ASIIN Seal & EUR-ACE® Label

Accreditation Report

Bachelor's Degree Programmes

- ***Ba Mechanical Engineering***
- ***Ba Aeronautics & Astronautics***
- ***Ba Materials Engineering***

Provided by

Institut Teknologi Bandung, Indonesia

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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]
Ba Teknik Mesin	Mechanical Engineering	ASIIN, EUR-ACE® Label	National Accreditation Agency for Higher Education in Indonesia (BAN-PT) 23.09.2011 – 23.09.2016	FA 01
Ba Teknik Aeronotika dan Astronotika	Aeronautics & Astronautics	ASIIN, EUR-ACE® Label	National Accreditation Agency for Higher Education in Indonesia (BAN-PT) 27.08.2010 – 27.08.2015	FA 01
Ba Teknik Material	Materials Engineering	ASIIN, EUR-ACE® Label	National Accreditation Agency for Higher Education in Indonesia (BAN-PT) 27.05.2011 – 27.05.2016	FA 01, FA 05
Date of the contract: 15.12.2014 **Submission of the final version of the self-assessment report:** 05.02.2016 **Date of the onsite visit:** 09.-10.03.2016 **at:** Faculty of Mechanical and Aerospace Engineering, Institut Teknologi Bandung, Indonesia				

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

[2] TC: Technical Committee for the following subject areas: TC 01 – Mechanical Engineering/Process Engineering; TC 05 – Physical Technologies, Materials and Processes).

Peer panel: Prof. Dr. Otto Iancu, Hochschule Karlsruhe Prof. Dr. Wolfgang Jaumann, Technische Hochschule Nürnberg Georg Simon Ohm Ms. Aisyah Nur Afianti (student peer), University of Indonesia, Jakarta Prof. Dr. Peter Pscheid, International University Liaison Indonesia-IULI, Bumi Serpong Damai / Indonesia Prof. Dr. Eike Stumpf, Rheinisch Westfälische Technische Hochschule (RWTH) Aachen Dr. Matthias Wunderlich, Robert Bosch Automotive Steering
Representative of the ASIIN headquarter: Dr. Thomas Lichtenberg
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 28.03.2014 Subject-Specific Criteria of Technical Committee 01 – Mechanical Engineering/Process Engineering as of 09.12.2011 Subject-Specific Criteria of Technical Committee 05 – Physical technologies, materials, and processes as of 09.12.2011

In order to facilitate the legibility of this document, only masculine noun forms will be used hereinafter. Any gender-specific terms used in this document apply to both women and men.

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
Ba Mechanical Engineering	B.Sc.		Level 6	Full time	/	8 Semester	144 credit points, equivalent 200 ECTS credit points	Fall Semester / Fall Semester 1941
Ba Aeronautics & Astronautics	B.Sc.		Level 6	Full time	/	8 Semester	144 credit points, equivalent 200 ECTS credit points	Fall Semester / Fall Semester 1991
Ba Material Engineering	B.Sc.		Level 6	Full time	/	8 Semester	144 credit points, equivalent 200 ECTS credit points	Fall Semester / Fall Semester 1994

According to the website (http://www.ftmd.itb.ac.id/?page_id=900&lang=en, Accessed 30.03.2016) the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the Bachelor degree programme Aerospace and Aeronautics (Sarjana Aeronotika dan Astronotika):

To generate graduates who are able to contribute positively to the society of knowledge, professionalism, and development of the nation and are capable of competing on an international level, with the general quality of the following:

- Having the integrity, discipline, mutual respect, fairness, and responsibility.
- Able to apply their knowledge and skills in the various lines of mechanical engineering professions, and being able to adapt to the development of their work environment.
- Able to communicate effectively, work in teams, being creative and innovative, and willing to learn eternally.

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

Graduates Achievement (Outcome)

The expected achievements from the graduates of Aeronautics and Astronautics Program are as follows:

1. An ability to apply knowledge of mathematics, science, basic engineering, aeronautics and astronautics science, and other related knowledge to identify, formulate, and solve problems in designing, manufacturing and operating flying vehicles
2. An ability to design and conduct experiments, as well as to analyze and interpret data
3. An ability to design systems, components, and processes to meet desired needs in aeronautics and astronautics
4. An ability to function effectively in multidisciplinary/multicultural teams
5. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
6. An understanding of professional and ethical responsibility
7. An ability to communicate effectively in both Bahasa Indonesia and English
8. Possessing the broad education necessary to understand the impact of aeronautic and astronautic solutions in the global, economic, environmental, and societal context
9. Recognizing the need for and able to engage in life-long learning
10. Knowledge of contemporary issues
11. An understanding of entrepreneurship and creative processes leading to innovation

According to the website (http://www.ftmd.itb.ac.id/?page_id=896&lang=en, Accessed 30.03.2016) the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the Bachelor degree programme Material Engineering (Sarjana Teknik Material):

To generate graduates who are able to contribute positively to the society of knowledge, professionalism, and development of the nation and are capable of competing on an international level, with the general quality of the following:

- Having the integrity, discipline, mutual respect, fairness, and responsibility.

- Able to apply their knowledge and skills in the various lines of mechanical engineering professions, and being able to adapt to the development of their work environment.
- Able to communicate effectively, work in teams, being creative and innovative, and willing to learn eternally.

Graduates Achievement (Outcome)

The expected achievements from the graduates of Material Engineering Program are as follows:

1. A broad understanding of the impact of engineering solutions on the global, economic, environmental, and societal context
2. Professional ethics and responsibility
3. An ability to apply knowledge of mathematics, sciences, and mechanics in order to identify, formulate and solve materials engineering problems
4. An ability to use the techniques, skills, and modern engineering tools necessary for materials engineering practice, and to design and conduct experiments, as well as to analyze and interpret data
5. An ability to design systems or processes to meet certain requirements in materials engineering and having a spirit of innovation and entrepreneurship
6. An ability to communicate effectively orally and written, both in Bahasa Indonesia and in English
7. An ability to contribute effectively either as an individual or in multidisciplinary and multicultural teams
8. An ability and willingness to conduct life-long learning

According to the website (http://www.ftmd.itb.ac.id/?page_id=889&lang=en, Accessed 30.03.2016) the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the Bachelor degree programme Mechancial Engineering (Sarjana Teknik Mesin):

To generate graduates who are able to contribute positively to the society of knowledge, professionalism, and development of the nation and are capable of competing on an international level, with the general quality of the following:

- Having the integrity, discipline, mutual respect, fairness, and responsibility.

- Able to apply their knowledge and skills in the various lines of mechanical engineering professions, and being able to adapt to the development of their work environment.
- Able to communicate effectively, work in teams, being creative and innovative, and willing to learn eternally.

Graduates Achievement (Outcome)

The expected achievements from the graduates of Mechanical Engineering Program are as follows:

- Being able to apply the knowledge of mathematics, science, engineering machinery and other relevant knowledge fields.
- Having the ability to design and conduct experiments, as well as analysing and interpreting data.
- Capable of designing a component, system, or mechanical process based on a certain design criteria.
- Able to act effectively both as an individual and give their best role in a multidisciplinary group / culture.
- Being able to utilize the methods, skills and modern engineering equipment, which are required for mechanical engineering tasks.
- Being able to identify, formulate and solve the problems of mechanical engineering cases.
- Ethics and professional responsibility.
- Ability to communicate effectively, both orally and in writing, in Indonesian and English.
- Have the will and ability for lifelong learning.
- Have a general understanding of the impact of engineering solutions in a global context, economic, environmental and social.
- Having knowledge of contemporary issues.
- Being able to think creative and innovative, thus being able to apply it.
- Having the knowledge of the basics of entrepreneurship and project management

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:

- Self Assessment Report of the Faculty of Mechanical and Aerospace Engineering, chapter 2.
- Aerospace and Aeronautics (Sarjana Aeronotika dan Astronotika): http://www.ftmd.itb.ac.id/?page_id=900&lang=en, (Accessed 30.03.2016)
- Material Engineering (Sarjana Teknik Material): http://www.ftmd.itb.ac.id/?page_id=896&lang=en, (Accessed 30.03.2016)
- Mechancial Engineering (Sarjana Teknik Mesin): http://www.ftmd.itb.ac.id/?page_id=889&lang=en, (Accessed 30.03.2016)
- Discussion with representatives of ITB management, programme coordinators, lecturers, business representatives, students

Preliminary assessment and analysis of the peers:

During the meeting with the management of ITB the peers were informed that ITB was about to broaden its vision in terms of stronger internationalisation and fostering "Entrepreneurship". The peers took this into consideration throughout the audit mission in order to see how the Faculty of Mechanical and Aerospace Engineering implemented the vision in its degree programmes. The peers examined the websites of the three different Bachelor programmes and could see that the Faculty of Mechanical and Aerospace Engineering of the Institut Teknologi Bandung (ITB) defined the study aims and the intended learning outcomes of the Bachelor programmes under review. However, the peers understood that the defined aims and intended learning outcomes are for Bachelor as well as for Master degree programmes alike. The peers highlighted that the aims and intended learning outcomes must differentiate between the different academic levels. It must be-

[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.

come clear in the learning outcomes that a Master degree programme intends to achieve aims that build on the competences of a Bachelor degree. The peers underlined that the educational objectives/learning outcomes need to describe the subject-specific and professional classification of the qualifications gained in the degree programmes for each programme.

The peers referred to the **Subject-Specific Criteria (SSC)** of the Technical Committee for Mechanical Engineering and Process Engineering as a basis for judging whether the intended learning outcomes of the three Bachelor programmes as defined by ITB correspond to the exemplary constituted learning outcomes of the Technical Committee of Mechanical Engineering. The peers also took note of the Self-Assessment Report (chapter 2.2) which explains the correlation between the learning outcomes as defined in the Subject-specific criteria of ASIIN and the learning outcomes as defined by ITB. The auditors examined the areas of competence as set forth by the *Subject-Specific Criteria* (SSC) for degree programmes and came to the following conclusions:

The peers comprehended that the Bachelor programme Aerospace and Aeronautics wants to achieve that graduates have the ability to apply knowledge of mathematics, science, basic engineering, aeronautics and astronautics science, and other related knowledge to identify, formulate, and solve problems in designing, manufacturing and operating flying vehicles. The peers concluded that this corresponds to the aim to develop a broad and sound knowledge in *mathematics, science and engineering* and identify, formulate and *solve problems* peculiar to aeronautics and astronautics. But as indicated in the previous section, it should be clear that Bachelor programmes focus on a sound and broad basis whereas Master programmes consolidate and deepen this knowledge of mathematic-scientific and engineering principles of mechanical engineering. The same distinction applies to the complexity of problem solving competences. The peers could also see that competences in e*ngineering design* shall be reached as the intended learning outcomes state that students shall be able to design and conduct experiments, as well as to analyze and interpret data and to design systems, components, and processes to meet desired needs in aeronautics and astronautics. Again, the learning outcomes must make clear that the design competences differ according to qualification level that shall be reached. When it comes to *engineering practice*, the competence to assess applicable techniques on the basis of their imminent knowledge and to assess their limits, the peers concluded that the ability to use the techniques, skills, and modern engineering tools necessary for engineering practice as outlined in the learning outcomes should be more programme specific. Furthermore, the peers judged that competences in the field of *investigation and assessment* like the competence to investigate and assess the application of new and emerging technologies in their discipline were missing.

