ASIIN Seal & EUR-ACE Label

Accreditation Report

Bachelor's Degree Programme
Mechanical Engineering
Master's Degree Programme
Mechanical Engineering

Provided by
University of Belgrade
Faculty of Mechanical Engineering

Version: 20 March 2020

Table of Content

A About the Accreditation Process

Name of the degree programme (in original language)	(Official) English translation of the name	Labels applied for [1]	Previous accreditation (issuing agency, validity)	Involved Technical Committees (TC)[2]
Основне академске студије	Bachelor of Science in Mechanical Engineering (BAS - basic academic studies)	ASIIN, EUR-ACE® Label	ASIIN, 28.06.2013 - 30.09.2018	TC 01
Мастер академске студије	Master of Science in Mechanical Engineering (MAS - master academic studies)	ASIIN, EUR-ACE® Label	ASIIN, 28.06.2013 - 30.09.2018	TC 01
Date of the contract: 18.09.2018 **Submission of the final version of the self-assessment report:** 31.08.2018 **Date of the on-site visit:** 05./06.12.2018 **at:** Faculty of Mechanical Engineering, Kraljice Marije 16, 11120 Belgrade 35				
Peer panel: Prof. Dr.-Ing. Stephan Kabelac, Leibniz University Hannover Prof. Dr. rer. nat. Norbert Bahlmann, Osnabrück University of Applied Sciences Dr. Christoph Hanisch, FESTO AG & Co. KG, Esslingen Ms. Lejla Vasić, B.Sc. Mechanical Engineering, University of Banja Luka (student peer)				
Representative of the ASIIN headquarter: Dr. Holger Korthals				

[1] ASIIN Seal for degree programmes; EUR-ACE® Label: European Label for Engineering Programmes

[2] TC: Technical Committee for the following subject areas: TC 01 - Mechanical Engineering/Process Engineering

Responsible decision-making committee: Accreditation Commission for Degree Programmes	
Criteria used: European Standards and Guidelines as of 15.05.2015 ASIIN General Criteria, as of 10.12.2015 Subject-Specific Criteria of Technical Committee 01 – Mechanical Engineering/Process Engineering as of 09.12.2011	

B Characteristics of the Degree Programmes

a) Name	Final degree (original/English translation)	b) Areas of Specialization	c) Corresponding level of the EQF[3]	d) Mode of Study	e) Double/Joint Degree	f) Duration	g) Credit points/unit	h) Intake rhythm & First time of offer
Mechanical Engineering (B.Sc.)	Инжењер машинства/ Bachelor of Science in Mechanical Engineering	--	6	Full time	--	6 Semester	180 ECTS	Once a year - 2005/2006
Mechanical Engineering (M.Sc.)	Мастер инжењер машинства/ Master of Science in Mechanical Engineering	21 areas of specialization	7	Full time	--	4 Semester	120 ECTS	Once a year - 2007/2008

For both the Bachelor's and the Master's degree programme Mechanical Engineering the institution has presented the following profile on the website of the faculty (https://www.mas.bg.ac.rs/eng/admissions/start, retrieved on 29.01.2019):

"Why choose Mechanical Engineering?

Just look around you. How much of what you see has been manufactured? Engineers are involved in the design and manufacture of everything, from cars to airplanes. Many recent medical advances have been made as a result of work done by engineers: from brain scanners to the drug dispensers used by asthma sufferers. If you want to be an informed member of society, able to understand modern technology as well as the infrastructure on which our society is built, then there can be no better training than that given to mechanical engineers at University of Belgrade. Graduates of the Faculty have benefited from education that enables them to make a real difference to the world outside while, at the same time, pursuing successful and rewarding careers."

For the Master's degree programme Mechanical Engineering the institution also provides an extract from a "Catalogue of Master study programs" (http://bg.ac.rs/en/members/faculties/FME.php, retrieved on 29.01.2019). The catalogue as a whole is still accessible but not linked any more on the website of the university:

[3] EQF = The European Qualifications Framework for lifelong learning

“M.Sc. Mechanical Engineers are able to manipulate methods, procedures and processes of work and research at the acquired level of education. They are able to apply knowledge in practical work and thorough understanding of the physicality of concepts studied in the respective study program. The M.Sc. Mechanical Engineers have developed the ability to connect basic knowledge from different spheres of its application. They can design projects for the development of economy, industry, individuals and broader social community.”

Apart from that, the brochure “Mechanical Engineering @ University of Belgrade” (https://www.mas.bg.ac.rs/_media/eng/education/bsc/ub-fme-booklet.pdf, retrieved on 29.01.2019) includes profiles of all areas of specialisation.

C Peer Report for the ASIIN Seal[4]

1. The Degree Programme: Concept, content & implementation

Criterion 1.1 Objectives and learning outcomes of a degree programme (intended qualifications profile)

Evidence:

- Academic Studies Guide (available as a printed brochure and on the website of the faculty)
- Self-Assessment Report
- Objectives-Modules-Matrices for both study programmes
- Discussions with representatives of faculty management, programme coordinators, students, lecturers and business representatives

Preliminary assessment and analysis of the peers:
After fulfilling one of the requirements of the previous accreditation procedure by formulating learning outcomes for the programmes as a whole and making them accessible to the public, the Faculty of Mechanical Engineering by now presents a comprehensive set of objectives and learning outcomes on programme level – for both degree programmes – as well as for the areas of specialisation and for the courses of the curriculum. For the general learning outcomes of the programmes, the faculty has used the EUR-ACE framework standards of engineering programmes and the Subject-Specific Criteria of the ASIIN Technical Committee for Mechanical and Process Engineering as a guideline. Consequently, the study aims and intended learning outcomes of the Bachelor programme correspond to learning outcomes relevant to level 6, that of the Master Programme to learning outcomes relevant to level 7 of the European Qualifications Framework. They are accessible to students, staff members, and other stakeholders on the faculty website.

The peers acknowledge that the learning outcomes reflect the level of academic qualification aimed at, are viable and valid, and are monitored by institutions within the faculty like

[4] This part of the report applies also for the assessment for the European subject-specific labels. After the conclusion of the procedure, the stated requirements and/or recommendations and the deadlines are equally valid for the ASIIN seal as well as for the sought subject-specific label.

the Teaching and Scientific Council, an expert body with student participation whose functions are described in the Statute of the Faculty of Mechanical Engineering. The peers consider the programmes to be focused on the technical skills of the students while the transferable skills could be outlined more specifically and the objectives on programme level better linked with the objectives of the areas of specialisation. However, from their perspective both degree programmes are well-established and well-functioning with regard to the learning outcomes.

From the discussion with business representatives, the peers gained the impression that industrial companies and other employers are largely satisfied by the qualification of the students, and that the graduates are quickly absorbed by the labour market. The company representatives particularly emphasised the high level of theoretical knowledge while few of them argued that practical and managerial skills could still be improved. Although not organised in a defined process with formal participation, the industrial partners stated that the faculty shows the willingness and capability to adapt to changing labour market demands – the development of the specialisation area Biomedical Engineering being mentioned as an example.

