management	25	5	10	40	50	90	3
Maintenance Strategies	25	10	5	40	50	90	3
Continuous and Discrete Optimisation	40	12	25	77	103	180	6
Computer Programming in Mechanical Engineering	12	10	15	37	53	90	3
Fundamentals of Modern Physics	25	5	10	40	50	90	3
Sports I	5	0	35	40	50	90	3
Sports II	5	0	35	40	50	90	3
Sports III	5	0	35	40	50	90	3
Project Work	0	15	0	15	165	180	6
Hydraulics and Pneumatics	25	5	22	52	68	120	4