SURAT KEPUTUSAN REKTOR UNIVERSITAS SAMPOERNA
DECREE OF THE RECTOR OF SAMPOERNA UNIVERSITY

NOMOR: 037-b/R/SK/RO-dm/IX/2022
NUMBER: 037-b/R/SK/RO-dm/IX/2022

TENTANG
CONCERNING

PENGESAHAN KURIKULUM PROGRAM STUDI TEKNIK INDUSTRI
FAKULTAS TEKNIK DAN TEKNOLOGI UNIVERSITAS SAMPOERNA
RATIFICATION OF THE INDUSTRIAL ENGINEERING STUDY PROGRAM CURRICULUM
FACULTY OF ENGINEERING AND TECHNOLOGY SAMPOERNA UNIVERSITY

REKTOR UNIVERSITAS SAMPOERNA,
THE RECTOR OF SAMPOERNA UNIVERSITY,

Menimbang
Considering
:

a. Bahwa dalam rangka mengembangkan kegiatan belajar mengajar dan capaian pembelajaran serta penyelarasan pada pencapaian Visi dan Misi Fakultas Teknik dan Teknologi Universitas Sampoerna sebagai upaya peningkatan mutu akademik, maka dipandang perlu melakukan pembaharuan kurikulum untuk Program Studi Teknik Industri Fakultas Teknik dan Teknologi Universitas Sampoerna;

That in order to develop teaching and learning activities and learning outcomes as well as alignment with the achievement of the Vision and Mission of the Faculty of Engineering and Technology of Sampoerna University as an effort to improve academic quality, it is deemed necessary to update the curriculum for the Industrial Engineering Study Program of the Faculty of Engineering and Technology of Sampoerna University.

b. Bahwa Rapat Senat Universitas Sampoerna pada tanggal 15 September 2022, telah menyetujui kurikulum Program Studi Teknik Industri Fakultas Teknik dan Teknologi Universitas Sampoerna;

That the Sampoerna University Senate Meeting on September 15th, 2022, has approved the curriculum of the Industrial Engineering Study Program, Faculty of Engineering and Technology, Sampoerna University;

c. Bahwa berdasarkan pertimbangan sebagaimana dimaksud pada huruf a dan b perlu ditetapkan Surat Keputusan Rektor.

That based on the considerations as referred to in letter a and b must be stipulated in a Rector's Decree.

Mengingat
In view of : 1. Undang-Undang Nomor 12 Tahun 2012 tentang Pendidikan Tinggi (Lembaran Negara Republik Indonesia Tahun 2012 Nomor 158, Tambahan Lembaran Negara Republik Indonesia Nomor 5336);

Law Number 12 of 2012 on Higher Education (Statute Book of 2012 No. 158, Supplement No. 5336);

2. Peraturan Presiden nomor 8 tahun 2012, tentang Kerangka Kualifikasi Nasional Indonesia (Lembaran Negara Republik Indonesia tahun 2012 Nomor 24);

Presidential Regulation number 8 of 2012, concerning the Indonesian National Qualifications Framework (State Gazette of the Republic of Indonesia of 2012 Number 24);

3. Peraturan Pemerintah Nomor 4 Tahun 2014 tentang Penyelenggaraan Pendidikan Tinggi dan Pengelolaan Perguruan Tinggi (Lembaran Negara Republik Indonesia Tahun 2014 Nomor 16, Tambahan Lembaran Negara Republik Indonesia Nomor 5500);

Government Regulation Number 4 of 2014 on Organization and Governance of Higher Education (Statute Book of 2014 No. 16, Supplement No. 5500);

4. Keputusan Menteri Pendidikan dan Kebudayaan Republik Indonesia Nomor 66/E/O/2013 tanggal 15 Maret 2013 tentang Izin Pendirian Universitas Siswa Bangsa Internasional *juncto* Keputusan Menteri Riset, Teknologi, dan Pendidikan Tinggi Republik Indonesia Nomor 122/KPT/I/2016 tanggal 10 Maret 2016 tentang Perubahan Nama Universitas Siswa Bangsa Internasional di Kota Jakarta Selatan menjadi Universitas Sampoerna di Kota Jakarta Selatan;