Criterion 1.2 Name of the degree programme

Evidence:

- Academic Studies Guide
- Website of the faculty
- Self-Assessment Report

Preliminary assessment and analysis of the peers:
The names of both degree programmes are indicated on the website of the faculty as well as in several printed documents like the brochures “Academic Studies Guide” and “Mechanical Engineering @ University of Belgrade”. Information about the programmes is published in Serbian and English language. While the predominant language of instruction is Serbian, it is also possible – according to the University Statute and the Statute of the Faculty of Mechanical Engineering – to conduct teaching in English. The peers confirm that the names of the programmes reflect the intended aims and learning outcomes although, especially in the Master programme, students can attain a high level of specialisation in particular fields of Mechanical Engineering.

Criterion 1.3 Curriculum

Evidence:

- Academic Studies Guide (includes study plans for both programmes)

- Course Catalogs for both programmes
- Self-Assessment Report
- Discussions with representatives of faculty management, programme coordinators, students, lecturers and business representatives

Preliminary assessment and analysis of the peers:
In general, the peers regard the curricula of both degree programmes as appropriate for matching the intended learning outcomes. In their opinion, the curriculum of the Bachelor programme follows a traditional understanding of mechanical engineering but is well designed within this setting. For each course or module of the curriculum (the manner in which the faculty uses the term "module" will be addressed in Chapters 2.1 and 5.1), the description includes information about goals and learning outcomes so that it is clear and comprehensible which knowledge, skills and competences students will acquire in each course/module.

The curriculum of the Bachelor programme largely consists of obligatory courses on Mathematics, Mechanics, Engineering Materials, Machine Elements as well as on fundamentals of Thermodynamics, Fluid Mechanics, Electrical Engineering etc. It also includes courses on computer programming and a period of practical experience called "Skill Praxis". "English 1 + 2" and "Sociology and Economy" can be regarded as courses in which students acquire transferable skills. From the second year on, the students may choose elective courses offered by the different areas of specialisation. Including the "Skill Praxis" and the Bachelor thesis, there are in total eight slots for electives.

In contrast to this, the Master programme provides students with a broad range of possibilities to make individual choices. Before they finish their studies with the "Skill praxis" module and the Master thesis in the fourth semester, they have to take eight courses from their chosen area of specialisation. Additionally, there are five slots for electives from outside this specialisation. Two modules are designed to assure that students acquire knowledge in either advanced Mechanics or advanced Fluid Mechanics and in either advanced Thermodynamics or Mechatronics.

The peers wondered whether it is possible to offer the elective courses of all specialisation areas continually and whether there is a constant demand. They learned that recently only two of those elective courses did not take place because they missed the necessary minimum student number.

In the discussion with the students the peers came to know that particularly the first semesters of the Bachelor programme are challenging but ultimately manageable. As the faculty management and the programme coordinators admit and as is proven by statistical

data, a remarkable number of students drops out of the programme. For this, the students do not blame the programme but argue in the same way as the programme coordinators that important reasons for the abandonment are the relatively high living costs in Belgrade which force students to work on the side and the decreasing quality level of high school education. From their point of view, with constant attendance in the first semesters, it is possible to finish the programme within six semesters. From the experience with their peer group, the students in the Master programme estimate that between 30 and 50 percent of their cohort finished their Bachelor studies in time.

During the previous accreditation procedure in 2013, the ASIIN Accreditation Commission for Degree Programmes contentiously debated the question whether it could be an obstacle for the accreditation that a Department of Weapon Systems is part of the faculty and that this department offers a specialisation "Weapon Systems" in the Master programme as well as elective courses for the Bachelor programme. For the reaccreditation, the peers therefore paid particular attention to this area of specialisation. They raised the issue in the discussions with the faculty management and the programme coordinators and asked the students for their opinions. The peers learned that "Weapon Systems" belongs to the group of smaller specialisations which is chosen by a number of 5 to 10 students of the Master programme on average per year. According to the programme coordinators, the number of graduates approximately matches the domestic defence industry's demand for engineers. None of the courses offered by the department is obligatory for all students, it is possible to avoid any contact with the subject. Furthermore, students with different specialisations did not see any problem concerning this field of research and study. They argued that research for military purposes is conducted in other countries' universities either, perhaps less openly than at their faculty, and that this research has also yielded useful products for civilian use. In total, the peers came to the conclusion that it would be doubtful to judge the faculty against the backdrop of the small number of German universities which committed themselves to exclude research for military purposes. More critical reflection on the subject could, however, be induced into the study programme by offering courses like "Engineering Ethics" within the frame of one or two elective modules for transferable skills (cf. 2.1 Structure and modules).

Criterion 1.4 Admission requirements

Evidence:

- Statute of the Faculty of Mechanical Engineering
- Enrollment Info Booklet
- Website of the faculty
- Self-Assessment Report

Preliminary assessment and analysis of the peers:

The requirements and procedures for admission are mandatory, transparent and the same for all applicants. They are laid down in the Statute of the Faculty of Mechanical Engineering and explained in an Enrolment Info Booklet and on the website of the faculty. For enroling in the Bachelor programme, an applicant needs to have a high school education of four years duration and to pass an entrance exam which consists of 20 selected tasks from the fields of mathematics and natural sciences belonging to the prescribed curriculum for high schools. The faculty has defined rules concerning the ranking of the candidates for admission based on the results obtained in the entrance exam and on their school grades. Enrolment in the Master programme requires completed bachelor studies with at least 180 ECTS credits. In case of this programme, the order of the candidates for admission is determined on the basis of the general average mark achieved at the bachelor level.

During the on-site visit the peers learned that the number of applicants has recently increased and reached a number of about 1.000 persons for the Bachelor programme while a maximum of 540 students can be admitted. However, in an additional meeting with the University's Vice-Rector for International Cooperation they also came to know that, as part of a demographic transition, the number of high school graduates in Serbia will significantly decrease within the next years. From the perspective of the peers, the Faculty of Mechanical Engineering should prepare for that development and find ways to adjust the number of staff and to attract students from abroad.

Concerning the Master programme, the peers learned that almost all graduates from the Bachelor programme continue with the Master programme for which up to 416 students may enrol each year. Additionally, a small number of master students enters the programme after having obtained their Bachelor's degree at another university.

Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 1:

As the faculty does not comment on this chapter of the report (for the issue of the representation of soft skills in the curriculum cf. final assessment regarding criterion 2), the peers confirm their preliminary assessment without any changes.

2. The degree programme: structures, methods and implementation

Criterion 2.1 Structure and modules

Evidence:

- Academic Studies Guide (includes study plans for both programmes)
- Course Catalogs for both programmes
- Rulebook on Student Mobility and Transfer of ECTS Credits
- Self-Assessment Report
- Discussions with programme coordinators, students and lecturers

Preliminary assessment and analysis of the peers:
At the beginning of this chapter, it is necessary to make a statement about the way the Faculty of Mechanical Engineering uses the term "module" in the Self-Assessment Report and in relevant documents like the brochures "Academic Studies Guide" and "Mechanical Engineering @ University of Belgrade". The peers were astonished when they discovered that "module" is used as a synonym for "area of specialisation". This is insofar misleading as each area of specialisation offers quite a large number of courses that would much better be termed as modules, especially if they form comprehensive units of and teaching and learning with the value of 6 ECTS credits.

With this restraint, the peers confirm that both degree programmes are divided into modules in a number of standardised sizes. The majority of courses/modules take a teaching time of 5 hours per week and equal 6 ECTS credits. A smaller number, particularly in the first year of the Bachelor Programme, has the size of 3 teaching hours and 4 ECTS credits respectively 2 teaching hours and 2 ECTS credits. The only exceptions from those course types of different duration are the "Skill Praxis" course of the Bachelor programme (if not seen in combination with the course "Mechanical Engineering Praxis") and the Master thesis. In the opinion of the peers, the structure of the programmes ensures that the learning outcomes can be reached and allows students to define an individual focus and course of study. The module objectives help to reach both the qualification level and the overall intended learning outcomes.