The analysis of the educational aims and intended learning outcomes of the Bachelor programme Material Engineering showed that knowledge of *mathematics, sciences, and mechanics* in order to identify, formulate and solve materials engineering problems shall be attained. However, the peers pointed out that the competences in the field of *engineering analysis* should also indicate that graduates are able to solve problems peculiar to mechanical and material engineering based on the application of established scientific methods. Moreover, students shall acquire the ability to use the techniques, skills, and modern engineering tools necessary for materials engineering practice, and to design and conduct experiments, as well as to analyze and interpret data. The peers acknowledged that competences in the field of *engineering analysis* shall be obtained. When it comes to competences in the field of *engineering design* the learning outcomes state that graduates shall have the ability to design systems or processes to meet certain requirements in materials engineering and having a spirit of innovation and entrepreneurship. The peers judged this as adequate. Like for the Aerospace and Aeronautics programme, the peers underlined that competences in the field of *engineering practice* and *investigation and assessment* should be elaborated in more detail.

The peers concluded for the Bachelor programme Mechanical Engineering that graduates should be able to apply the knowledge of mathematics, science, engineering machinery and other relevant knowledge fields. Furthermore, students shall obtain competences like the ability to identify, formulate and solve the problems of mechanical engineering cases. Like for the Bachelor Material Engineering the peers explained that the competences of *engineering analysis* should be elaborated in more detail. The students shall be capable of designing a component, system, or mechanical process based on a certain design criteria which is in line with competences in the field of *engineering design* as the peers pointed out. The peers also stated that competences in the field of *engineering practice* and *investigation and assessment* need to be outlined in more detail.

Regarding transferrable skills, the peers acknowledged that they had been formulated for all three degree programmes alike and comprised competences like the ability of students to communicate effectively orally and written, both in Bahasa Indonesia and in English and to contribute effectively either as an individual or in multidisciplinary and multicultural teams. Additionally, the peers welcomed that the learning outcomes state that graduates should have the knowledge of the basics of entrepreneurship and project management. This knowledge is fully in accordance with the learning outcomes relevant to level 6 of the European Qualifications Framework for lifelong learning. In summary, the peers confirmed that transferable skills are properly formulated and, except for the indicated limitation, they learning outcomes of the three Bachelor programmes under review correspond to the learning outcomes of level 6 of the European Qualification Framework.

The peers concluded that the subject specific criteria of ASIIN are partly covered in the learning objectives of all three degree programmes under review considering the stated deficiencies. It is particularly important to differentiate the learning outcomes for Bachelor und Master level. The peers summarised that the educational objectives/learning outcomes have to describe the subject-specific and professional classification of the qualifications gained in the degree programmes.

Furthermore, the University applied for the EUR-ACE® (European Accredited Engineer) Label. The EUR-ACE® Label is a quality certificate for engineering degree programmes and is recognized Europe-wide. During the accreditation process, the reviewers verified whether the engineering degree programs comply with the criteria fixed in the EUR-ACE Framework Standards. The Subject-Specific Criteria (SSC) of the Technical Committee for Mechanical Engineering and Process Engineering are closely linked to the EUR-ACE Framework Standards; consequently, the analysis of the Subject-Specific Criteria encompasses the EUR-ACE Framework Standards. The peers confirmed that the EUR-ACE Framework Standards regarding the intended learning outcomes are, considering the shortcomings as indicated in the previous sections, fulfilled for the First (Bachelor) Cycle Degree Programmes in line with the Bologna Declaration.

The peers were explained that a team of lecturers of the respective Department normally develops the objectives and intended learning outcomes of a degree programme. Based on this draft concept of a study programme, the university invites representatives from businesses as well as alumni and conducts two workshops to present and discuss the degree programmes. The feedback from the different stakeholders is being taken into consideration when revising the educational objectives and the intended learning outcomes. The business representatives who participated in a meeting with the peers confirmed that there were meetings between the university and business representatives at least once a year; additionally a number of case to case meetings take place. Finally, the Senate at faculty level has to approve the final version of the degree programmes. The peers acknowledged that relevant stakeholders were included in the process of formulating and further developing the objectives and learning outcomes.

The peers wanted to know if the business representatives employed graduates from ITB and if they thought that graduates were properly prepared for the requirements of the labour market. The business representatives highlighted that ITB graduates were ready to take on demanding work positions. From their point of view ITB graduates were better educated in the field of logical and more abstract thinking than colleagues from other universities. They confirmed that graduate students from ITB have become leaders in technological development, sales and marketing and strategic development of the com-

pany. The peers understood that the intended qualifications profile allows the students to take up an occupation which corresponds to their qualification.

Criterion 1.2 Name of the degree programme

Evidence:

- Aerospace and Aeronautics (Sarjana Aeronotika dan Astronotika): http://www.ftmd.itb.ac.id/?page_id=900&lang=en, (Accessed 30.03.2016)
- Material Engineering (Sarjana Teknik Material): http://www.ftmd.itb.ac.id/?page_id=896&lang=en, (Accessed 30.03.2016)
- Mechancial Engineering (Sarjana Teknik Mesin): http://www.ftmd.itb.ac.id/?page_id=889&lang=en, (Accessed 30.03.2016)

Preliminary assessment and analysis of the peers:

The names of all three degree programmes are published on the subject specific web-page. The auditors confirmed that the name of the degree programmes “Astronautics and Aeronautics”, “Material Engineering”, and “Mechanical Engineering” properly reflects the intended aims and learning outcomes. The programmes are published in English and in Indonesian language. The study programmes are primarily carried out in Indonesian language.

Criterion 1.3 Curriculum

Evidence:

- Self Assessment Report of the Faculty of Mechanical and Aerospace Engineering, chapter 2.5
- Study plans:
    - Aerospace and Aeronautics (Sarjana Aeronotika dan Astronotika): http://www.ftmd.itb.ac.id/?page_id=191&lang=en (Accessed 30.03.2016)
    - Material Engineering (Sarjana Teknik Material): http://www.ftmd.itb.ac.id/?page_id=188&lang=en (Accessed 30.03.2016)
    - Mechancial Engineering (Sarjana Teknik Mesin): http://www.ftmd.itb.ac.id/?page_id=189&lang=en (Accessed 30.03.2016)
- Module descriptions:

  - Aerospace and Aeronautics (Sarjana Aeronotika dan Astronotika): http://www.ftmd.itb.ac.id/wp-content/uploads/2016/03/Appendix-7.2-Module-Handbook-AE-gabung-revisi-6Nov2015.pdf (Accessed 30.03.2016)
  - Material Engineering (Sarjana Teknik Material): http://www.ftmd.itb.ac.id/wp-content/uploads/2016/03/Appendix-xx-Module-Handbook-MT.pdf (Accessed 30.03.2016)
  - Mechancial Engineering (Sarjana Teknik Mesin): http://www.ftmd.itb.ac.id/wp-content/uploads/2016/03/Module-Handbook-New1.pdf (Accessed 30.03.2016)
- Objective-Matrices provided in the Self-Assessment Report, Appendix 5
- Discussions with representatives of ITB management, programme coordinators, lecturers, business representatives, students

Preliminary assessment and analysis of the peers:
On the webpage of the Faculty of Mechanical and Aerospace Engineering all three degree programmes under review are published. The peers welcomed that each subject-specific webpage entails the description of the curriculum and the module handbook.

The curriculum of the three undergraduate programmes comprises 8 semesters and consists of a Common First Year programme of 2 semesters and the subject-specific Bachelor programme of 6 semesters. In the first year, the undergraduate programme students of the Faculty of Mechanical and Aerospace Engineering join the Common First Year programme with the same courses taken. This programme teaches every student the foundations of science and engineering that are used in the consecutive programmes. The courses include mathematic, physics, chemistry, and other basic engineering subjects; additionally, modules like English and Sports are also taught.

As outlined under criterion 1.1, the auditors could see that the intended learning outcomes are reflected with some limitations in the learning outcomes which are in line with the Subject-Specific Criteria (SSC) of the Technical Committee for Mechanical Engineering and Process Engineering. The peers based their assessment, if the curricula of the different degree programmes are designed in a way to achieve the intended learning outcomes on the module descriptions and the module-objective matrix. ITB provided module-objective matrices for each degree programme depicting which module contributes to the fulfilment of which learning outcome; the respective contribution was specified in terms of “high”, “medium” or “low” contribution. The analysis of the peers came to the following conclusions:

Looking at the First Common Year compulsory for all students of the Faculty of Mechanical and Aerospace Engineering, peers confirmed that modules like “Mathematics I and II”, “Elementary Physics I and II”, “Basic Chemistry I and II”, “Introduction to Engineering and Design I and II”, and “Introduction to Mechanical, Material and Aerospace Engineering” were appropriate modules to gain a broad and sound knowledge in mathematics, science and engineering.

When analysing more specifically the curriculum of the Bachelor programme Aerospace and Aeronautics the peers confirmed that modules like “Aircraft Materials and Manufacturing Methods I and II”, “Aerodynamic and Flight Performance Analysis I and II”, or “Aerodynamics I and II” were appropriate to provide proper knowledge in the field of *engineering analysis*. Even though the learning outcomes in the field of engineering analysis had been described in a vague form, the peers confirmed that the curriculum provided convincing modules to achieve respective competences. Competences in the field of *engineering design* shall be obtained in modules like “Analysis and Design of Lightweight Structures I and II” and “Aircraft design” as the peers confirmed.

In the Bachelor programme Material Engineering competences in the field of *engineering analysis* shall be achieved by the students in modules like “Material Characterization I and II”, “Material engineering laboratory I, II and III”, “Manufacturing Processes of Metallic Materials”, “Processing of Ceramic Materials”, “Electronic and Magnetic Materials”, “Composite Materials” or “processing of polymeric materials”. The peers confirmed that these modules were appropriate to achieve competences in the field of engineering analysis even though the respective competences have not been properly outlined in the learning objectives. The peers confirmed that competences in the field of *engineering design* can be acquired in modules like “Computation Methods in Material Engineering”, “Project on Materials Selection and Product Processing Oriented”, “Principle of Material Design” or “Plasticity and Deformation Process”.

The peers analysed the curriculum of the Bachelor degree programme Mechanical Engineering and concluded that modules like “Basic Engineering Analysis”, “Mechanical Drawing + CAD Lab”, “Strength of Materials” or “Kinematics and Dynamics of Machinery” were adequate to teach competences in the field of engineering analysis. For this programme applies the same like for the other two, the respective learning outcomes should be more detailed. The peers confirmed that engineering design was part of modules like “Design of Machine Elements I and II”, “Energy design I and II”, “Energy conversion systems I and II” or “Manufacturing process I and II”.