Decision of the Minister of National Education and Culture of the Republic of Indonesia Nomor 66/E/O/2013 dated March 15, 2013 on License for Establishing Universitas Siswa Bangsa Internasional juncto Decision of the Minister of Research, Technology, and Higher Education of the Republic of Indonesia Number 122/KPT/I/2016 dated March 10, 2016 concerning the Change of Name of the International Student Nations University in South Jakarta City to Sampoerna University in South Jakarta City;

5. Peraturan Menteri Pendidikan dan Kebudayaan Nomor 3 Tahun 2020 tentang Standar Nasional Pendidikan (Berita Negara Republik Indonesia tahun 2020 nomor 47);

   Regulation of the Minister of Education and Culture Number 3 of 2020 National Standard of Higher Education (State Gazette of the Republic of Indonesia of 2020 Number 47);

6. Pedoman Penyusunan Kurikulum Universitas Sampoerna.

   Curriculum Preparation Guidelines of Sampoerna University.

M E M U T U S K A N:
D E C I D E D

Menetapkan / *To enact* : PENGESAHAN KURIKULUM PADA PROGRAM STUDI TEKNIK INDUSTRI FAKULTAS TEKNIK DAN TEKNOLOGI UNIVERSITAS SAMPOERNA.

THE CURRICULUM RATIFICATION IN INDUSTRIAL ENGINEERING STUDY PROGRAM OF FACULTY OF ENGINEERING AND TECHNOLOGY SAMPOERNA UNIVERSITY.

Kesatu / *Firstly* : Menyetujui pengesahan kurikulum pada Program Studi Teknik Industri Fakultas Teknik dan Teknologi Universitas Sampoerna sebagaimana terlampir dalam Lampiran 1 Surat Keputusan ini.

Approved the curriculum ratification in the Industrial Engineering Study Program at Faculty of Engineering and Technology Sampoerna University as attached in Attachment 1 of this Decree.

Kedua / *Secondly* : Surat Keputusan ini berlaku sejak tanggal ditetapkan. Apabila di kemudian hari terdapat perubahan dan/atau hal-hal yang belum diatur, maka akan dilakukan perbaikan sebagaimana mestinya.

This Decree is valid from the stipulation date. If there are matters that are not provided in this Decree, it shall be added, amended, and stipulated accordingly.

Ditetapkan di Jakarta / *Stipulated in Jakarta*
Pada tanggal 22 September 2022/ *On September 22nd, 2022*

Rektor / *Rector*

Drs. Wahdi Salasi April Yudhi, M.Dev.Admin., Ph.D.
NIDK 8813120016

Tembusan:
Copy:

1. Para Wakil Rektor, Universitas Sampoerna;
   Vice Rectors, Sampoerna University;
2. Para Dekan, Universitas Sampoerna;
   Deans, Sampoerna University;
3. Para Ketua Program Studi, Universitas Sampoerna;
   Heads of Study Programs, Sampoerna University;
4. Para Manajer, Universitas Sampoerna.
   Managers, Sampoerna University.
5. Para Kepala Unit, Universitas Sampoerna.
   Head of Units, Sampoerna University.

Lampiran 1
ATTACHMENT I
SURAT KEPUTUSAN REKTOR UNIVERSITAS SAMPOERNA
DECREE OF THE RECTOR OF UNIVERSITAS SAMPOERNA
NOMOR: 037-b/R/SK/RO-dm/IX/2022
NUMBER: 037-b/R/SK/RO-dm/IX/2022

CURRICULUM DOCUMENT

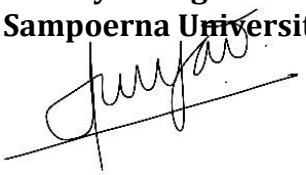
INDUSTRIAL ENGINEERING

SAMPOERNA UNIVERSITY
CURRICULUM TEAM | JAKARTA

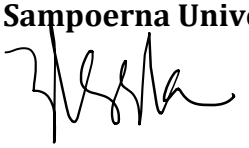
CURRICULUM DOCUMENT

Industrial Engineering Study Program

Team Leader : **Surya Danusaputro Liman, Ph.D.**
NIDK : **8927220021**
Study Program : **Industrial Engineering**
Faculty : **Faculty of Engineering Technology**
University : **Sampoerna University**
Signature :