While the students are largely satisfied with the structure of the programmes and the modules, the peers noticed that they also pointed at a few aspects that could still be improved. Many students regard some modules from the first semesters of the Bachelor programme as expendable, particularly "English 1 + 2" and "Sociology and Economy". As the discussion showed, this is obviously not due to a disesteem of transferable skills but because they

think that the content currently taught in those modules does not improve their knowledge and skills. Some students expressed interest in learning other languages if one's English skills are already on a higher level, others supported the idea that the curriculum should offer more opportunities to acquire managerial skills. Although the programme coordinators take the view that transferable skills are to some extent present in a large number of modules, the peers nevertheless concluded that the faculty should offer more choices in that field. They propose to develop the compulsory modules "English 1+2" and "Sociology and Economy" into the direction of a subcatalog of elective soft-skill modules that could encompass other languages, managerial skills or engineering ethics.

The peers also learned from the students that the elective courses within the Bachelor programme can be quite on different levels with regard to the content and the necessary effort to pass the exam. This offers the possibility to pimp up one's grades for the admission to the Master programme by choosing the less challenging courses. From the perspective of the peers, the faculty should make sure that the level of the elective courses/modules is comparable.

To facilitate the mobility of the students the university has developed rules for the recognition of credits acquired at other higher education institutions based on the competences of the students in a "Rulebook on Student Mobility and Transfer of ECTS Credits". So far, the number of students participating in international exchange – both incoming and outgoing – is relatively small. This may be due to the fact that Serbia has not been a full member of the Erasmus+ programme until the beginning of 2019. As a partner country, it did not have access to the full range of European exchange programmes. Nevertheless, the faculty already introduced learning agreements and started participating in the limited number of programmes available about one year before the audit.

Although the peers understand that this issue has not been treated with priority in the setup process for international student exchange, they miss an information for the students, which semester(s) would suit best for a stay at a university abroad – a mobility window. The programme coordinators stated that they recommend a stay abroad after completion of the first year of the Bachelor programme. This can be seen as a hint but the peers would prefer a binding stipulation combined with a reflection on a possible impact for the curriculum, and therefore think that a mobility window should explicitly be defined.

Criterion 2.2 Work load and credits

Evidence:

- Course Catalogs for both programmes
- Self-Assessment Report

- Discussions with programme coordinators, students and lecturers

Preliminary assessment and analysis of the peers:
The faculty makes use of the ECTS credit point system and allocates ECTS credits to all of the courses/modules according to an estimated workload that is required from an average student for the successful completion of the course. The allocation of credits is based on the assumption that one ECTS credit equals a workload ranging between 25 and 30 hours. Although the peers would have preferred the stipulation of one specific value, they understood that the faculty calculates with this margin to balance minor differences between the modules of the various specialisations. The ECTS credits are evenly distributed over the semesters, in every semester students can acquire a total of 30 credits.

The workload comprises both attendance-based learning and self-study despite the fact that the time for self-study is not explicitly indicated in the course catalog. The faculty states that the content of the courses was adapted to the calculated workload. Certain workload adjustments have been made since the introduction of the programme after professors or students noticed gaps between the indicated and the actual workload.

Accordingly, the students regard the estimated time budgets as realistic. The peers did not encounter complaints about workload peaks except for a hint that “Mechanics” is a particularly difficult and time-consuming topic and module. The peers concluded that the workloads have been calculated realistically and therefore enable students to complete the programme without exceeding its regular duration.

Criterion 2.3 Teaching methodology

Evidence:

- Course Catalogs for both programmes
- Self-Assessment Report
- Discussions with programme coordinators, students and lecturers

Preliminary assessment and analysis of the peers:
In both degree programmes, lectures and presentations by the professors in the classroom or in the laboratories are accompanied by class exercises, laboratory exercises, calculation tasks, seminar works, design projects, discussions and workshops, practical work and excursions.

According to the faculty, students are given the possibility to work independently in the laboratories with the required equipment. During this work, members of the teaching staff or older student tutors are available to offer assistance. Each student is provided with an

access to a wide range of free licensed software that enables him or her to acquire and deepen necessary knowledge by self-study.

In general, the students confirmed their satisfaction with the quality of teaching. There were only few remarks about aspects of teaching in which the faculty could improve. Some students mentioned that teaching is sometimes too theoretical and not focused on the skills they need as engineers. This criticism particularly applied to the Mathematics modules of the Bachelor programme. In a similar way, the laboratory practice met some criticism for not being interactive enough, too often confined to theoretical explanation by the teaching assistants.

Nevertheless, the peers gained the impression that the teaching staff showed a convincing motivation to instruct the students in their respective disciplines. They found that the teaching methods and instruments in use support the students in achieving the learning outcomes. To them, the programmes seem to be well-balanced between attendance-based learning and self-study. At least on the master level, students have the opportunity to take part in research activities.

Criterion 2.4 Support and assistance

Evidence:

- Self-Assessment Report
- Discussions with programme coordinators, students and lecturers

Preliminary assessment and analysis of the peers:
As the faculty states in the Self-Assessment Report, all professors and assistants are available to the students for individual and group consultations. From the perspective of the faculty, support and consultancy includes (among others) the timely information about important dates like the mid-term test/colloquium, the registration for exams and the exam itself, information about the content of the elective subjects, recognition of the capacities of the students and the scientific areas that are particularly prone to them, and the readiness for regular meetings with the students.

In the discussion with the peers, the students confirmed that the motivation of the teaching staff to offer individual assistance, advice and support is high. Professors and assistants will usually answer questions quickly (within 12 hours in case of an e-mail request) and obviously pursue an open-door-policy. The students mentioned the recently introduced mentoring system (cf. Chapter 6) in which professors act as mentors for a group of students during their first year.

Because of the impressions from that discussion, the peers have no doubt that the allocated advice and guidance on offer assist the students in achieving the learning outcomes and in completing the course within the scheduled time.

Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 2:

The statement of the faculty refers to two issues raised by the peers: possible changes in the representation of soft skills in the curriculum and the definition of a mobility window. In both cases, the faculty positively responds to the peers' suggestions. It commits itself to introduce more courses with a focus on soft skills, explicitly taking a course on "Engineering Ethics" as an example. Concerning the mobility window the faculty promises to analyse the possibility of an official introduction into the study programmes and envisages an introduction within a period of two or three years.

The peers appreciate those considerations. Since the faculty states that the implementation of the measures will take some time, the peers confirm their preliminary assessment and maintain their recommendations.

3. Exams: System, concept and organisation

Criterion 3 Exams: System, concept and organisation

Evidence:

- Statute of the Faculty of Mechanical Engineering
- Rulebook on Taking Exams and Grading Exams
- Course Catalogs for both programmes
- Selection of examination papers and final theses
- Self-Assessment Report
- Discussions with programme coordinators, students and lecturers

Preliminary assessment and analysis of the peers:

The peers acknowledge that the faculty has defined a form of assessment for each of the modules/courses that are offered in the course catalogs of both degree programmes. Binding rules for the organization of exams and grading, including for the Bachelor and the Master thesis, are laid down in the Statute of the Faculty and a "Rulebook on Taking Exams and Grading Exams". Those documents also contain regulations for re-sits and for the treat-

ment of persons with disabilities who may take exams in a manner suited to their capabilities. The documents can be found on the website of the faculty, and the rules are thus transparent for all students and teaching staff.