When it comes to *engineering practice* the peers gained the impression that the situation is similar in all three bachelor programmes. The peers understood that laboratories are

included in a number of modules but it looked to them as if there are only 2 hours of laboratories per module. ITB corrected this and explained that more laboratory work is included in the modules but they are not properly indicated in the module descriptions (compare criterion 5.1). With regard to practical exposure in a real working environment the peers were told that there was an industrial internship or job training of at least one month awarded with one credit point that is required for all students. Additionally, a final project has to be completed by all students covering 5 credit points. Industrial internships of a duration of 5-6 months giving deeper insights in the practical working environment are optional. These internships can be chosen as electives and are awarded with 9 credit points in total. Companies can publish internship opportunities on the website of ITB and students can apply for them. Before the students actually commence with the internship an agreement between the company and ITB has to be signed. The peers could comprehend that there were not sufficient internship places for all students available and that is why ITB offered this as an optional elective. However, given the outdated laboratory equipment (compare criterion 4.3) and the interest of students to get more practical working experiences, the peers strongly recommended providing more opportunities for students to carry out an internship in a company. In summary, the peers concluded that, particularly in the light of the intention of ITB to develop a more entrepreneurial focus, the practical components in the modules are too little. Even if taking into consideration that the laboratory exercises comprise more hours than indicated in the module descriptions the peers underlined that the exact amount of laboratory exercises needs to be made transparent and increased to enhance the practical skills of the students.

Transferable skills are taught, for example, in modules like “Religion and Ethics”. But beside individual modules that teach transferable skills, they are normally integrated in subject specific modules. In the module “Engineering mechanics” the students are given a task and have to fulfil this task in groups of up to five students which contributes to team working competences; the same applies to other design projects where students learn to apply innovative and creative approaches. The students confirmed that they had to take a leading role in group work in turns. The intended learning outcomes of the Bachelor programmes Aerospace and Aeronautics, Mechanical Engineering, and Material Sciences include the goal to teach students the basics of entrepreneurship but the peers were unable to identify in which modules these skills are taught. They expected modules in the field of product management and product costing but could not find anything of this kind in the curriculum. Therefore the peers recommended including more business oriented modules to achieve the intended learning outcomes of the three Bachelor programmes and to fulfil the vision of ITB.

ITB explained that the curriculum of degree programmes is being revised systematically every five years. Minor changes are done when need arises. The key modules normally remain the same for the duration of five years but elective modules can be changed flexibly if particular topics or interests are being brought forward by students, alumni or business partners. When revising the curriculum, stakeholders like business partners and alumni are involved to get their feedback. This will be taken into consideration for the updating of programmes.

Considering the limitations indicated in this section the peers confirmed that the curriculum allows the students to achieve the intended learning outcomes in order to obtain the degree.

Criterion 1.4 Admission requirements

Evidence:

- Ministry of Education Regulation No. 034/2010
- http://usm.itb.ac.id/international/ (Accessed 30.03.2016)
- Self Assessment Report of the Faculty of Mechanical and Aerospace Engineering, chapter 2.4.

Preliminary assessment and analysis of the peers:

The peers learnt that student admission for all faculties and schools within ITB is organized centrally by the Directorate of Education of ITB. ITB uses a nation-wide student admission system which consists of two types: Student admission based on written and skill test and Student admission based on academic performance. Additionally, all state universities have to recruit students with a high academic performance but who have financial difficulties with a proportion of at least 20% of the new students to be admitted to the university. New students do not enter one of the degree programmes directly but they have to follow the First Common Year programme (compare criterion 2.3). At the end of the first year, the students choose a study programme within the Faculty of Mechanical and Aerospace Engineering. They propose three different choices. The faculty places each student in a programme according to a scoring formula based on the grades of the first-year courses. If the capacity of a programme is insufficient, the remaining students are placed at the program of their second or third choice with a similar process. The peers asked the students what they do if they are put into a programme they do not like to study at all. The students explained that for most students the parents take the decision what to study. As they have been educated like this, students tend to follow this cul-

ture. Hence, if somebody is placed in another programme than originally wanted they accept this decision. It has not happened that this leads to severe conflicts. Besides, students can also change the programme later if it turns out that somebody is particularly gifted in a certain subject or that somebody has serious problems with a certain subject. Additionally, students can also change when entering a master programme after graduation. The peers accepted this explanation.

As the whole admission procedure is organised centrally with clear governmentally determined regulations, the peers come to the conviction that the requirements and procedures for admission are transparent and the same for all applicants. Due to the clear admission rules the peers also concluded that the admission requirements are structured in a way that supports the students in achieving the learning outcomes. As the First Common Year is the same for all new students and provides some kind of harmonisation of knowledge the peers comprehended that this secures a more or less homogeneous level of competence before the students proceed to the actual subject specific study programmes.

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

The peers welcomed the confirmation of FMAE that information currently available for all three degree programmes on the website does not clearly distinguish between Bachelor and Master programmes and that the aim and learning outcomes of the programmes will be revised. Until this will have been accomplished the peers confirmed their intended requirement that the educational objectives/learning outcomes have to describe the subject-specific and professional classification of the qualifications gained in the degree programmes. Furthermore, the peers positively noted that FMAE wants to make efforts to provide more opportunities for students to carry out internships in industry and stick to their intended recommendation. The peers properly understood that FMAE students who wish to take entrepreneurial related courses may do so by taking elective courses in the Bachelor Programme of Entrepreneurship, School of Business and Management (SBM). The peers agreed with FMAE that electives in the field of business operations would be sufficient to give students an opportunity to pursue a more business oriented business path. Hence, the peers concluded that this does need to be a compulsory part of the curriculum and refrain from the intended recommendation. However, these elective courses need to be communicated transparently. The peers understood that FMAE intends to revise the intended learning outcomes in close collaboration with respective stakeholders; this revision may also entail amendments in the curriculum like the increase of practical engineering exercises as the peers recommended.

Apart from the above mentioned issues, the peers concluded that this criterion is fulfilled.

2. The degree programme: structures, methods and implementation

Criterion 2.1 Structure and modules

Evidence:

- Self Assessment Report of the Faculty of Mechanical and Aerospace Engineering, chapter 3.1
- Study plans:
    - Aerospace and Aeronautics (Sarjana Aeronotika dan Astronotika): http://www.ftmd.itb.ac.id/?page_id=191&lang=en (Accessed 30.03.2016)
    - Material Engineering (Sarjana Teknik Material): http://www.ftmd.itb.ac.id/?page_id=188&lang=en (Accessed 30.03.2016)
    - Mechancial Engineering (Sarjana Teknik Mesin): http://www.ftmd.itb.ac.id/?page_id=189&lang=en (Accessed 30.03.2016)
- Module descriptions:
    - Aerospace and Aeronautics (Sarjana Aeronotika dan Astronotika): http://www.ftmd.itb.ac.id/wp-content/uploads/2016/03/Appendix-7.2-Module-Handbook-AE-gabung-revisi-6Nov2015.pdf (Accessed 30.03.2016)
    - Material Engineering (Sarjana Teknik Material): http://www.ftmd.itb.ac.id/wp-content/uploads/2016/03/Appendix-xx-Module-Handbook-MT.pdf (Accessed 30.03.2016)
    - Mechancial Engineering (Sarjana Teknik Mesin): http://www.ftmd.itb.ac.id/wp-content/uploads/2016/03/Module-Handbook-New1.pdf (Accessed 30.03.2016)
- Guidelines for Credit Earning and Credit Transfer at Institut Teknologi Bandung
    - http://lp4.itb.ac.id/wp-content/uploads/TERJEMAHAN-SK-CreditTransfer-Final1.pdf (Accessed 30.03.2016).
- Objective-Matrices provided in the Self-Assessment Report, Appendix 5
- Discussions with representatives of ITB management, programme coordinators, lecturers, business representatives, students

Preliminary assessment and analysis of the peers:
The programme structure of the three undergraduate programmes under review is clearly outlined on the subject specific website for each study programme. All degree programmes consist of modules which comprise a sum of teaching and learning. The module descriptions are also published on the subject specific website in English and can be downloaded. Based on the analysis of the sequence of modules and the respective module descriptions the peers concluded that the structure of the degree programmes ensures that the learning outcomes can be reached. The programmes also offer a number of elective courses which allows the students to define an individual focus. Based on the analysis of the curriculum and the module descriptions the peers confirmed that module objectives and the respective content help to reach both the qualification level and the overall intended learning outcomes.

When looking at international exchange programmes ITB explained that the university maintains a number of exchange programmes with many universities; ITB also runs a number of dual degree programmes. As outlined in the Self-Assessment Report the peers could study the list of university co-operations. The programme coordinators added that there are also particular programmes on the level of faculties. The Faculty of Mechanical and Aerospace Engineering, for example, received 17 students from other countries in 2015 and 10 students went to other countries for studying. However, only Master students benefited from these programmes and hardly any undergraduate students could participate in any of these programmes due to the fact that there is hardly any scholarship support for covering living expenses. Even though there is a large interest among undergraduate students there are only very scarce opportunities. The peers understood that ITB was highly dependent on governmental funding because ITB is a state university; that is why ITB should also look for alternative funding sources (e.g. from alumni and industries) to send their students abroad. Hence, the peers recommended improving the (financial) opportunities for students (including alternative funding sources) to complete a period of vocational practice or a stay at a different higher education institution abroad without any prolongation of the studies.

Regarding the recognition of credit points, ITB explained that there exist a number of agreements with specific universities and students could arrange learning agreements with the supervisor to make sure credit points are easily recognized. But even if learning agreements have not been drafted beforehand, students can get credit points accredited if the modules were also part of the curriculum of ITB. This needs to be approved by the supervisor. The peers understood that student mobility was practically taking place and the “Guidelines for Credit Earning and Credit Transfer at Institut Teknologi Bandung” provided a clear regulation of recognition of credit points.

In general, the undergraduate programmes at ITB were designed to be completed within four academic years. The maximum length of study is limited to six years. The peers were explained that the majority of students completed their degree in the given 4 year's time frame and only a minority needed to extend the studies to 6 years. According to ITB this applied to all study programmes. The figures provided in the Self-Assessment Report also proved that only a very small number of students resigned or dropped out. The peers could comprehend that the curriculum was structured in a way to allow students to complete the degree in the regular timeframe.

As outlined under criterion 1.3 in more detail there are mandatory industrial internships foreseen in the curriculum which are accredited. Internships can be carried out as electives and are accredited, too. However, the overall amount of practical working exposure is too small from the peer's point of view and they recommended increasing the opportunities for students to carry out an internship in a company.