Team Member : **Tika Endah Lestari, M.Sc.**
NIDN : **0316088902**
Study Program : **Industrial Engineering**
Faculty : **Faculty of Engineering Technology**
University : **Sampoerna University**
Signature :



Team Member : **Sri Susilawati Islam, M.T.**
NIDN : **0925118601**
Study Program : **Industrial Engineering**
Faculty : **Faculty of Engineering Technology**
University **Sampoerna University**
Signature :

Team Member : **Filscha Nurprihatin, M.T.**
NIDN : **0315118802**
Study Program : **Industrial Engineering**
Faculty : **Faculty of Engineering Technology**
University : **Sampoerna University**
Signature :

UNIVERSITAS SAMPOERNA
2022

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FOREWORD

We thank God Almighty because it is by His grace that the team who compiled the Industrial Engineering Study Program curriculum of Sampoerna University have completed their task of evaluating the 2019 curriculum and making updates to the 2022 curriculum.

Evaluation of the 2019 curriculum is carried out by taking into account several important references such as the National Curriculum based on Kerangka Kualifikasi Nasional Indonesia (KKNI) Competency level 6, the 2020 BKS-TI Curriculum, Indonesian Accreditation Board for Engineering Education (IABEE) accreditation criteria for the engineering field, the Independent Learning policy of the Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia, the Industrial Revolution 4.0 trend, as well as aspects of the vision and mission of the University of Sampoerna. In addition, surveys were also conducted using questionnaires and FGD (focus group discussions) via online meetings (Zoom meetings) with stakeholders both internally and externally to obtain inputs which are expected to have a good impact on the development and operation of the study program in the future.

Based on the results of this evaluation, the 2022 Curriculum of the Industrial Engineering Study Program, Sampoerna University, was compiled. The 2022 curriculum is expected to answer the needs and challenges in the digital era where Industrial Engineering graduates are required to contribute positively to the industrial world and society in general.

We, the curriculum team, apologize if in the preparation of this 2022 Curriculum document there are still errors and inconsistencies. We look forward to various constructive criticisms and suggestions for improvements in the future.

Jakarta, 18 April 2022
Team of Industrial Engineering Study Program

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CONTENTS

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IDENTITAS PROGRAM STUDI

1	Nama Perguruan Tinggi (PT)	Universitas Sampoerna
		□ PTN √ PTS
2	Fakultas	Fakultas Teknik dan Teknologi
3	Jurusan/Departemen	Teknik Industri
4	Program Studi	Teknik Industri
5	Status Akreditasi	C (Baik) No SK BAN-PT: 1318/SK/BAN-PT/Akred/S/II/2020
6	Jumlah Mahasiswa	162
7	Jumlah Dosen	6
8	Alamat Prodi	Jl. Raya Pasar Minggu, Kav 16, Jakarta Selatan
9	Telpon	+62-21-5022-2234, Ext:7727
10	Web Prodi/PT	https://www.sampoernauniversity.ac.id/academics/faculty-of-engineering-technology/industrial-engineering/

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1. Curriculum Foundation

The Undergraduate Industrial Engineering Study Program is one of the higher educations in engineering and has an important role in solving complex problems in society. The expertise or competencies that are expected from the graduates are the skills in performing Engineering Design and Analysis, which are needed to solve the complex problems. Included also in the competencies of the graduates are the skills to communicate effectively, to collaborate in teamwork, to uphold ethics, norm, standards, and rules in the society. Industrial Engineering knowledge is supported with a strong foundation from mathematics and basic sciences such as physics and chemistry. The foundation from mathematics and basic science is needed in performing industrial engineering practice in solving complex problems in the society.

The role of Industrial Engineering Graduates in this technological advance era of Industrial Revolution 4.0 becomes increasingly challenged. To improve the Global Competitiveness Index Indonesia (GCII), Indonesian government has announced the 'Roadmap Making Indonesia 4.0', where local industries in automotive, robotics and automation, Internet of Things (IoT), and additive manufacturing are expected to innovate to create superior and efficient products. The graduates of Industrial Engineering are expected to play a key role in realizing these superior and efficient industrial-related products.

In answering the above-mentioned challenges, the Undergraduate Curriculum of Industrial Engineering (IE) Study Program at Sampoerna University (SU) must be evaluated regularly and revised when necessary to ensure the quality of the graduates that can fulfill the demands in the industries and societies. This is the motivation in developing the Curriculum of Undergraduate IE Study Program of SU.