The faculty organises six examination terms during the academic year pursuant to the University Statute. One additional examination period for re-sits is usually organised before the start of the next academic year. The number of exams in the final examination period of a semester (in January respectively in June) is always 5. An exam in the same subject can be taken up to three times during the school year. A student who has only one attempt left for an exam can make use of the additional examination period prior to the start of the next academic year. Students who do not pass the exam in a compulsory subject until the beginning of the next school year must enrol in the same subject again. A student who has not achieved at least 48 ECTS credits within one study year has to enrol for the same year again. Students have the possibility to study three additional years to complete all exams before they are expelled, altogether a maximum of 6 years.

From the discussion with the students, the peers learned that the exam organisation works well. With the exception of the first semesters of the Bachelor programme in which the number of exams is higher due to the amount of (partly small) modules, the students rated the number of exams as appropriate.

In the discussion with the lecturers, the peers debated the issue of split classes in fundamental modules after they had found out that there are rules that require to split up large audiences. They were assured that a coordination between the different instructors takes place ahead of the semester, and that in the end only one of them is responsible for the final exam.

The peers conclude that the number and distribution of the final exams ensure that the exam load and preparation times are adequate. The exams are scheduled in order to avoid delays in students' academic progress. Failed exams can be repeated quickly. All exams are marked using transparent criteria. If one course is taught by different instructors, mechanisms are in place which ensure that all students get the same preparation for the final exam.

Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 3:

As the faculty does not comment on this chapter of the report, the peers confirm their preliminary assessment without any changes.

4. Resources

Criterion 4.1 Staff

Evidence:

- Mechanical Engineering @ University of Belgrade (available as a printed brochure and on the website of the faculty)
- Statute of the Faculty of Mechanical Engineering
- Staff Handbook
- Self-Assessment Report
- Discussions with representatives of faculty management, programme coordinators and lecturers

Preliminary assessment and analysis of the peers:
According to the "Facts and Figures" page of the brochure "Mechanical Engineering @ University of Belgrade" the teaching staff of the faculty is composed of 81 full professors, 39 associate professors, 37 assistant professors and 44 teaching assistants (as of October 2018). Apart from the teaching staff, 119 researchers and 152 other employees (laboratory personnel, administrative personnel, employees of the technical service and in the restaurant) work at the faculty. Regulations for the selection and promotion of teaching staff are laid down in the Statute of the Faculty.

As the faculty reports, the teaching personnel of the different departments is involved in a large number of research projects and cooperation both on a national and international level. In the period from 2014 until 2018, the Faculty of Mechanical Engineering participated in 55 scientific and research projects funded by the Ministry of Education, Science and Technological Development of the Republic of Serbia. In the same period, it was also engaged in several European scientific projects within the programmes FP7, Horizon 2020, EUREKA and ERASMUS as well as other bilateral international projects. From the perspective of the faculty, the intense research activities contribute to a continuous improvement of the quality of teaching and to the procurement of new equipment.

Summarising, the peers acknowledged that the composition, scientific orientation and qualification of the teaching staff are suitable for sustaining the degree programmes and that the quantity of the staff ensures a good ratio between teaching personnel and students.

As has already been mentioned in Chapter 1.4, the peers learned from the University's Vice-Rector for International Cooperation that a significant decrease in the number of high

school graduates in Serbia is expected for the following years as part of a demographic transition. While presently the demand for admission to the study programmes is on a high level this could change for the universities in Serbia in general. If smaller numbers of students resulted in a reduced governmental funding, the expenses for staff would become a burden. Therefore, the peers recommend that the Faculty works on a strategy to cope with the demographic developments and to find ways to adjust the number of staff.

Criterion 4.2 Staff development

Evidence:

- Staff Handbook
- Self-Assessment Report
- Discussions with representatives of faculty management, programme coordinators and lecturers

Preliminary assessment and analysis of the peers:
The faculty explained that both the university and the faculty offer a number of measures for the continuing education of staff members with regard to subject-related and didactical skills. Those offers include courses provided by the university on didactics, pedagogy, andragogy, methodology, psychology, etc. but also a separate plan for the development of young researchers. The Faculty of Mechanical Engineering, together with its Innovation Center, organises a number of scientific meetings funded by the Ministry of Education, Science and Technological Development.

From the discussion with the lecturers, the peers learned that the faculty fosters a culture of continuous improvement in teaching. The evaluation of individual staff members by the students, if it shows deficiencies, can result in a recommendation to participate in didactic training offers. One recently introduced personnel selection tool is a trial lecture that assistant professors have to give before they are employed by the faculty.

In summary, the peers confirm that the faculty provides sufficient support mechanisms and opportunities for members of the teaching staff who wish to further develop their professional and teaching skills.

Criterion 4.3 Funds and equipment

Evidence:

- Mechanical Engineering @ University of Belgrade (available as a printed brochure and on the website of the faculty)

- Financial Plan of the Faculty of Mechanical Engineering for 2018 and Register of scientific equipment (in Serbian language)
- Catalog of international research projects (2017)
- Presentations on recent R&D cooperations
- Self-Assessment Report
- Discussions with representatives of faculty management, programme coordinators, students, lecturers and business representatives
- On-site visit of the faculty building including lecture rooms and laboratories

Preliminary assessment and analysis of the peers:
As the Faculty of Mechanical Engineering displays in the brochure "Mechanical Engineering @ University of Belgrade" the income of the faculty is composed of governmental funding from the Ministry of Education, Science and Technological Development and of self-earned income from cooperation with industrial partners. In 2017, income from industrial sources accounted for about one third of the total income. Altogether, the funding seems sufficient to cover the costs of personnel, equipment and facility operation. However, the peers learned from the representatives of the faculty management that for certain purposes like the costs of facility operation and building restoration the funding from the industry is indispensable.

A catalog of international research projects in which the faculty participates, numerous agreements about international cooperation with universities outside Serbia, and presentations about R&D cooperation with industrial partners demonstrate the efforts of the faculty (and the success) in conducting research projects and generating research income from both European projects and bilateral cooperation with domestic and international companies.

The faculty disposes of facilities of about 38,000 m² in four buildings of which the "New Building" (1960) with about 32,000 m² makes up the largest part. The facilities comprise 30 lecture rooms, 4 main lecture halls, 3 celebration rooms, 4 rooms for numerical laboratories, 30 laboratories, 118 offices and 2 internet alleys with 30 free access places. The New Building also hosts the faculty library with over 100,000 books and periodicals and 200 reading spaces available for both group-work and individual study. By connection through the library information system COBISS, the library provides full involvement into the National Library and Information System. Through the online consortium KoBSON, library users can access a large number of international scientific journals.

By joining the faculty, students get the opportunity to use one of the more than 500 computers. The faculty provides the latest versions of subject-specific software, including calculation packages (Matlab) and engineering drawing and modeling packages (AutoCAD, CATIA, SolidWorks, CREO, etc.). Since the faculty is a subscriber of the Microsoft Imagine Program, all active students and faculty employees can obtain licensed software from Microsoft.