Criterion 2.2 Work load and credits

Evidence:

- Self Assessment Report of the Faculty of Mechanical and Aerospace Engineering, chapter 3.2 and APPENDIX 8 WORKLOAD CALCULATION
- Module descriptions:
    - Aerospace and Aeronautics (Sarjana Aeronotika dan Astronotika): http://www.ftmd.itb.ac.id/wp-content/uploads/2016/03/Appendix-7.2-Module-Handbook-AE-gabung-revisi-6Nov2015.pdf (Accessed 30.03.2016)
    - Material Engineering (Sarjana Teknik Material): http://www.ftmd.itb.ac.id/wp-content/uploads/2016/03/Appendix-xx-Module-Handbook-MT.pdf (Accessed 30.03.2016)
    - Mechancial Engineering (Sarjana Teknik Mesin): http://www.ftmd.itb.ac.id/wp-content/uploads/2016/03/Module-Handbook-New1.pdf (Accessed 30.03.2016)
- Discussions with representatives of ITB management, programme coordinators, lecturers, business representatives, students

Preliminary assessment and analysis of the peers:

The programme coordinators explained that ITB uses credit units instead of credit points and 1 credit unit (SKS) is equivalent to 60 hours of workload. Students have to earn 144 credit units in order to earn their bachelor's degree. The normal length of study to

achieve the bachelor's degree is 4 years, or 8 semesters. On average, each student takes 20 credit units per semester and in § 1, Article 1.6 of the "Academic and Student Regulations" it is defined that 1 credit unit for the undergraduate programme is equivalent to 3 hours a week: 1 hour of contact time with teaching staff, 1 hour of structured activities related to lectures, and 1 hour of independent study but this ratio can change according to the activities in a module. For example, for laboratory activities, final projects, and internships, 1 credit unit is equivalent to 3-5 hours a week of independent student study. This is also properly reflected in the module descriptions. The peers understood that the work load comprises both attendance-based learning and self-study which includes all compulsory elements of the degree. The modules descriptions are published on the website and can be accessed by interested stakeholders. The peers positively noted that the module handbook of Aerospace and Aeronautics describes consistently in all modules the credit points and the workload distinguishing between contact time and time of self-study; each credit point corresponds to a workload of 45 hours; the peers noticed one mistake in the module "Mechanics of materials". However, the module handbooks of Mechanical Engineering and Material Engineering have inconsistent ways of calculating the workload in relation to the credit units. This needs to be rectified (compare criterion 5.1).

The students responded to the question if the workload and the credit units were realistic that there were some modules like "Aircraft design" or "Technical drawing" which required far more time than expressed in the credit units; however, the students also admitted that if students have problems in certain modules this was normally caused by their own work ethics. With a few exceptions the workload and the corresponding credit units were realistic; the weekly workload was around 40 to 50 hours as they estimated. Based on the information provided, the peers could not see if there was any systematic approach to verify if the awarded credit units for the modules correspond to the actual workload of the students (e.g. based on results of the teaching evaluation). The peers kindly ask ITB to provide a questionnaire of the teaching evaluation or any other document that provides evidence if the workload and credit unit relation is systematically verified.

Based on the workload calculation (Appendix 8 of the Self Assessment Report) the peers comprehended that for all three degree programmes under review, on average 18 credit units (SKS) are awarded with slight deviations; one semester has 19 and another 17 credit units. The peers saw that structure-related peaks in the work load have been avoided.

Criterion 2.3 Teaching methodology

Evidence:

- Self Assessment Report of the Faculty of Mechanical and Aerospace Engineering, chapter 3.2
- Module descriptions:
    - Aerospace and Aeronautics (Sarjana Aeronotika dan Astronotika): http://www.ftmd.itb.ac.id/wp-content/uploads/2016/03/Appendix-7.2-Module-Handbook-AE-gabung-revisi-6Nov2015.pdf (Accessed 30.03.2016)
    - Material Engineering (Sarjana Teknik Material): http://www.ftmd.itb.ac.id/wp-content/uploads/2016/03/Appendix-xx-Module-Handbook-MT.pdf (Accessed 30.03.2016)
    - Mechancial Engineering (Sarjana Teknik Mesin): http://www.ftmd.itb.ac.id/wp-content/uploads/2016/03/Module-Handbook-New1.pdf (Accessed 30.03.2016)
- Discussions with representatives of ITB management, programme coordinators, lecturers, business representatives, students

Preliminary assessment and analysis of the peers:

The three Bachelor degree programmes at ITB are full-time programmes with classroom, structured, and self-study activities. The lecturers underlined that they apply a student-centered approach with various educational methods, such as lectures, tutorials, laboratory activities, homework assignments, independent study, seminars, field trips, and a final project. The lecturers illustrate the different teaching methods and explain that in design classes, for example, the students have to work on class projects where they are divided into groups of 5 students and apply statistical methods. Or students have to take different positions on critical topics like nuclear power and have to carry out a debate in English; a student jury judges the debate. The lecturers underline that the students are very enthusiastic about these participatory teaching methods and the peers concluded that the teaching methods and instruments used support the students in achieving the learning outcomes. However, the peers critically noted that these different types of teaching methods are not outlined in the module descriptions (compare criterion 5.1).

The peers wanted to know where the students learnt independent academic research and writing. ITB explained that in the “Common First Year” there were several compulsory modules for all students like “Scientific Writing in Indonesian”, “Introduction to Information Technology”, and “Academic Writing (English)”. Furthermore, in the 7th and 8th semester, the curriculum included a final project (also called “research project”), which was a written report related to a topic in the student’s major studies. The project was conducted independently under guidance of a supervisor and consisted of literature study, empirical research (including experimentation/observation), or simulation. The final project report was then defended

orally in front of examiners. The peers confirmed that independent academic research and writing were properly implemented in the curriculum.

As indicated under criterion 2.2 the degree programmes apply a learning approach which includes class attendance as well as time for self-study.

Criterion 2.4 Support and assistance

Evidence:

- Self Assessment Report of the Faculty of Mechanical and Aerospace Engineering, chapter 3.4
- http://www.itb.ac.id/education/ITB_undergraduate_handbook.pdf (Accessed 30.03.2016)
- Discussions with representatives of ITB management, programme coordinators, lecturers, business representatives, students

Preliminary assessment and analysis of the peers:

The peers welcomed the concept of an academic advisor. The programme coordinators explain that as students commence their studies in the Common First Year programme, an academic advisor is appointed for each of them. The academic advisor plays a "parent-like" role, someone who gives advice to students for successful completion of the academic programme. One academic advisor is responsible for supervising about 20 students. Usually, the academic advisor is available for any consultation a student may need, even for problems beyond academic matters. Academic data of the students are monitored and recorded at the university level through the academic information system. At the beginning of each semester, based on the student's prior performance, the academic advisor gives considerations concerning the courses a student should take. The students confirm that the academic advisors normally try to be very supportive to students and if a student's performance is becoming worse or the work ethics of a student is not as it should be, the academic advisors contact the parents or friends to take influence in the respective student. The peers wanted to know if there had ever been conflicts between an academic advisor and a student and how this is being resolved. The students reported that conflicts between students and staff members or the academic advisor hardly occur; one student gave the example that the student wanted to take a specific module which had no prerequisites but the academic advisor recommended not to take this module; the student accepted the decision of the academic advisor. The peers learnt that it was not planned that the academic advisors were exchanged. In case of serious problems or conflicts the student could turn to the Head of Department. According to the students, dis-

agreements were normally settled amicably. The students also explained that tutorials were offered for particularly difficult modules; in some cases the students also organised tutorials themselves.

The peers noticed that an "Undergraduate Handbook" was published on the website which contained a lot of information on additional support services like the "Counselling Center" where students can get consultation about academic or non-academic problems. Depending on the kind of problem, also psychological services were offered. If students felt under severe pressure they could also turn to the Dean. The Agency for Students managed all types of scholarships and provided respective support for students who were eligible. ITB's health centre offered health services for students and faculty members. The ITB Career Development Centre (ITB CDC) maintained an on-line job application and career opportunity information system for all ITB students. ITB also maintained a Language Centre which offers courses for ITB students and staff particularly pre-departure courses like "TOEFL Preparation Courses" and "Courses in English for Specific Purposes" especially in science and technology. The peers confirmed that the webpage of the International Office provided all required information about studies at ITB. Even an online tour through some of the facilities of ITB was offered. The auditors concluded that there were adequate resources available to provide individual assistance, advice and support for all students. The peers underlined that the allocated advice and guidance, namely the academic advisor assisted 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 peers appreciated the indication of FMAE to make efforts to provide more opportunities for students to carry out internships in industry. In addition to this, the peers also recommended to particularly improve the financial opportunities for students to complete a period of vocational practice or a stay at a different higher education institution abroad without any prolongation of the studies. The peers welcomed FMAE's understanding that a certain mechanism is required to verify if the awarded credit units for the modules correspond to the actual workloads of the students and took positively note of the newly developed methodological approach to verify the credit hour and student labour relation. The peers recommended to further test the empirical methods to verify if the awarded credits for the modules correspond with the actual workload of the students. Apart from the above mentioned issues, the peers concluded that this criterion is fulfilled.

3. Exams: System, concept and organisation

Criterion 3 Exams: System, concept and organisation

Evidence:

- Self Assessment Report of the Faculty of Mechanical and Aerospace Engineering, chapter 4
- Module descriptions:
    - Aerospace and Aeronautics (Sarjana Aeronotika dan Astronotika): http://www.ftmd.itb.ac.id/wp-content/uploads/2016/03/Appendix-7.2-Module-Handbook-AE-gabung-revisi-6Nov2015.pdf (Accessed 30.03.2016)
    - Material Engineering (Sarjana Teknik Material): http://www.ftmd.itb.ac.id/wp-content/uploads/2016/03/Appendix-xx-Module-Handbook-MT.pdf (Accessed 30.03.2016)
    - Mechancial Engineering (Sarjana Teknik Mesin): http://www.ftmd.itb.ac.id/wp-content/uploads/2016/03/Module-Handbook-New1.pdf (Accessed 30.03.2016)
- Discussions with representatives of ITB management, programme coordinators, lecturers, business representatives, students

Preliminary assessment and analysis of the peers:

The peers were explained that ITB adopted the concept of multi-component assessments to measure the achievement of course outcomes and thus the programme's learning outcomes. The types of examinations used in each course were determined in the syllabus and the module descriptions of the curriculum. In the module descriptions it was specified that in most modules the overall final grade was composed of the mid-term test, the final examination, quizzes and home work. In principal, the auditors supported this approach of a "continuous assessment" as it offered students continuous feedback on their progress in developing competences. However, the module descriptions are inconsistent in indicating the weighing factor of the different examinations for the final grade. This should be changed in the module descriptions (compare criterion 5.1). As far as the auditors comprehended, the final exam was a comprehensive test covering the content of the entire module. Regarding the type of examination, the peers were unable to understand in the module descriptions the exact type of examination. Based on the discussion with the lecturers and students, the peers understood that presentations and oral examinations were applied in a number of modules but based on the information provided in the module descriptions the peers could only identify the "internship" and the "final project"

where an oral presentation was required. Although the peers took positive note of the active and communicative students during the audit, the peers would like to have an overview of the oral examinations that need to be conducted during the entire undergraduate programme to be able to fully comprehend to which extend oral skills are being developed.

The programme coordinators explained that the ITB Directorate of Education arranges the schedule of examinations. The mid-semester examination is usually held in week 8 or 9, while the end-semester examination takes place during the 2 weeks following completion of the classes. In addition to the publication of the course schedule, the examination dates and times are announced on each undergraduate programme's announcement board. The students confirmed that the examinations were well organised and fully transparent. The peers gained the conviction that exams were marked using transparent criteria. The auditors understood that the deadline for submission of the Final Score List is two weeks after the end of semester examinations to ascertain that no delays hampered the progression of the students. Students have the right to inquire their marked examination, quizzes, and assignments and can ask questions should there be a grading mistake. The lecturers have the obligation to arrange examinations for students who have not taken the examination for a valid reason; for students with disabilities or other limitations compensational measures are agreed on individually.