In evaluating and revising the curriculum, below are the rules, laws, and the policy that are used as references:

1. Undang-Undang Republik Indonesia Nomor 14 Tahun 2005 tentang Guru dan Dosen (Lembaran Negara Republik Indonesia Tahun 2005 Nomor 157, Tambahan Lembaran Negara Republik Indonesia Nomor 4586);
2. Undang-Undang Republik Indonesia Nomor 12 Tahun 2012 tentang Pendidikan Tinggi (Lembaran Negara Republik Indonesia Tahun 2012 Nomor 158, Tambahan Lembaran Negara Republik Indonesia Nomor 5336);
3. Peraturan Presiden Republik Indonesia Nomor 8 Tahun 2012, Tentang Kerangka Kualifikasi Nasional Indonesia (KKNI);
4. Peraturan Menteri Pendidikan dan Kebudayaan Republik Indonesia Nomor 73 Tahun 2013, Tentang Penerapan KKNI Bidang Perguruan Tinggi;
5. Peraturan Menteri Pendidikan dan Kebudayaan Republik Indonesia Nomor 3 Tahun 2020, Tentang Standar Nasional Pendidikan Tinggi;
6. Peraturan Menteri Pendidikan dan Kebudayaan Republik Indonesia Nomor 5 Tahun 2020, Tentang Akreditasi Program Studi dan Perguruan Tinggi;

7. Peraturan Menteri Pendidikan dan Kebudayaan Republik Indonesia Nomor 7 Tahun 2020, Tentang Pendirian, Perubahan, Pembubaran PTN, dan Pendirian, Perubahan, Pencabutan Izin PTS;
8. Peraturan Menteri Pendidikan dan Kebudayaan Republik Indonesia Nomor 81 Tahun 2014, Tentang Ijazah, Sertifikat Kompetensi, Dan Sertifikat Profesi Pendidikan Tinggi;
9. Peraturan Menteri Riset, Teknologi, dan Pendidikan Tinggi Republik Indonesia

To develop the substantial aspect of the curriculum, the following references are used:

1. Core curriculum developed by Badan Kerja Sama Teknik Industri (BKS-TI) tahun 2020.
2. General criteria and field of knowledge criteria from Indonesian Accreditation Board for Engineering Education (IABEE).
3. Bloom Taxonomy.
4. Curriculum 2019 of Undergraduate Study Program of Industrial Engineering, Faculty of Engineering Technology (FET), Sampoerna University (SU).
5. Input and suggestions from teaching staff in IE Study Program, FET, SU.
6. Input and suggestions from advisory board: Industrial Advisory Board, academics, students, and alumni.
7. Benchmarking with local and international universities.
8. Panduan Penyusunan Kurikulum Pendidikan Tinggi di era Industri 4.0 untuk mendukung Merdeka Belajar-Kampus Merdeka, Direktorat Jenderal Pendidikan Tinggi Kementerian Pendidikan dan Kebudayaan, 2020.
9. Buku Panduan Merdeka Belajar-Kampus Merdeka 2020, Direktorat Jenderal Pendidikan Tinggi Kementerian Pendidikan dan Kebudayaan, 2020.

Based on the above consideration, the 2022 Curriculum of IE Study Program of SU is designed to create superior graduates that can compete globally. The graduates are emphasized to have superior core industrial engineering skills, moral integrity, ethics, teamwork, and leadership, and the initiative to conduct lifelong learning to continuously innovate and create useful products for the society.

2. Vision, Mission, Purpose, and Strategy of Study Program

2.1. Vision

University's Vision	Faculty's Vision	Study Program's Scientific Vision
Sampoerna University aspires to foster future leaders with strong moral character and internationally competitive skills sets, enabling them to actively participate in building a more prosperous, equitable, respected, and globally competitive Indonesia.	The Faculty of Engineering and Technology at Sampoerna University aspires to become a faculty that is internationally competitive in the field of engineering and technology by 2030 whose graduates are highly sought after by industries, are entrepreneur minded, are socially responsible, and are competent to pursue advanced degrees.	The Industrial Engineering Study Program at Sampoerna University's Faculty of Engineering and Technology aims to be internationally competitive by 2030, producing graduates who are highly sought after by industries, possess entrepreneurial mindsets, exhibit social responsibility, are prepared for advanced degrees, and have the capability to design, analyze, implement, and improve integrated systems of people, materials, machines, and information.