The peers inspected the lecture rooms and a number of laboratories from various departments in order to assess the quality of the infrastructure and the technical equipment. They recognised that the equipment has been modernised and improved since the previous accreditation procedure and deemed the technical infrastructure adequate to support teaching and practical exercises within the study programmes. Since the buildings were constructed more than 50 years ago, they set limitations for space and thus for the number or size of student workplaces in certain labs.

For the modernisation of the buildings but also for the costs of facility operation, for the renewal of laboratory equipment and for the financial support of students who would like to participate in international exchange, the peers see it as desirable that the government increases its financial support. The leadership of the faculty as well as the university should address the respective ministries and try to demonstrate how this could boost the faculty's impact on national economic development.

Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 4:

In its statement, the faculty agrees with the peers that the number of staff will have to be adjusted to lower figures in the near future, a process that the faculty will try to manage on its own initiative. As the faculty does not add further comments on this chapter of the report, the peers confirm their preliminary assessment without any changes.

5. Transparency and documentation

Criterion 5.1 Module descriptions

Evidence:

- Academic Studies Guide (includes study plans for both programmes)
- Course Catalogs for both programmes.

Preliminary assessment and analysis of the peers:
The peers positively noted that the faculty published catalogs with the course/module descriptions for both degree programmes under review on their website in a Serbian and an English version. Hence, the module descriptions are accessible to all students, teaching staff and other interested stakeholders. All modules are tagged with an identification code. The descriptions include information on the number of credit points awarded, the intended learning outcomes, the module content, the teaching methods, the prerequisites for participation and admission to the examination, the forms of assessment, the composition of the module mark and references to recommended literature.

However, the peers also found a number of relevant aspects missing in the module descriptions, and therefore deem it necessary that the module catalogue is revised with regard to the following points of criticism:

- As indicated in Chapter 2.1, the term "module" needs to be applied to appropriate units with regard to the stipulation that a module should be "a sum of teaching and learning whose contents are concerted". In order to transform the course catalog into a module catalog the faculty should consider whether courses with 2 and 3 teaching hours can be aggregated to modules. This seems particularly obvious in case of the combinations of courses that some areas of specialization offer for the elective slots of the curriculum.
- It is not sufficient that the module descriptions indicate the teaching/contact hours. They also have to inform about the necessary amount of time for self-study and, as the combination of both, the total student workload of the module.
- The module descriptions indicate the type of the final exam but not its duration. The duration of the examination needs to be added.
- In the English version, the module descriptions do not name a person responsible for the module but a "teaching professor". The Serbian version seems to make a distinction between the person responsible for the module and the person(s) that may teach within the module. It has to be clarified in all catalogs who is responsible for the design of the module and who is teaching it.
- Currently, the presentation of the courses in the catalog does not follow the order of the curricula but groups courses along dividing lines between the areas of specialisation. The faculty should consider reworking that order, and better regroup the modules along the dividing line between obligatory and elective modules and/or the sequence of the semesters. What is definitely needed in the module descriptions is an indication for which semester the module is offered. An indication of the slot to which an elective module belongs should be added to the provided information either.

The faculty also needs to check the module catalogs for completeness. As an example, the peers could not find a module description for “Fundamentals of Control Engineering” (6th semester, Bachelor programme).

The peers learned that presently the Teaching and Scientific Council revises the Course Catalogs once every year in order to adapt them to changes in the teaching staff, replacing courses that are not taught any more by courses held by new staff members. If rules for this change management have not already been laid down, it should be defined who can change the catalogue, when can it be changed and which committee is overall responsible. For constant supervision of the module catalogue it might also be helpful to appoint a single responsible “module coordinator” who regularly checks the entries for consistency and standardisation, for correctness and timeliness.

Criterion 5.2 Diploma and Diploma Supplement

Evidence:

- Sample Diploma Certificate for both degree programmes
- Sample Diploma Supplement for both degree programmes

Preliminary assessment and analysis of the peers:
The peers found that – based on Article 116 of the Statute of the University of Belgrade – graduates receive a diploma supplement along with the Diploma Certificate. In case of the Faculty of Mechanical Engineering, the Diploma Supplement of the university is accompanied by an Additional Diploma Supplement which “is designed to provide more detailed description of the learning outcomes and syllabi of courses of the mechanical engineering studies successfully completed by the individual named in the diploma and its general supplement.” Altogether, those documents provide information on the student’s qualification profile and individual performance as well as the classification of the degree programme with regard to its applicable education system. In addition to the final mark, statistical data as set forth in the ECTS User’s Guide are included to allow readers to categorise the individual result.

Criterion 5.3 Relevant rules

Evidence:

- Statute of the University of Belgrade
- Statute of the Faculty of Mechanical Engineering
- Rulebook on Teaching at Bachelor Academic Studies
- Rulebook on Teaching at Master Academic Studies

- Rulebook on Taking Exams and Grading Exams
- Rulebook on Student Evaluation of the Pedagogical Work of Teachers and Associates

Preliminary assessment and analysis of the peers:
The peers confirm that the rights and duties of both the university and the students are laid down in the statutes of the university and the faculty as well as in several rulebooks, clearly defined and binding. All rules and regulations are published either on the website of the university or that of the faculty, and hence accessible to all relevant stakeholders.

Nevertheless, the peers noticed that there is obviously no document that sums up all the information for students on how to organise their studies; such information seems to be dispersed over a number of different rulebooks and explanatory booklets. They recommend to consolidate the most important rules on subjects like admission, enrolment, exam organization etc. in a single document for the sake of transparency and in order to be of better use for the students and the faculty.

Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 5:

By providing new versions of the Course Catalogs (accessible on the faculty website), the faculty demonstrates that it started the reworking process upon receipt of the peers' suggestions. The module/course descriptions now include a distinction between the "responsible professor" and the "teaching professor(s)" and indicate the semester for which the course is offered respectively the slot in the curriculum to which it belongs. In addition to the original Course Catalogs sorted according to the areas of specialisation, the faculty offers alternative versions sorted according to the curriculum. The faculty states that it is willing to implement further changes like the revision of the use of the term module or the indication of the total student workload but that this process will take until the beginning of the following academic year due to the necessity to involve bodies on university level. Apart from that, the faculty clarifies that it has defined rules and responsibilities for the decision-making with regard to revisions of the Course Catalogs.

Concerning the peers' recommendation to combine the most important rules in a single document, the faculty immediately responded by providing a "Unified rulebook for students", a compilation of all existing documents considered relevant, on its website. However, the faculty is aware that the peers aim at a more concise document, and therefore proposes to continue working on this document in order to consolidate the rules.

The peers welcome the efforts that the faculty has already made in order to comply with their criticism, and are convinced that it will further pursue the measures outlined in its statement. They acknowledge that their requirements for the Course Catalogs have been

fulfilled to some extent but not entirely. With the respective modifications, they suggest a requirement with regard to the Module/Course Catalogs and a recommendation with regard to the unified rulebook.

6. Quality management: quality assessment and development

Criterion 6 Quality management: quality assessment and development

Evidence:

- Rulebook on Student Evaluation of the Pedagogical Work of Teachers and Associates
- Sample questionnaires and statistics (teaching staff evaluation, graduate survey)
- Statistical Data about the progression of the students
- Presentation on Quality Management System
- Self-Assessment Report
- Discussions with representatives of faculty management, programme coordinators, students and lecturers

Preliminary assessment and analysis of the peers:
As the faculty reports, its quality assurance system is based on the Statute of the Faculty and defined in a document “Rules and procedures for quality assurance”. A Commission for Quality Assurance organises and coordinates evaluation procedures, monitors compliance with quality standards and the implementation of the “Strategy for Quality Assurance”. It comprises teaching and non-teaching staff as well as student representatives. Final decisions on quality issues are taken by the Teaching Assembly of the faculty.