In all three Bachelor degree programmes students have to finish a final project by conducting research in one of the areas of interest. Each student chooses a prospective supervisor through the Final Project Information System and decides on the research subject for their final project. The objective of the final project is to synthesize the engineering knowledge, apply the scientific method to conduct problem solving and obtain the research objective, and deepen the understanding in the research areas concerned. Each student is under supervision from a faculty staff in the related laboratory. The final project takes 6-12 months to complete, depending on the complexity of the research. The final project report is defended orally in front of a committee. The auditors examined the final theses from the different degree programmes and gained the impression that the quality of the theses was generally of good standard.

ITB added that it was possible that a student carried out the final thesis outside the university. Some lecturers maintained close connections to private businesses and if the supervisor and the student agreed on a topic accepted by the private company the project could be conducted in the company. The first supervisor had to be the staff member from ITB, but the project could also be co-supervised by an expert from outside of the respective undergraduate programme. The peers understood that about 20% of the final theses were written in private companies. Given the fact that ITB wants to foster "entrepreneur-

ship" and support its graduates to have entrepreneurial competences the peers encouraged ITB to generally increase the cooperation with industry and try to increase the number of final theses written at private companies.

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

The peers thank FMAE for the submission of appendix 3 which provides a full list of oral examinations that have to be completed by students in the different Bachelor programmes. Based on this information the peers are convinced that students have to take sufficient oral examinations to develop proper oral skills. Hence, the peers decided to refrain from the intended recommendation. However, the peers underlined that this needs to be transparent in the module descriptions. The peers understood that FMAE maintains good relationships with private businesses and seeks to intensify this collaboration, therefore the peers recommended to further increase the cooperation with industry and the number of final theses written at private companies. Apart from this, the peers confirmed that this criterion is fulfilled.

4. Resources

Criterion 4.1 Staff

Evidence:

- Self Assessment Report of the Faculty of Mechanical and Aerospace Engineering, chapter 3.4
- Staff handbook for all degree programmes under review (Self Assessment Report, Appendix 4)
- Discussions with representatives of ITB management, programme coordinators, lecturers, business representatives, students

Preliminary assessment and analysis of the peers:

ITB provided staff handbooks for all degree programmes. The auditors welcomed that 69 of the permanent faculty members of the Faculty of Mechanical and Aerospace Engineering were PhD holders in related fields from reputable overseas universities (i.e. Japan, Australia, Germany, France, UK, Singapore, USA, etc.). ITB explained that the Indonesian government encouraged the universities to employ staff members holding a doctorate degree. Retired staff members were normally replaced in due time. Recruitment of fac-

ulty members was managed by ITB, based on the necessity of the faculty and available position provided by the government. The minimum qualification of the applicant was a master's degree. Just recently a new regulation for the recruitment of international staff members was published. The ITB management representatives underlined that the number of permanent as well as visiting international staff members or guest lecturers shall be increased in the next five years to achieve a good ratio between national and international staff members. The challenge is, however, that international staff members expect higher salaries; staff members receive an incentive if they offer their lectures in English. In principal, the peers could see that the composition, scientific orientation and qualification of the teaching staff team are suitable for sustaining the degree; however, in the light of the new strategic orientation of ITB to become an entrepreneurial university the peers noticed that most of the present staff members had pursued a purely academic career. The peers welcomed the indication of ITB management to plan to recruit more staff members with industrial experiences to further strengthen the links to the private sector and to expose the students to first-hand information of the business world. The peers encouraged ITB to vigorously implement this plan which would also support the recommendation to have more practical components in the teaching approaches.

The peers understood that staff members have three tasks to fulfil which are education, research and community services. The concept of "community services" means that staff members of ITB conduct minor services for companies or communities which are contracted and remunerated. Regarding the amount of staff members, the peers could comprehend that sufficient resources were available to provide appropriate assistance and advice to students which is also reflected in an appropriate student-lecturer ratio. The auditors referred particularly to the concept of the academic advisors who provide individual support to students. However, when it comes to the technical equipment and the respective technical support staff, the peers saw considerable room for improvement as is being outlined under criterion 4.3.

The research activities at the Faculty of Mechanical and Aerospace Engineering are carried out by research groups. Each research group has specific research topics within the fields of mechanical engineering, aeronautics and astronautics, and materials engineering. In the self-assessment report the Faculty presents a number of main research activities for each degree programme. The lecturers added that research proposals, presentations at international conferences or publications in international journals are awarded with incentives in order to motivate lecturers to get actively involved in research activities. Based on the individual curricula vitae of the staff members the peers could see that most staff members have more or less recent publications in different journals which shows the active research environment of the Faculty. Additionally, the staff members of

the Faculty made it plausible for the auditors that students are actively involved in research activities primarily in terms of final theses; the peers noted that the majority of final projects were implemented at ITB. The peers could see that research and development activities are implemented by the teaching; however, the peers underlined critically that they are concerned that the outdated laboratory equipment might hamper the implementation of advanced research projects.

Criterion 4.2 Staff development

Evidence:

- Self Assessment Report of the Faculty of Mechanical and Aerospace Engineering, chapter 5.2
- http://pmo.itb.ac.id (Accessed 30.03.2016)
- Discussions with representatives of ITB management, programme coordinators, lecturers, business representatives, students

Preliminary assessment and analysis of the peers:
ITB explained that there were several concepts to enhance the didactical competences of staff members. ITB supported academic staff members who hold a master's Degree to continue their study to doctorate level. Faculty members were encouraged to present their research papers in both national and international conferences, and to collaborate with colleagues from leading foreign universities. Additionally, there is a specific division at ITB offering in-house training particularly in relation to human resources development, management and organization. Especially new staff members were required to take short courses in teaching methodology. Hence, the peers could see that ITB offered opportunities to staff members to further develop their professional and teaching skills. However, when asking who actually participated in these offers, the peers learnt that especially older and more experienced staff members indicated that they felt properly prepared for their teaching obligations and saw no need to take part in any of these trainings. The peers underlined that also experienced lecturers would benefit if they got to know new didactical approaches and methods. Hence, the peers recommended encouraging staff members to make use of offers and support mechanisms available for teaching staff and to actively further develop their professional and teaching skills.

Criterion 4.3 Funds and equipment

Evidence:

- Self Assessment Report of the Faculty of Mechanical and Aerospace Engineering, chapter 5.2
- Discussions with representatives of ITB management, programme coordinators, lecturers, business representatives, students

Preliminary assessment and analysis of the peers:
The peers were explained that financial sources for ITB originated from government funding, society funding, and tuition fees. The report provided an overview of the "operational budget" and the "research grants" for the Faculty of Mechanical and Aerospace Engineering. The operational funds were distributed to the Faculties and Schools of ITB based on a specific formula depending on the number of students. The salary for staff members included a basic salary from government and incentives depending on additional efforts of staff members. The peers wondered about the fluctuation of research funds and were told that research funds also come from private businesses and depend on the research cooperation. Hence, the amount fluctuates depending on the additional means received from private businesses. But the management of ITB stressed that even if the contributions from private businesses decreased to zero due to bad economic developments, ITB would still be capable to maintain its operations. Furthermore, ITB management indicated that in the next five years the ratio between undergraduate and graduate / doctoral students shall be changed because there is a growing need of master graduates in industry. At the same time the total number of students shall be considerably increased while the governmental budget of ITB shall also grow by a significant amount. The peers took note of this information and were convinced that the financial means were sufficient and secured for the timeframe of the accreditation.

During the on-site inspection of laboratories and other facilities that should demonstrate the physical resources the panel noted that a lot of the laboratory infrastructure was significantly outdated. In principal, the peers confirmed that even old equipment was appropriate for teaching the principles of engineering. However, the laboratory facilities do not meet the minimum requirements for more advanced engineering applications, so that immediate action should be taken to upgrade the mechanical engineering laboratories. The auditors understood that the upgrading of infrastructure requires a certain timeframe and that is why the peers ask for a conceptual framework (including a timetable of implementation which should be completed until the re-accreditation) indicating how the faculty plans to overcome this shortcoming accompanied by initial steps of implementation. In addition, the peers noted that in some instances appropriate safety equipment was lacking and wondered if safety regulations for each laboratory were in place. The peers kindly request the safety regulations for each laboratory. In addition, the peers un-

derlined the importance to establish the necessary equipment to avoid possible hazards of persons.

The peers were told that ITB had signed a number of cooperation agreements with different international universities; the Self-Assessment Reports provided proof of the existing cooperation. The peers concluded that internal and external cooperation was based on transparent regulations.

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

The peers welcomed the information that in recent years the "Aeronautics and Astronautics Programme" has already recruited two permanent staff members with strong industrial background and the other two programs also intend to take this into consideration in the future staffs recruitment plan. To see the improvements made, the peers maintained their recommendation to increase the number of staff members with industrial experiences. The peers highly appreciated that FMAE has prepared a budgeting plan for the improvement of technical equipment within a 5 year time frame. The budgeting and procurement plans are being developed presently as FMAE indicated. The peers underlined that this concept (including a timetable of implementation) for upgrading and maintaining the mechanical engineering laboratories needs to be made available. The peers noted positively that FMAE intends to encourage both junior and senior staff members to be involved in training activities and kept the respective intended recommendation. Furthermore, the peers were pleased to hear that FMAE will make inventory of the currently available safety equipment and regulation, so that any missing equipment or non-existent regulation can be identified and rectified; until the fulfilment of this indication the peers maintained the respective intended requirement.

5. Transparency and documentation

Criterion 5.1 Module descriptions

Evidence:

- Module descriptions:
    - Aerospace and Aeronautics (Sarjana Aeronotika dan Astronotika): http://www.ftmd.itb.ac.id/wp-content/uploads/2016/03/Appendix-7.2-Module-Handbook-AE-gabung-revisi-6Nov2015.pdf (Accessed 30.03.2016)

- Material Engineering (Sarjana Teknik Material): http://www.ftmd.itb.ac.id/wp-content/uploads/2016/03/Appendix-xx-Module-Handbook-MT.pdf (Accessed 30.03.2016)
- Mechancial Engineering (Sarjana Teknik Mesin): http://www.ftmd.itb.ac.id/wp-content/uploads/2016/03/Module-Handbook-New1.pdf (Accessed 30.03.2016)

Preliminary assessment and analysis of the peers:

The peers positively noted that the full set of modules descriptions is published for every degree programme under review. Hence, the module descriptions are available for all interested stakeholders. The peers examined the module descriptions of all three programmes and noted that the modules have comprehensible names and identification codes, however the responsible module coordinators were missing in most cases. In some cases the lecturers were not mentioned (e.g. “Introduction to Engineering and Design I and II”). If requirements for the successful participation in a module are necessary, this is clearly stated. The work load was properly specified in lectures, tutorials, structured activities and individual study correlated with credit units; additionally, the exact amount of laboratory work also needs to be made transparent. However, the calculation of the working hours and credit units was not consistently applied as outlined under criterion 2.2; the peers underlined that it must be clear how many hours of workload correspond to one credit hour and this must be applied consistently in all modules. The intended leaning outcomes are subdivided into knowledge, skills, and competences which is positively judged by the peers; however, when looking at the learning objectives of the modules in more detail the peers noticed that the learning objectives are described in very generic manner and not really specific to the content of the respective module. The type of examination and the calculation of the overall module mark were outlined, even though not consistently for all modules (e.g. “Transport Phenomena in Materials Engineering”, “Mechanical Drawing + CAD Lab”, “Manufacturing Processes of Metallic Materials”, “Fluid Mechanics” or “Project on Materials Selection and Manufacturing Process” without weighing percentage, etc.). Also a reading list was provided in most module descriptions but not in all (e.g. “Electrical Driving System + Lab”, “System Dynamics”. ITB indicated that e-books were provided in addition and some of the classical literature was still relevant today. The peers critically noted that the different types of teaching methods are not outlined in the module descriptions (compare criterion 2.3). Additionally, mandatory literature (e.g. Textbook) should be mentioned. The peers underlined that the module descriptions must be revised based on the aspects mentioned above.