2.2. Mission

University's Mission	Faculty's Mission	Study Program's Mission
Sampoerna University aims to provide students affordable access to education that meets the highest international standards. Sampoerna University offers a curriculum unique in Indonesia built around an American general education core, successfully preparing students for credential completion at Sampoerna University or for recognized transfer abroad. We also provide a full spectrum of co-curricular and pre-professional opportunities that ensure student success,	The Faculty of Engineering and Technology at Sampoerna University strives • To provide an education in engineering and technology having international standards, built around an American general education core, that prepares its graduates as highly competent, entrepreneur minded, and socially responsible leaders; and are committed to giving back to Indonesia and society.	The Industrial Engineering Study Program of the Faculty of Engineering and Technology at Sampoerna University strives • To provide Industrial Engineering curriculum that meets the needs of industries and contributes to the wellbeing of society and the nation. • To engage in innovative research in Industrial Engineering. • To instill leadership and entrepreneurship characteristics in our graduates.

preparing leaders for a global society.	• To conduct innovative research in the field of engineering and technology for the benefits of humankind.	• To impart high ethical standards and social awareness in our graduates.

2.3. Purpose

University's Purpose	Study Program's Purpose
Sampoerna University aims to provide students affordable access to education that meets the highest international standards.	1. To produce high quality industrial engineering graduates which have high competitiveness to become leaders upholding ethics and integrity. **2.** To produce industrial engineering graduates who have international insights and are able to communicate and compete internationally. **3.** To produce applied research and scientific work which contribute to the development of industrial engineering knowledge, science and technology, business, and academic society nationally, regionally, and internationally. **4.** To produce industrial engineering graduates who have responsibility in the development of the national economy to improve life by the program of society service.

2.4. Strategy

University's Strategy	Study Program's Strategy
Sampoerna University employs four pillars: 1. **Reimagine and maintain our core curriculum**. This is done to identify skills and competencies of graduates and to review and strengthen Sampoerna University's core curriculum.	To ensure graduates of IE Study Program upholding Sampoerna University's values (see section 2.5), the graduate profiles of IE Study Program are first derived by considering university's values. These graduate profiles are then derived into PLO (Program Learning Outcomes), Body of Knowledge, Courses, and Subject Learning Outcome.

2. **Create an Institution of and for our students**. This is done by recruiting and preparing qualified students to enroll and succeed in Sampoerna University, also to engage students in university governance, policy development, and external relations. 3. **Build toward the future of Indonesia**. This is done to develop students' capacity to contribute to the nation. 4. **Provide a model of tomorrow's university today**. This is to ensure affordability and access to education that increases in value.	In focusing on the American style general education, IE Study Program adopts General Education Sampoerna University Core Curriculum. Meanwhile IE Study Program adopts the guidance from IABEE in developing its curriculum. In ensuring the achievement of the graduate profiles, IE Study Program measures the learning outcome for each course and develops assessments to measure the achievement of the learning outcomes.

2.5. University Value

Sampoerna University strives to produce graduates with a strong moral character and has sufficient skill sets to contribute to the nation. Sampoerna University values the contribution or giving to the nation as the highest goal in all aspects. Historically, Putera Sampoerna Foundation, which owns Sampoerna University, has had a strong responsibility in contributing to the nation and this is shown greatly in the vision and mission of the university. In supporting this value, IE Study Program strives to equip the graduates with competitive skill sets and strong moral character to be able to contribute to the nation.

In general, following are the values that are instilled to the graduates of Sampoerna University:

1. Integrity → Accountability, intellectual integrity, and respect for human values and social ethics.
2. Growth → Intellectually curious to expand their competencies and courageously take initiative, sharing expertise as responsible leaders in the community.
3. Knowledge → Authoritative and internationally articulate in their field, while continuing to be at the forefront of expanding knowledge, especially in modern science and technology.
4. Inspiration → Able to inspire individuals and communities through effective communication, critical thinking and problem solving.
5. Tenacity → Determined and persistent in achieving goals.
6. Empowerment → Has entrepreneurial spirit and be creative in achieving outcomes.