An evaluation of the teaching staff is conducted each year in regular periods during the last two weeks in a semester in which the teaching is being finished for a certain subject. The Commission reports the results of the survey process to the Teaching Assembly. For every evaluated member of the teaching staff, an overall average grade is identified. This grade expresses the opinion of the students about the pedagogical performance of the teacher and will be taken into account when it comes to the election for a certain position within the faculty. The report is passed to the Teaching and Scientific Council of the faculty for discussion and adoption.

Apart from those determined procedures, the teaching staff is generally responsive to direct feedback from the students. According to the students, the faculty also arranges a meeting between the professors and the students in the first year in which issues like a

high number of students failing a certain exam will be discussed and solutions will be sought.

The peers acknowledged that the efforts of the faculty concerning the quality of teaching are encompassed by activities to adjust and strengthen a Quality Management System for the faculty as a whole. A professor from the Department of Industrial Engineering acts as the QMS coordinator who directly reports to the dean. As one of the first faculties in Serbia, the Faculty of Mechanical Engineering has updated its ISO certification to the ISO 9001:2015 standard in October 2018. The activities range from the definition of processes, improvement of documented information and its storage to measurement of performance of teaching and supporting processes.

One example of decision-making based on the results of performance measurement is the way in which the faculty reacted to the finding that the level of high school learning outcomes has deteriorated in recent years: The faculty organised preparatory lectures in Mathematics and Physics before and at the beginning of the study year in order to overcome the missing knowledge in those subjects. In line with an ideal of student-centered learning, they also decided to assign a mentor teacher to groups of ten students who follows their study progress and can offer assistance if necessary.

Linked by the Academy of Engineering Sciences of Serbia, the faculty also participates in the Euro-CASE Engineering Education Platform. On a European level, this network – among other subjects – addresses the problems of the knowing-doing gap in engineering education and of the drop-out rate in engineering study programmes.

The peers gained the impression that both degree programmes are subject to regular internal quality assessment procedures aiming at continuous improvement. Responsibilities and mechanisms are defined and binding, and the students are involved in the quality assurance process not only by surveys but also by participation in the relevant bodies. The peers welcome the recent developments and ongoing activities with the aim of establishing a full-scale quality management system for the faculty. They recommend to use the results of this process for reflection upon the further development of both degree programmes with regard to changes in the social, educational and professional environment.

Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 6:

As the faculty does not comment on this chapter of the report, the peers confirm their preliminary assessment without any changes.

D Additional Documents

No additional documents needed

E Comment of the Higher Education Institution (01.03.2019)

The institution provides a detailed statement and a number of documents to prove that it has already met the peers' criticism and followed the recommendations with regard to some of the criticised aspects:

- Academic Studies Guide (includes study plans for both programmes) – new version of February 2019
- Course Catalogs for both programmes – corrected versions of the catalogs, one sorted by areas of specialisation and one sorted by the position in the curriculum respectively
- Unified rulebook for students

F Summary: Peer recommendations (11.03.2019)

Taking into account the additional information and the comments given by the Faculty of Mechanical Engineering of the University of Belgrade the peers summarize their analysis and **final assessment** for the award of the seals as follows:

Degree Programme	ASIIN seal	Subject-specific labels	Maximum duration of accreditation
Ba Mechanical Engineering	With requirements	EUR-ACE®	30.09.2025
Ma Mechanical Engineering	With requirements	EUR-ACE®	30.09.2025

Requirements

For all degree programmes

A 1. (ASIIN 2.1/5.1) Rework the module catalogue, particularly to apply the term “module” to the appropriate units, to specify the total student workload of each module including self-study time and to indicate the type and duration of exams.

Recommendations

For all degree programmes

E 1. (ASIIN 2.1) It is recommended to improve the opportunities for students to complete a stay at a different higher education institution abroad by defining a mobility window.

E 2. (ASIIN 4.1) It is recommended to develop a concept to align the number of staff to foreseeable future needs in connection with the demographic transition.

E 3. (ASIIN 4.3) It is recommended to address the government for further support to increase budgets for lab equipment, facility operation costs, and international student exchange.

E 4. (ASIIN 5.3) It is recommended to integrate the essential rules of the “Rulebooks on Teaching” and the “Rulebook on Taking and Grading Exams” into one document like the “Academic Studies Guide” for better availability.

E 5. (ASIIN 6) It is recommended to use the results of the developing QM system to reflect upon the further development of the programmes.

For the Bachelor's degree programme

E 6. (ASIIN 2.1) It is recommended to develop the compulsory modules "English 1", "English 2" and "Sociology and Economy" (1st year) into the direction of a subcatalog of elective soft-skill modules that could include other languages, managerial skills or engineering ethics.

E 7. (ASIIN 2.1) It is recommended to ensure that the level of the elective modules is comparable in order to preserve equal opportunities for the admission to the master programme.

G Comment of the Technical Committee 01 – Mechanical and Process Engineering (14.03.2019)

Assessment and analysis for the award of the ASIIN seal:

The Technical Committee discusses the procedure and follows the assessment of the peers. It also agrees with the judgment of the peers that the mere existence of a specialization area "Weapon Systems" and its representation in the elective courses of the study programmes should not be seen as an obstacle for the accreditation.

Assessment and analysis for the award of the EUR-ACE® Label:

The Technical Committee deems that the intended learning outcomes of the degree programmes comply with the engineering specific part of Subject-Specific Criteria of the Technical Committee 01.

The Technical Committee 01 – Mechanical and Process Engineering recommends the award of the seals as follows:

Degree Programme	ASIIN seal	Subject-specific labels	Maximum duration of accreditation
Ba Mechanical Engineering	With requirements	EUR-ACE®	30.09.2025
Ma Mechanical Engineering	With requirements	EUR-ACE®	30.09.2025

Requirements

For all degree programmes

A 1. (ASIIN 2.1/5.1) Rework the module catalogue, particularly to apply the term "module" to the appropriate units, to specify the total student workload of each module including self-study time and to indicate the type and duration of exams.

Recommendations

For all degree programmes

E 1. (ASIIN 2.1) It is recommended to improve the opportunities for students to complete a stay at a different higher education institution abroad by defining a mobility window.

E 2. (ASIIN 4.1) It is recommended to develop a concept to align the number of staff to foreseeable future needs in connection with the demographic transition.

E 3. (ASIIN 4.3) It is recommended to address the government for further support to increase budgets for lab equipment, facility operation costs, and international student exchange.

E 4. (ASIIN 5.3) It is recommended to integrate the essential rules of the "Rulebooks on Teaching" and the "Rulebook on Taking and Grading Exams" into one document like the "Academic Studies Guide" for better availability.

E 5. (ASIIN 6) It is recommended to use the results of the developing QM system to reflect upon the further development of the programmes.

For the Bachelor's degree programme

E 6. (ASIIN 2.1) It is recommended to develop the compulsory modules "English 1", "English 2" and "Sociology and Economy" (1st year) into the direction of a subcatalog of elective soft-skill modules that could include other languages, managerial skills or engineering ethics.