Criterion 5.2 Diploma and Diploma Supplement

Evidence:

- Certificate of study programme is missing
- Transcript of Records of study programme is missing
- Diploma Supplement is missing

Preliminary assessment and analysis of the peers:
The peers comprehended that after graduation a degree certificate, a transcript of records and a Diploma Supplement are issued. However, none of these documents had been made available to the peers and they request to submit this as additional information.

Statistical data as set forth in the ECTS User's Guide is not included to allow readers to categorise the individual result/degree.

Criterion 5.3 Relevant rules

Evidence:

- Regulations for Academic and Student Affairs Institut Teknologi Bandung, 2014.
    - http://www.as.itb.ac.id/en/images/files/academicregulation2014.pdf (Accessed 30.03.2016)

Preliminary assessment and analysis of the peers:
The peers acknowledged that in the “Academic and Student Regulations” a full section on “Student Ethics” clearly defined the behavioural expectations ITB had towards the students. Furthermore, the section on “Academic Regulations” explained the rights and duties of ITB and students in detail. The auditors could see that all necessary rights and duties of both ITB and students were clearly defined and binding for all relevant stakeholders. The “Academic and Student Regulations” document is published under heading of Peraturan Akademik dan Kemahasiswaan at https://six.akademik.itb.ac.id. However, this site can only be accessed inside campus through intranet as the peers had been told.

The peers understood that the students received all relevant course material in the language of the degree programme including the syllabi at the beginning of each semester. In addition, most information was also available on the intranet accessible for all students.

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

The peers required to revise the module descriptions and to include more specific information about the content, qualification objectives, teaching formats, conditions for the award of credits, workload and duration of each module. The examples provided by FMAE look promising as the peers confirmed; the format should be applied to all modules consistently. The peers gratefully received the requested documents in appendix 2 and confirmed that the certificate and the transcript of records provided all required information about the modules taken and the composition of the final grade. However, the Diploma Supplement seems to be available in Indonesian only. The peers underlined that a Diploma supplement needs to be available in English for all students; they support the indication that statistical graduation data will be made available in the Diploma Supplement for all students.

6. Quality management: quality assessment and development

Criterion 6 Quality management: quality assessment and development

Evidence:

- Self Assessment Report of the Faculty of Mechanical and Aerospace Engineering, chapter 6
- Regulations for Academic and Student Affairs Institut Teknologi Bandung, 2014.
    - http://www.as.itb.ac.id/en/images/files/academicregulation2014.pdf (Accessed 30.03.2016)
- https://karir.itb.ac.id/tracerstudy/ (Accessed 30.03.2016)
- https://karir.itb.ac.id/tracerstudy/report (Accessed 30.03.2016)
- https://karir.itb.ac.id/tracerstudy/uploads/report_prodi/SF%20TS%202014.pdf (access 20.03.2015)
- Discussions with representatives of ITB management, programme coordinators, lecturers, business representatives, students

Preliminary assessment and analysis of the peers:

The auditors were explained that the University applied two types of quality assurance system, namely the Internal Quality Assurance and External Quality Assurance systems. The Internal Quality Assurance encompasses all activities focused on the improvement of

teaching and learning quality within the university. The External Quality Assurance focused on both national and international accreditation. National accreditation is conducted by National Accreditation Agency of Higher Education (NAAHE). ITB maintained a Quality Assurance Unit which was in charge of preparing the guidelines and quality standards for institutional programmes and carry out the respective activities. The auditors had not received a quality assurance policy where ITB provided its understanding of quality and quality assurance and presented the techniques applied to ensure quality. The peers kindly request the quality assurance policy.

In article 5.1 Evaluation of Learning Processes of the "Academic and Student Regulations Quality" it was defined that the evaluation of the students' learning processes should be done at least twice a semester, during the semester and at the end of the semester. The evaluations are implemented both by online and written surveys; students have to submit their evaluation results to obtain their grades which enforces high participation of the students. The peers ask for an example of the questionnaire. ITB staff members reported that they had the feeling that the questions are not always understood by the students. If staff members received bad evaluation results the Head of Department discussed this with the lecturers and possibly encouraged them to take additional didactical training. If the bad performance persisted the Dean would talk to respective lecturer. Students had the right to inquire their marked examination and pose questions. Furthermore, there was also a complaint box available which was used occasionally. The evaluation results were published in a generalized way but not for individual modules. The peers learnt that it was not a custom to discuss the evaluation results with the students; the students cannot really judge if changes take place based on their evaluation. Sometimes they get information about changes from students of the following year. The students explained that they could approach lecturers directly if they were discontent with certain aspects of a lecture and some lecturers changed the lecture according to the recommendation of the student. Even though the peers could see that the results of evaluations were used to further improve the degree programmes, they could not get a full comprehension of the feedback loops in the quality management system and recommended further developing and improving this.

In addition to the student's course evaluations, there was a "fresh graduate survey" just prior to graduation; ITB distributed a standardized questionnaire to the graduating students regarding their educational experience in the programme and their readiness to enter the job market. Furthermore, ITB explained that the university conducted formal tracer studies to alumni who have worked in various fields to reflect their educational experiences in the programme and the impacts to their professional career paths.

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

The peers gratefully confirmed the receipt of appendix 5 the Quality Assurance Policy and, although it is available in Indonesian only, they concluded that ITB has defined its understanding of quality and defined its quality assurance procedures. The peers comprehended that a central quality control unit is responsible for the collection of evaluation data of degree programmes and can develop an action plan in case of severe problems in teaching or tuition. However, the peers underlined that the quality management should not be limited to the degree programmes but should rather be comprehensive and include all structures and processes of the institution. Additionally, the peers recommended implementing a quality management system that does not intervene in case of problems only but that focuses particularly on closed feedback loops and on systematic procedures how actions of improvement are implemented.

D Additional Documents

Before preparing their final assessment, the panel ask that the following missing or unclear information be provided together with the comment of the Higher Education Institution on the previous chapters of this report:

1. Diploma Supplements/Certificates
2. List of mandatory oral assignments of the three Bachelor programmes
3. Questionnaire for lecturer evaluation / evidence that workload-credit unit relation is verified
4. Quality assurance policy / Questionnaire of student evaluation

All documents provided.

E Assessment of the peers

The peers recommend the award of the seals as follows:

Degree Programme	ASIIN-seal	EUR-ACE label	Maximum duration of accreditation
Ba Mechancial engineering	With requierements	With requirements	30.09.2021
Ba Aeronautics & Astronautics	With requirements	With requirements	30.09.2021
Ba Materials Engineering	With requirements	With requirements	30.09.2021

Requirements

A 1. (ASIIN 1.1) The educational objectives/learning outcomes should describe the subject-specific and professional classification of the qualifications gained in the degree programmes.

A 2. (ASIIN 4.3) A concept (including a timetable of implementation) for upgrading and maintaining the mechanical engineering laboratories has to be developed and initial steps to its implementation need to be established.

A 3. (ASIIN 4.3) Safety standards for laboratories and necessary safety equipment need to be established.

A 4. (ASIIN 5.1) Revise the module descriptions so as to include more specific information about the content, qualification objectives, teaching formats, conditions for the award of credits, workload, duration of each module and mandatory literature (e.g. Textbook) (compare respective paragraph in the report).

A 5. (ASIIN 5.2) A Diploma Supplement in English must be made available to all students. Statistical data according to the ECTS-Users‘ guide in addition to the final grade has to be provided.

Recommendations

E 1. (ASIIN 1.3) It is recommended to increase the opportunities for students to carry out an internship in a company.

E 2. (ASIIN 1.3) It is recommended that students have to carry out more practical engineering exercises to enhance their practical skills.

E 3. (ASIIN 2.1) It is recommended to improve the (financial) opportunities for students to complete a period of vocational practice or a stay at a different higher education institution abroad without any prolongation of the studies.

E 4. (ASIIN 2.2) It is recommended to further test the empirical methods to verify if the awarded credits for the modules correspond with the actual workload of the students.

E 5. (ASIIN 3) It is recommended to increase the cooperation with industry and the number of final theses written at private companies.

E 6. (ASIIN 4.1) It is recommended to increase the number of staff members with industrial experiences.

E 7. (ASIIN 4.2) It is recommended to encourage staff members to make use of offers and support mechanisms available for teaching staff to further develop their professional and teaching skills.

E 8. (ASIIN 6) It is recommended further developing the quality management system und particular consideration of closed feedback loops, a systematic analysis of collected evaluation data and to develop systematic procedures how actions of improvement are implemented.

F Assessment of Technical Committee 01 – Mechanical Engineering / Process Engineering (15-06.2016)

Assessment and analysis for the award of the ASIIN seal:

The Technical Committee fully comprehends the requirements and recommendations and sees no need for amendments. The peers accept the suggestions of the peers without changes.

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

The Technical Committee confirms that the intended learning outcomes of the degree programmes do 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	EUR-ACE label	Maximum duration of accreditation
Ba Mechancial engineering	With requierements	With requirements	30.09.2021
Ba Aeronautics & Astronautics	With requirements	With requirements	30.09.2021
Ba Materials Engineering	With requirements	With requirements	30.09.2021

Requirements

A 1. (ASIIN 1.1) The educational objectives/learning outcomes should describe the subject-specific and professional classification of the qualifications gained in the degree programmes.

A 2. (ASIIN 4.3) A concept (including a timetable of implementation) for upgrading and maintaining the mechanical engineering laboratories has to be developed and initial steps to its implementation need to be established.

A 3. (ASIIN 4.3) Safety standards for laboratories and necessary safety equipment need to be established.

A 4. (ASIIN 5.1) Revise the module descriptions so as to include more specific information about the content, qualification objectives, teaching formats, conditions for the award of credits, workload, duration of each module and mandatory literature (e.g. Textbook) (compare respective paragraph in the report).

A 5. (ASIIN 5.2) A Diploma Supplement in English must be made available to all students. Statistical data according to the ECTS-Users‘ guide in addition to the final grade has to be provided.

Recommendations

E 1. (ASIIN 1.3) It is recommended to increase the opportunities for students to carry out an internship in a company.

E 2. (ASIIN 1.3) It is recommended that students have to carry out more practical engineering exercises to enhance their practical skills.

E 3. (ASIIN 2.1) It is recommended to improve the (financial) opportunities for students to complete a period of vocational practice or a stay at a different higher education institution abroad without any prolongation of the studies.

E 4. (ASIIN 2.2) It is recommended to further test the empirical methods to verify if the awarded credits for the modules correspond with the actual workload of the students.