These values are taught by focusing on an American-style general education which is a distinctive value of academic programs at Sampoerna University. By referring to these values and the distinctive American-style general education, IE Study Program then developed the 2022 Curriculum.

3. Curriculum Evaluation & Tracer Study

3.1. Curriculum Evaluation

The curriculum was evaluated to include the needs of graduate users such as the industries that have not been covered in the previous curriculum, learning process, research, and the society service at the faculty level. Usually, the change in the curriculum is expected to take place once every five years if there are fundamental changes related to the graduate competencies. However, the curriculum review of IE Study Program is expected to be done once every two years.

The 2022 Curriculum is the result of evaluation to the 2019 Curriculum. The review of the 2019 Curriculum is done because of the requirement to obtain IABEE accreditation that employs outcome-based education (OBE). The followings are the steps in evaluating the curriculum in IE Study Program of Sampoerna University:

1. The Dean of Faculty of Engineering and Technology issues a Dean's decree to form the Curriculum Development team in each study program.
2. The Head of Study Program holds evaluation meetings on the ongoing curriculum with all the teaching staff in the study program.
3. The Head of Study Program forms the schedule and the curriculum development team.
4. The Head of Study Program with the curriculum development team develop the curriculum framework which refers to: (i) discussion meeting with teaching staffs, (ii) recent trends in science, technology, and information, (iii) government's law, (iv) vision and mission of the university, faculty, and study program, (v) graduates' user, (vi) stakeholders' opinion (Academia, Industrial Advisor Board, Students, Alumni), and (vii) benchmarking with related universities.
5. The Head of Study Program holds meetings on the curriculum concepts by inviting all stakeholders, i.e., permanent lecturers, non-permanent lecturers, practitioners, and graduates' users to obtain input.
6. The Head of Study Program improves the curriculum based on input from several stakeholders and prepares the presentation.
7. The curriculum is presented at the faculty and university level to obtain the approval from the Vice Rector of Academic Affairs.
8. The Head of Study Program finalizes the concept of the curriculum to be the document that is ready to be validated.
9. The Dean of FET submitted a letter to the Vice Rector of Academic Affairs to validate the curriculum.
10. The curriculum is then submitted to the University Senate for approval. After approval, the Rector signs the decree acknowledging the new curriculum.
11. Once the curriculum is validated, the curriculum is socialized to all lecturers and students.
12. The new curriculum is implemented.

In evaluating the curriculum of the IE Study Program, the flowchart shown in Figure 1 is used as a reference. In the flowchart, the curriculum development starts from the definition of the Graduate Profile (GP). The GP is formulated based on the market needs

considering the university's vision. In detail, following are the mechanism in evaluating the 2022 Curriculum at the study program:

1. The market needs of industrial engineering graduates are evaluated by getting the inputs from the IAB (Industrial Advisory Board) of the study program. These inputs are then made as a reference to evaluate the GP of the study program. The GP is also evaluated and developed by considering the university's vision. In addition, the inputs from the alumni and the current students are also considered. The meetings with the alumni were performed online. Meanwhile, surveys were carried out to the current students to obtain their inputs on the strengths and weaknesses of the current courses.
2. After the GP is evaluated, the PLOs (Program Learning Outcomes) are evaluated. The PLOs are defined as the outcomes necessary to be achieved so that graduates have the characteristics of the GP. Benchmarking with other universities was also performed to evaluate the PLOs. The PLOs is finalized with a curriculum team meeting with the Head of Study Program.
3. After PLOs' evaluation, mapping of PLOs to the courses are done. This evaluation is done by technical meeting of teaching staff in the study program by considering rules from the university pertaining courses.
4. The next step is to evaluate the SLO (Subject Learning Outcome). This is the outcome setting for each course which must refer to the PLOs related to the course. To bridge the PLO and SLO, we define PI (Performance Indicator) for each PLO which is developed from Bloom's Taxonomy. Basically, PI divides its PLO into several steps of outcome.
5. The SLO is one of the contents in the Syllabus (RPS). The RPS explains about the outcome expected from the course and the learning plan in one semester. The RPS for all courses are then evaluated thoroughly to conform to the newly defined PLOs and SLOs.
6. The last step is to develop the operational guidance for MBKM (Merdeka Belajar Kampus Merdeka).