E 7. (ASIIN 2.1) It is recommended to ensure that the level of the elective modules is comparable in order to preserve equal opportunities for the admission to the master programme.

H Decision of the Accreditation Commission (29.03.2019)

Assessment and analysis for the award of the subject-specific ASIIN seal:

The Accreditation Commission agrees with the requirements and recommendations proposed by the peers and the Technical Committee 01.

Assessment and analysis for the award of the EUR-ACE® Label:

The Accreditation Commission deems that the intended learning outcomes of the degree programmes comply with the engineering specific part of Subject-Specific Criteria of the Technical Committee 01.

The Accreditation Commission for Degree Programmes decides to award the following seals:

Degree Programme	ASIIN-seal	Subject-specific label	Maximum duration of accreditation
Ba Mechanical Engineering	With requirements for one year	EUR-ACE	30.09.2025
Ma Mechanical Engineering	With requirements for one year	EUR-ACE	30.09.2025

Requirements

For all degree programmes

A 1. (ASIIN 2.1/5.1) Rework the module catalogue, particularly to apply the term “module” to the appropriate units, to specify the total student workload of each module including self-study time and to indicate the type and duration of exams.

Recommendations

For all degree programmes

E 1. (ASIIN 2.1) It is recommended to improve the opportunities for students to complete a stay at a different higher education institution abroad by defining a mobility window.

E 2. (ASIIN 4.1) It is recommended to develop a concept to align the number of staff to foreseeable future needs in connection with the demographic transition.

E 3. (ASIIN 4.3) It is recommended to address the government for further support to increase budgets for lab equipment, facility operation costs, and international student exchange.

E 4. (ASIIN 5.3) It is recommended to integrate the essential rules of the "Rulebooks on Teaching" and the "Rulebook on Taking and Grading Exams" into one document like the "Academic Studies Guide" for better availability.

E 5. (ASIIN 6) It is recommended to use the results of the developing QM system to reflect upon the further development of the programmes.

For the Bachelor's degree programme

E 6. (ASIIN 2.1) It is recommended to develop the compulsory modules "English 1", "English 2" and "Sociology and Economy" (1st year) into the direction of a subcatalog of elective soft-skill modules that could include other languages, managerial skills or engineering ethics.

E 7. (ASIIN 2.1) It is recommended to ensure that the level of the elective modules is comparable in order to preserve equal opportunities for the admission to the master programme.

I Fulfilment of Requirements (20.03.2020)

Analysis of the peers and the Technical Committee 01 (09.03.2020)

Requirements

For all degree programmes

A 1. (ASIIN 2.1/5.1) Rework the module catalogue, particularly to apply the term "module" to the appropriate units, to specify the total student workload of each module including self-study time and to indicate the type and duration of exams.

Initial Treatment	
Peers	Fulfilled/not completely fulfilled (divided) Justification: The peers acknowledge that the word "module" has been replaced by "specialization (module)" where applicable, preventing confusion, but they note that the time allocated for self-study is not clearly stated in the module descriptions.
TC 01	Not completely fulfilled Justification: The Technical Committee accepts the modified usage of the word "module". The module descriptions have not been adjusted sufficiently, as only the workload in ECTS points and the teaching hours are listed; neither the total number of hours nor the fraction assigned to self-studying is evident. The duration of exams is still not specified.

Decision of the Accreditation Commission (20.03.2020)

The Commission discusses the modifications to the relevant documents. They conclude that the term "module" is now applied in such a way that it is unlikely to cause confusion. While the Commission members agree with the auditors and the Technical Committee in that the module descriptions could be further improved, they conclude that the remaining shortcomings do not warrant upholding the requirement. They therefore decide to extend the award of the seals as follows:

Degree programme	ASIIN-label	Subject-specific label	Accreditation until max.
Ba Mechanical Engineering	All requirements fulfilled*	EUR-ACE®	30.09.2025
Ma Mechanical Engineering	All requirements fulfilled*	EUR-ACE®	30.09.2025

*The Accreditation Commission for Degree Programmes decides to include the following reference into the notifying letter to the HEI:

“It is recommended to explicitly state the time allocated for self-study and the duration of exams in all module descriptions.”

Appendix: Programme Learning Outcomes and Curricula

According to the brochure "Academic Studies Guide" (Edition of November 2018; that brochure is also available as a PDF in a Serbian and an English version on the website of the faculty) the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the Bachelor degree programme Mechanical Engineering:

"Following the EUR-ACE framework standards of engineering programmes, the qualifications which students get when they complete UB-FME BSc studies are:

1. Knowledge and understanding of the scientific and mathematical principles of general mechanical engineering, as well as its key aspects and concepts. Bachelors will have the ability to demonstrate knowledge and understanding of the basics of fundamental and engineering sciences, such as:
    a. Mathematics, including differential and integral calculus, linear algebra, numerical methods, programming and computational tools;
    b. Mechanics, solid and fluid, thermodynamics, as well as physics and measurements;
    c. Material science and strength of materials, with machine elements and manufacturing technology;
    d. Electrical and control engineering;
    e. Elements of general operation of common machines: engines, vehicles, pumps, fans, turbines, tractors, material handling machines, etc. for which courses are elective;

    and ability to further use professional literature and continue studies.
2. Ability of basic engineering analysis by application of their knowledge and understanding to identify, analyse, formulate and solve engineering problems using relevant analytic (mass, energy and thermodynamic balances, efficiency of systems, etc.), empirical and experimental methods.
3. Ability to carry out simple engineering design of machine components to meet defined and specified requirements using knowledge and understanding of design methodologies and computer-aided design tools.
4. Ability to do simple investigations, as to conduct searches of literature, to use data bases and other sources of information, to design and conduct appropriate simple

experiments by being elementary trained in workshop and laboratory skills, to collect and interpret the data and draw conclusions.

5. Basic experience in engineering practice, with the ability to select and use appropriate mechanical equipment, tools and methods; to combine theory and practice to solve engineering problems; to understand of applicability and limitations of certain techniques and methods and to have awareness of the nontechnical implications of engineering practice.
6. Possession of basic transferable skills in order to function as an individual and as a member of a team, to communicate effectively with the engineering community, to have awareness of wider multidisciplinary context of engineering (responsibility, environment, health, safety, social, ethical and legal issues), to demonstrate awareness of project management and business practices."

The following **curriculum** is presented in the same brochure:

<table>
<tr><td rowspan="2">Hours weekly</td><td colspan="2">1st year</td><td colspan="2">2nd year</td><td colspan="2">3rd year</td></tr>
<tr><td>1st semester</td><td>2nd semester</td><td>3rd semester</td><td>4th semester</td><td>5th semester</td><td>6th semester</td></tr>
<tr><td>1</td><td rowspan="5">Mathematics 1</td><td rowspan="5">Mathematics 2</td><td rowspan="5">Mathematics 3</td><td rowspan="5">Thermodynamics B</td><td rowspan="5">Fluid mechanics B</td><td rowspan="5">Electrical engineering</td></tr>
<tr><td>2</td></tr>
<tr><td>3</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td></tr>
<tr><td>6</td><td rowspan="5">Mechanics 1</td><td rowspan="5">Fundamentals of strength of structures</td><td rowspan="5">Mechanics 2</td><td rowspan="5">Mechanics 3</td><td rowspan="5">Numerical methods</td><td rowspan="5">Fundamentals of control engineering</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td><td rowspan="2">Constructive geometry and graphics</td><td rowspan="5">Engineering graphics</td><td rowspan="5">Machine elements 1</td><td rowspan="5">Machine elements 2</td><td rowspan="5">Manufacturing technology</td><td rowspan="5">Elective course 6.3.5</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td rowspan="3">Strength of materials</td></tr>
<tr><td>14</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td rowspan="5">Physics and measurements</td><td>Engineering materials 1</td><td rowspan="5">Engineering materials 2</td><td rowspan="5">Elective course 4.4.5</td><td rowspan="5">Elective course 5.4.5</td><td rowspan="5">Elective course 6.4.5</td></tr>
<tr><td>17</td></tr>
<tr><td>18</td><td rowspan="3">Sociology and Economy</td></tr>
<tr><td>19</td></tr>
<tr><td>20</td></tr>
<tr><td>21</td><td rowspan="2">English 1</td><td rowspan="2">English 2</td><td rowspan="5">Elective course 3.5.5</td><td rowspan="4">Mechanical engineering praxis</td><td rowspan="5">Elective course 5.5.5</td><td rowspan="5">B.Sc. work 6.5.5</td></tr>
<tr><td>22</td></tr>
<tr><td>23</td><td rowspan="3">Programming in C</td><td rowspan="3">Computational tools</td></tr>
<tr><td>24</td></tr>
<tr><td>25</td><td></td></tr>
<tr><td colspan="4"></td><td>Skill praxis B 4.5</td><td colspan="2"></td></tr>
</table>

According to the brochure “Academic Studies Guide” (Edition of November 2018) the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the Master degree programme Mechanical Engineering:

“Following the EUR-ACE framework standards of engineering programmes, the qualifications which students get when they complete UB-FME MSc studies are:

1. Advanced and in-depth knowledge and understanding of the scientific and mathematical principles of mechanical engineering, which supplements the knowledge acquired at the Bachelor academic studies, and provides development of critical thinking and expertise in a certain branch of mechanical engineering (study module). Masters will have the ability to demonstrate in-depth knowledge and understanding of engineering sciences, such as:
    a. Advanced mathematics, ordinary differential equations, advanced numerical methods, programming, computational tools and software engineering;
    b. Advanced mechanics, solid and fluid, as well as thermodynamics and heat transfer;
    c. Mechatronics and automatic control engineering, electronics and measurements;
    d. Advanced machine elements with design procedures of components and systems;
    e. Computer aided design and manufacturing, project management;
    f. Details of operation and design of (elective): Devices in biomedical engineering; Ship structures, resistance, propulsion, equipment; Aerospace machines, with deepening in aerodynamics, elasticity of structures, aircraft design, propulsion and control systems; Product aesthetics, ergo- and eco-designs, decision-making methods; Railway locomotives and cars; Welding structures, structural integrity; Biotechnical (agricultural) systems, tractors, equipment; Industrial (management) methods and organization; IT technologies with optimization techniques; Motor vehicles, gears, brakes and friction systems, equipment; Internal combustion engines, testing, auxiliary systems and equipment; Food industry machines, condition monitoring, manipulating, packaging; Production machines and systems, manufacturing automation, quality management, intelligent systems; Process engineering machines, environment protection, chemical and biochemical reactors, air pollution control and waste treatment; Devices for automatic control, with knowledge of digital and nonlinear systems, object and process dynamics; Weapon systems, missiles, artillery; Steam and gas turbines, boilers and

steam generators, thermal power plants; Material handling machines, constructions, conveying machinery, cranes; Refrigerating, heating and air conditioning systems, heat pumps; Hydraulic machinery, pumps, fans, hydraulic turbines, hydraulic torque converters, fluid energy systems, etc;

and the ability to fulfill requirements for the professional title of Chartered Engineer (as defined by the Engineering Chamber of Serbia), as well as the ability to continue studies further, to a more advanced degree – scientific level of PhD.

2. Ability of advanced engineering analysis by application of their knowledge and understanding to identify, analyse, formulate and solve engineering problems using relevant analytic (mass, energy and thermodynamic balances, efficiency of systems, etc.), empirical and experimental methods.
3. Ability to carry out engineering design of machine components and full systems to meet defined and specified requirements using knowledge and understanding of design methodologies and computer-aided design tools. Masters should be able to propose, design, analyze, and build a mechanical or electromechanical device.
4. Ability to do investigations, as to conduct searches of literature, to use on line libraries and repositories and other sources of information, to design and conduct appropriate experiments to gather data and test theories by being trained in workshop and laboratory skills, to collect and interpret the data and draw conclusions.
5. Experience in engineering practice, with the ability to select and use appropriate mechanical equipment, tools and methods; to combine theory and practice to solve engineering problems; to understand of applicability and limitations of certain techniques and methods and to have awareness of the nontechnical implications of engineering practice.
6. Possession of transferable skills in order to function as an individual and as a member of a team, to communicate effectively with the engineering community in the same-discipline and cross-disciplinary groups with written, oral, and visual means, to have awareness of wider multidisciplinary context of engineering (responsibility, environment, health, safety, social, ethical and legal issues), to demonstrate awareness of project management and business practices, be prepared for a lifetime of continuing education."

The following **curriculum** is presented in the same brochure:

<table>
<tr><td rowspan="2">Hours weekly</td><td colspan="2">1st year</td><td colspan="2">2nd year</td></tr>
<tr><td>1st semester</td><td>2nd semester</td><td>3rd semester</td><td>4th semester</td></tr>
<tr><td>1</td><td rowspan="5">COURSE OF ELECTIVE MODULE 1.1.5</td><td rowspan="5">COURSE OF ELECTIVE MODULE 2.1.5</td><td rowspan="5">COURSE OF ELECTIVE MODULE 3.1.5</td><td>Skill praxis M 4.1</td></tr>
<tr><td>2</td></tr>
<tr><td>3</td></tr>
<tr><td>4</td><td>Optional: Foreign language 4.2</td></tr>
<tr><td>5</td></tr>
<tr><td>6</td><td rowspan="5">COURSE OF ELECTIVE MODULE 1.2.5</td><td rowspan="5">COURSE OF ELECTIVE MODULE 2.2.5</td><td rowspan="5">COURSE OF ELECTIVE MODULE 3.2.5</td><td rowspan="15">M.Sc. thesis 4.3</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td><td rowspan="5">Mechanics M or Fluid mechanics M 1.3.5</td><td rowspan="5">COURSE OF ELECTIVE MODULE 2.3.5</td><td rowspan="5">COURSE OF ELECTIVE MODULE 3.3.5</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td></tr>
<tr><td>14</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td rowspan="5">Thermodynamics M or Mechatronics 1.4.5</td><td rowspan="5">Elective course 2.4.5</td><td rowspan="5">Elective course 3.4.5</td></tr>
<tr><td>17</td></tr>
<tr><td>18</td></tr>
<tr><td>19</td></tr>
<tr><td>20</td></tr>
<tr><td>21</td><td rowspan="5">Elective course 1.5.5</td><td rowspan="5">Elective course 2.5.5</td><td rowspan="5">Elective course 3.5.5</td></tr>
<tr><td>22</td></tr>
<tr><td>23</td></tr>
<tr><td>24</td></tr>
<tr><td>25</td></tr>
</table>

In addition to the general learning outcomes on the level of the programme, the institution has formulated particular learning outcomes for 20 of the areas of specialisation. Those particular learning outcomes are presented in the Self-Assessment Report.