E 5. (ASIIN 3) It is recommended to increase the cooperation with industry and the number of final theses written at private companies.

E 6. (ASIIN 4.1) It is recommended to increase the number of staff members with industrial experiences.

E 7. (ASIIN 4.2) It is recommended to encourage staff members to make use of offers and support mechanisms available for teaching staff to further develop their professional and teaching skills.

E 8. (ASIIN 6) It is recommended further developing the quality management system und particular consideration of closed feedback loops, a systematic analysis of collected evaluation data and to develop systematic procedures how actions of improvement are implemented.

G Final Decision of the Accreditation Commission of ASIIN (01.07.2016)

Assessment and analysis for the award of the ASIIN seal:

The Accreditation Committee discussed the report and made some editorial changes for clarifying the circumstances.

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

The Accreditation Committee confirms that the intended learning outcomes of the degree programmes do comply with the engineering specific part of Subject-Specific Criteria of the Technical Committee 01 and 05.

The Accreditation Committee decided the award of the seals as follows:

Degree Programme	ASIIN-seal	EUR-ACE label	Maximum duration of accreditation
Ba Mechanical Engineering	With requirements	With requirements	30.09.2021
Ba Aeronautics & Astronautics	With requirements	With requirements	30.09.2021
Ba Materials Engineering	With requirements	With requirements	30.09.2021

Requirements

A 1. (ASIIN 1.1) Revise the educational objectives/learning outcomes so as to describe the subject-specific and professional classification of the qualifications gained in the degree programmes.

A 2. (ASIIN 4.3) Provide a concept (including a timetable of implementation) for upgrading and maintaining the mechanical engineering laboratories and prove that initial steps to its implementation have been established.

A 3. (ASIIN 4.3) Establish safety standards for laboratories and necessary safety equipment.

A 4. (ASIIN 5.1) Revise the module descriptions so as to include more specific information about the content, qualification objectives, teaching formats, conditions for

the award of credits, workload, duration of each module and mandatory literature (e.g. Textbook) (compare respective paragraph in the report).

A 5. (ASIIN 5.2) Make available a Diploma Supplement in English to all students. Statistical data according to the ECTS-Users‘ guide in addition to the final grade has to be provided.

Recommendations

E 1. (ASIIN 1.3) It is recommended to increase the opportunities for students to carry out an internship in a company.

E 2. (ASIIN 1.3) It is recommended that students have to carry out more practical engineering exercises to enhance their practical skills.

E 3. (ASIIN 2.1) It is recommended to improve the (financial) opportunities for students to complete a period of vocational practice or a stay at a different higher education institution abroad without any prolongation of the studies.

E 4. (ASIIN 2.2) It is recommended to further test the empirical methods to verify if the awarded credits for the modules correspond with the actual workload of the students.

E 5. (ASIIN 3) It is recommended to extend the cooperation with industry and to increase the number of final theses written at private companies.

E 6. (ASIIN 4.1) It is recommended to increase the number of staff members with industrial experiences.

E 7. (ASIIN 4.2) It is recommended to encourage staff members to make use of offers and support mechanisms available for teaching staff to further develop their professional and teaching skills.

E 8. (ASIIN 6) It is recommended further developing the quality management system under particular consideration of closed feedback loops, a systematic analysis of collected evaluation data and to develop systematic procedures how actions of improvement are implemented.

H Fulfillment of Requirements (30.06.2017)

Requirements

For all degree programmes

A 1. (ASIIN 1.1) Revise the educational objectives/learning outcomes so as to describe the subject-specific and professional classification of the qualifications gained in the degree programmes.

Initial Treatment	
Peers	fulfilled Justification: Much improvement in the description of the learning outcomes has been achieved and the qualification profile for the different degree programmes becomes evident.
TC 01	fulfilled Justification: The peers fully agree with the assessment of the peers and agree that this requirement is fulfilled.

A 2. (ASIIN 4.3) Provide a concept (including a timetable of implementation) for upgrading and maintaining the mechanical engineering laboratories and prove that initial steps to its implementation have been established.

Initial Treatment	
Peers	fulfilled Justification: The technical equipment has been partly improvement. Some items are already purchased and installed. Al lot of additional new laboratory equipment has been ordered, but is not in place yet; however the funding seems to be secured.
TC 01	fulfilled Justification: The peers fully agree with the assessment of the peers and agree that this requirement is fulfilled.

A 3. (ASIIN 4.3) Establish safety standards for laboratories and necessary safety equipment.

Initial Treatment	
Peers	fulfilled Justification: The safety measures have been changed significantly since the on-site-visit. Safety documents have been added and even though they in in Bahasa Indonesian, they seem to be of good quality.

TC 01	fulfilled Justification: The peers fully agree with the assessment of the peers and agree that this requirement is fulfilled.

A 4. (ASIIN 5.1) Revise the module descriptions so as to include more specific information about the content, qualification objectives, teaching formats, conditions for the award of credits, workload, duration of each module and mandatory literature (e.g. Textbook) (compare respective paragraph in the report).

Initial Treatment	
Peers	fulfilled Justification: The module descriptions have been revised and are of acceptable quality now.
TC 01	fulfilled Justification: The peers fully agree with the assessment of the peers and agree that this requirement is fulfilled.

A 5. (ASIIN 5.2) Make available a Diploma Supplement in English to all students. Statistical data according to the ECTS-Users‘ guide in addition to the final grade has to be provided.

Initial Treatment	
Peers	fulfilled Justification: ITB has provided up to standard diploma supplement documents. All required information is included.
TC 01	fulfilled Justification: The peers fully agree with the assessment of the peers and agree that this requirement is fulfilled.

The Accreditation Committee decided the award of the seals as follows:

Degree Programme	**ASIIN-seal**	**EUR-ACE label**	**Maximum duration of accreditation**
Ba Mechanical Engineering	All requirements are fulfilled	All requirements are fulfilled	30.09.2021
Ba Aeronautics & Astronautics	All requirements are fulfilled	All requirements are fulfilled	30.09.2021
Ba Materials Engineering	All requirements are fulfilled	All requirements are fulfilled	30.09.2021

I Learning Objectives and Curricula of the degree programmes

Ba Mechanical Engineering

The Undergraduate Program of Mechanical Engineering (UPMS) develops the body of knowledge based on mechanical engineering science, defined as design, production/manufacturing, and operation of machines. The scope of mechanical engineering can be broadened to include product life cycle analysis, maintenance, and decommissioning/recycling with the use of mechanical engineering science.

The body of knowledge of mechanical engineering science includes: solid mechanics, dynamics and control, design and manufacture, materials engineering, production process and systems, thermal-fluid sciences, and heat transfer. These subjects are delivered either by an analytic or an empirical approach to obtain the intended cognitive level, from understanding to application in the design process.

Mechanical engineering requires basic knowledge of the engineering sciences, such as mathematics, physics, chemistry, and information technology, to support the development of expertise of the bachelor of engineering. Basic engineering science is delivered to obtain the necessary cognitive understanding level. Other knowledge is also provided in order to supply learning outcomes to the students such as: economy engineering and project management, Indonesian language, English language, and entrepreneurship.

In general, the global challenges of an engineer in the present and future can be described as follows:

- Growing complexity and interdisciplinary foundations of engineered systems
- Rapid emergence of new technologies
- Blurring of boundaries between technical disciplines
- Globalization as a principal driving force of change, accompanied by increasing global competition
- Convergence of biology and engineering
- Declining financial support for state colleges and universities, and corresponding emphasis on limiting baccalaureate-level programs to four years
- Prospective students' interests going well beyond perceived boundaries associated with engineering disciplines' traditional roles

The learning outcomes of UPMS are formulated based on the results from discussions in several workshops involving academic staff, stakeholders and alumni. The learning outcomes of UPMS ITB are published and updated on a regular basis. Referring to previous the description, the learning outcomes for graduates from UPMS based on curriculum document Kur2013-S1-MS program are:

a. An ability to apply knowledge of mathematics, sciences, and mechanical engineering sciences, and other relevant knowledge
b. An ability to design and conduct experiments, as well as to analyze and interpret data
c. An ability to design components, systems, or mechanical processes to meet certain design requirements
d. An ability to contribute effectively, either as an individual or as a part of multidisciplinary and multicultural teams
e. An ability to use the techniques, skills, and modern engineering tools necessary for mechanical engineering practice
f. An ability to identify, formulate and solve mechanical engineering problems (addendum from Kur2013-S1-MS)
g. Professional ethics and responsibility
h. An ability to communicate effectively orally and written, both in Bahasa Indonesia and English
i. An ability and willingness to conduct life-long learning
j. A broad understanding of the impact of engineering solutions on the global, economic, environmental, and societal context
k. Knowledge of contemporary issues
l. An ability to think and act creatively and innovatively
m. Knowledge of the basics of entrepreneurship and project management

Each learning outcome should be achieved in order to attain the educational objectives of UPMS. Each point is detailed so that the reachability of each learning outcome becomes more visible. The detailed points are described under 3 points: knowledge, skills, and competences.

Year	Study Groups	Total Credits	Percentages (%)	Codes	Courses	Credits
1	General Study	30	23.26	MA1101	Mathematics IA	4
				FI1102	Elementary Physics IB	3
				KI1102	Basic Chemistry IB	2
				KU1101	Introduction to Engineering and Design I	2
				KU1001	Sports	2
				KU102X	English	2
				KU1072	Introduction to Information Technology B	2
				MA1201	Mathematics IIA	4
				FI1202	Elementary Physics IIB	3
				KI1202	Basic Chemistry IIB	2
				KU1201	Introduction to Design and Engineering II	2
				KU1011	Indonesian Language: Scientific Writing	2
	Introduction to Engineering Study	6	4.65	MS1100	Introduction to Mechanical, Material and Aerospace Engineering	1
				MS1200	Engineering Drawing	2
				MS1210	Statics	3
2	General study: General Scientific Skill	2	1.55	KU206x	Ethics and Religion	2
	Major Studies	34	26.36	MS2100	Basic Engineering Analysis	2
				MS2101	Mechanical Drawing CAD Lab	2
				MS2111	Strength of Materials	3
				MS2112	Kinematics and Dynamics of Machinery	4
				MS2130	Engineering Thermodynamics I	3
				MS2150	Engineering Materials	2
				MS2200	Electrical Drive System Lab	3
				MS2210	System Dynamics	2
				MS2211	Design of Machine Elements I	3
				MS2230	Engineering Thermodynamics II	2
				MS2231	Fluid Mechanics I	3
				MS2250	Structure and Properties of Materials	2
				MS2260	Manufacturing Processes I	3
3	General study: General Scientific Skill	2	1.55	MS3201	Engineering Economics and Management	2
	Major Studies	35	27.13	MS3100	Engineering Measurements	2
				MS3110	Basic Mechanical Vibration	2
				MS3111	Design of Machine Elements II	3
				MS3130	Heat Transfer I	2
				MS3131	Fluid Mechanics II	2
				MS3150	Materials Engineering Laboratory	1
				MS3160	Manufacturing Processes II	2

Year	Study Groups	Total Credits	Percentages (%)	Codes	Courses	Credits
				MS3161	Industrial Metrology and Statistics	4
				MS3200	Numerical Analysis	3
				MS3202	Mechanical Engineering Lab I	1
				MS3203	Introduction to Control Systems	3
				MS3204	Mechatronics I	2
				MS3205	Engineering Design I	3
				MS3230	Heat Transfer II	2
				MS3231	Energy Conversion Systems I	3
4	General study: General Scientific Skill	2	1.55	KU2071	Pancasila and Civics	2
	Major Studies	18	13.95	MS4101	Environmental Aspects in Mechanical Engineering	2
				MS4102	Mechanical Engineering Lab II	1
				MS4103	Maintenance Engineering	3
				MS4104	Mechatronics II	2
				MS4105	Engineering Design II	2
				MS4131	Energy Conversion Systems II	2
				MS4090	Industrial Internship	1
				MS4094	Comprehensive Examination	1
				MS4095	Final Project	4
TOTAL		129	100			129

Ba Aeronautics & Astronautics

The main focus points of the Undergraduate Program of Aeronautics and Astronautics (UPAE) are airframe construction, aerodynamics, flight mechanics, aircraft systems and spacecraft, and transportation systems.
Generally, the strict demands on aircraft require engineering graduates who have the following competences:

- A solid understanding in basic engineering science, including the functions and instruments used
- An extensive and thorough knowledge and understanding in basic engineering science and its application in aerospace engineering
- An extensive and thorough knowledge and understanding in aerospace engineering

1. Basic Science: comprehensive knowledge in basic engineering, including general methods and engineering science tools.

a. Statics and dynamics
b. Solid and fluid mechanics
c. Thermodynamics
d. Electrical theory
e. Chemistry (high school chemistry knowledge is sufficient)
f. Basic method and engineering science tools, i.e. calculus, differential equation, linear algebra, and numerical analysis
g. Informatics

Basic knowledge and tools are general and not related to a particular object. This knowledge is more like "physics and mathematics for engineering graduates". UPAE graduates need additional expertise to apply the above fields to aeronautics and astronautics disciplines.

2. Basic Engineering Science

a. Engineering drawing
b. Material strength
c. Engineering mechanics
d. Materials and manufacturing
e. Design methodology
f. Engineering fluid mechanics
g. Thermal engineering
h. Control theory or system theory

UPAE graduates should be able to apply the above knowledge to "state-of-the-art" problems. Furthermore, they should be able to independently apply their knowledge to new conditions using problem analysis, appropriate model selection, and new model development. Lastly, they should be able to absorb new developments in the field, evaluate their practical use, and apply them when needed.

3. Aerospace Engineering

a. Aircraft aerodynamics
b. Flight performance, stability, and control
c. Propulsion and rocket propulsion
d. Analysis and design of lightweight structures
e. Mechanical vibration
f. Aircraft systems
g. Industrial production, maintenance, and process management

h. Aircraft operation: air traffic control (ATC) and air transport systems
i. Orbit mechanics, space environment, satellite dynamics and attitude control

The learning outcomes of UPAE are formulated based on the results from discussions in several workshops involving academic staff, stakeholders and alumni. The learning outcomes of UPAE are published and updated on a regular basis. The Undergraduate Program in Aeronautics and Astronautics defines the program learning outcomes for graduates as follows:

1. An ability to apply knowledge of mathematics, science, basic engineering, aeronautics and astronautics science, and other related knowledge to identify, formulate, and solve problems in designing, manufacturing and operating flying vehicles
2. An ability to design and conduct experiments, as well as to analyze and interpret data
3. An ability to design systems, components, and processes to meet desired needs in aeronautics and astronautics
4. An ability to function effectively in multidisciplinary/multicultural teams
5. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
6. An understanding of professional and ethical responsibility
7. An ability to communicate effectively in both Bahasa Indonesia and English
8. Possessing the broad education necessary to understand the impact of aeronautic and astronautic solutions in the global, economic, environmental, and societal context
9. Recognizing the need for and able to engage in life-long learning
10. Knowledge of contemporary issues
11. An understanding of entrepreneurship and creative processes leading to innovation

Year	Study Groups	Total Credits	Percentages (%)	Codes	Courses	Credits
1	General Study	30	23.26	MA1101	Mathematics IA	4
				FI1102	Elementary Physics IB	3
				KI1102	Basic Chemistry IB	2
				KU1101	Introduction to Engineering and Design I	2
				KU1001	Sports	2
				KU102X	English	2
				KU1072	Introduction to Information Technology B	2
				MA1201	Mathematics IIA	4
				FI1202	Elementary Physics IIB	3
				KI1202	Basic Chemistry IIB	2
				KU1201	Introduction to Design and Engineering II	2
				KU1011	Indonesian Language: Scientific Writing	2
	Introduction to Engineering Study	6	4.65	MS1100	Introduction to Mechanical, Material and Aerospace Engineering	1
				MS1200	Engineering Drawing	2
				MS1210	Statics	3
2	General study: General Scientific Skill	2	1.55	KU206x	Ethics and Religion	2
	Major Studies	36	27.9	AE2100	Introduction to Aerospace Engineering	2
				AE2101	Engineering Mathematics I	3
				MS2111	Mechanics of Materials	3
				AE2102	Thermal Engineering	4
				AE2103	Kinematics and Dynamics	3
				AE2150	Aircraft Materials and Manufacturing Methods I	3
				AE2200	Engineering Mathematics II	3

Year	Study Groups	Total Credits	Percentages (%)	Codes	Courses	Credits
				AE2201	Statistics	2
				AE2202	Instrumentation, Measurements and Experiments in Aeronautics	3
				AE2210	Fluid Mechanics	3
				AE2211	Aerodynamic and Flight Performance Analysis I	2
				AE2230	Astrodynamics	3
				AE2250	Aircarft Materials and Manufacturing Methods II	2
3	General study: General Scientific Skill	2	1.55	TI40xx	Industrial Management	2
	Major Studies	35	27.13	AE3100	Engineering Analysis and Numerical Methods	3
				AE3110	Aerodynamics I	3
				AE3111	Aerodynamic and Flight Performance Analysis II	3
				AE3140	Mechanical Vibrations	3
				AE3141	Analysis and Design of Lightweight Structures I	3
				AE3180	Aircraft Systems I	3
				AE3210	Aerodynamics II	3
				AE3220	Flight Dynamics	3
				AE3240	Analysis and Design of Lightweight Structures II	3
				AE3270	Air Transportation System	3
				AE3280	Aircraft Propulsion	3
				AE3281	Aircraft Systems II	2
4	General study: General Scientific Skill	2	1.55	KU2071	Pancasila and Civics	2
	Major Studies	16	12.41	AE4100	Aero-Environmental	2
				AE4120	Control Theory	3
				AE4160	Aircraft Design	3
				AE4170	Aircraft Maintenance Engineering	2
				AE4090	Industrial Internship	1
				AE4091	Bachelor Final Project and Comprehensive Examination	5
TOTAL		129	100			129

Ba Materials Engineering

The objective of the Undergraduates Program in Materials Engineering (UPMT) is to produce graduates who are able to contribute positively to academic, professional and public society, both at national and international level, with the following competences:

a. 1 Moral integrity, discipline; respectful, just, and responsible behavior
b. 2 An ability to apply their knowledge and skills in various fields of materials engineering and adapt to their career environment
c. 3 Good leadership, an ability to communicate and work in teams, professional and concerned with social issues

The learning outcomes of UPMT are formulated based on the results from discussions in several workshops involving academic staff, stakeholders and alumni. The learning outcomes of UPMT are published and updated on a regular basis. UPMT defines the learning outcomes (LO) for graduates as follows:

LO 1. A broad understanding of the impact of engineering solutions on the global, economic, environmental, and societal context

LO 2. Professional ethics and responsibility

LO 3. An ability to apply knowledge of mathematics, sciences, and mechanics in order to identify, formulate and solve materials engineering problems

LO 4. An ability to use the techniques, skills, and modern engineering tools necessary for materials engineering practice, and to design and conduct experiments, as well as to analyze and interpret data

LO 5. An ability to design systems or processes to meet certain requirements in materials engineering and having a spirit of innovation and entrepreneurship

LO 6. An ability to communicate effectively orally and written, both in Bahasa Indonesia and in English

LO 7. An ability to contribute effectively either as an individual or in multidisciplinary and multicultural teams

LO 8. An ability and willingness to conduct life-long learning

Year	Study Groups	Total Credits	Percentages (%)	Codes	Courses	Credits
1	General Study	30	21.53	MA1101	Mathematics IA	4
				FI1102	Elementary Physics IB	3
				KI1102	Basic Chemistry IB	2
				KU1101	Introduction to Engineering and Design I	2
				KU1001	Sports	2
				KU102X	English	2
				KU1072	Introduction to Information Technology B	2
				MA1201	Mathematics IIA	4
				FI1202	Elementary Physics IIB	3
				KI1202	Basic Chemistry IIB	2
				KU1201	Introduction to Design and Engineering II	2
				KU1011	Indonesian Language: Scientific Writing	2
	Introduction to Engineering Study	6	4.17	MS1100	Introduction to Mechanical, Material and Aerospace Engineering	1
				MS1200	Engineering Drawing	2
				MS1210	Statics	3
2	General Study: General Scientific Skill	2	1.39	KU2071	Pancasila and Civic Education	2
	Major Studies	33	22.92	MS2100	Basic Engineering Analysis	2
				MT2101	Mechanical Properties of Materials	3

Year	Study Groups	Total Credits	Percentages (%)	Codes	Courses	Credits
				MT2102	Mechanics of Materials	3
				MT2103	Materials Characterization 1	2
				MS2101	Mechanical Drawing + CAD Lab.	2
				KI2142	Physical Chemistry	3
				MS3200	Numerical Analysis	3
				MT2231	Polymer Chemistry	3
				MT2202	Thermodynamics of Materials	3
				MT2203	Materials Characterization 2	2
				MT2224	Ceramic Materials	3
				MT2205	Materials Engineering Practical Laboratory -1	1
				MT2216	Metallic Materials	3
3	General Studies: General Scientific skill	2	1.39	MS3201	Engineering Economics and Management	2
	Major Studies	32	22.22	MT3101	Transport Phenomena in Materials Engineering	3
				MT3132	Polymeric Materials	3
				MT3103	Materials Engineering Practical Laboratory -2	1
				MT3114	Phase Transformation	3
				MT3125	Ceramic Raw Materials	3
				MT3116	Manufacturing Processes of Metallic Materials	3
				MT3221	Ceramics Processing	3
				MT3202	Electronic & Magnetic Materials	3
				MT3203	Materials Engineering Practical Laboratory -3	1
				MT3234	Composite Materials	3
				MT3205	Computation Methods in Materials Engineering	3
				MT3236	Polymer Processing	3
4	General Studies: General Scientific Skill	2	1.39	KU206X	Religion and Ethics	2
	Major Studies	22	15.28	MT4006	Environmental Aspects in Materials Technology	2
				MT4001	Experimental Design	3
				MT4002	Project on Materials Selection and Product Processing Oriented.	3
				MT4003	Materials Technology Seminar	1
				MT4004	Electrochemistry and Corrosion	3
				MT4005	Principle of Materials Design	3
				MT4091	Industrial Internship	2
				MT4092	Final Project	5
	TOTAL	129	90.28			