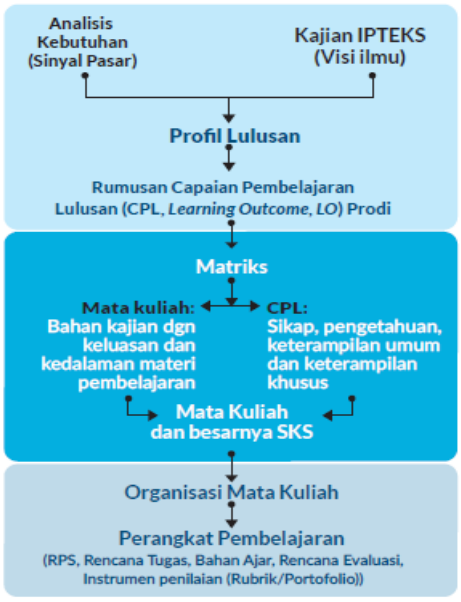

Figure 1. Flowchart of the curriculum development

Following is the summary of changes/evaluations done to the curriculum of IE Study Program of SU:

1. Graduate Profiles in the 2022 Curriculum adopt the concept of career line as the GP, for example engineer, researcher, etc. Based on the input from IAB, this is too restricting and thus needs many GP to be listed. The reason is that the graduates from IE Study Program can contribute in many ways in society, not just as an engineer or research engineer. The 2022 curriculum does not state the career line anymore as the GP, but it states only the characteristics of the graduates. These characteristics include the hard skill (key profile of IE graduates) and soft skill to support the graduates in contributing to the society.
2. There are 45 PLOs in the 2022 Curriculum, which are not that easy to measure, especially with the IABEE's standard. The 2022 Curriculum adopts the PLOs recommended by ABET with only 7 PLOs.
3. The mapping from PLOs to the courses are changed drastically. In 2022 Curriculum mapping, the soft skills are mapped only to some core courses in IE. Meanwhile, in 2022 Curriculum mapping, all core IE courses have soft skills in addition to the IE hard skills as the learning outcome. The 2022 Curriculum mapping is more focused than the previous one.
4. The SLOs for each course are defined based on the related PI. These SLOs are more compact and more focused than the SLOs in the previous curriculum. The SLOs are set so that it is measurable.
5. The RPS is reviewed and redeveloped based on the defined SLOs. These change some of the assignments in the course.
6. The implementation of MBKM is included in the 2022 Curriculum.

3.2. Tracer Study

IE Study Program has prepared the necessary instrument for the graduates' tracer study which is integrated with the university. The instrument is a questionnaire handled by SAA (Student and Alumni Affairs) of Sampoerna University. There are two types of questionnaires. The first type of questionnaire is distributed to the Alumni to obtain feedback for the study program whether the Alumni thinks that they have achieved the Program Learning Outcomes (PLOs). The second type of questionnaire is distributed to the graduates' user (companies where our graduates work), essentially to obtain feedback whether the Alumni have achieved the specified PLOs. The second type of questionnaire is also used to gather information from the graduates' user about the skills needed by the graduates in the working field. The Tracer Study is prepared in preparation for the first graduates in Academic Year 2021/2022, even though the IE Study Program does not have any graduates yet.

IE Study Program strives to improve the performance and quality of the study program to produce graduates with skills that are needed by the industry and the society and able to compete globally. IE Study Program is also directing the graduates to open their own startup company to open employment opportunities for the society.

The first type of questionnaire is given in **Table 1**. The questionnaire asks the graduates whether they have the listed skill set on the left-most column. The skill set is

straightforwardly taken from the Performance Indicator (see chapter 4) which directs to the PLOs. An example is given to make the skill set easy to understand. The second type of questionnaire is shown in **Table 2**. This questionnaire is given to the graduates' user (companies where our graduates work); thus, it can validate the opinion from the Alumni, especially those who directly work under the same structure in the company.

Tabel 1. Questionnaire to be Distributed to IE Graduates.

Skill set	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The ability to *explain* principles of Mathematics (Calculus & Mathematical Foundation of IE). Example: can you explain how to estimate the maxima and minima of two variable functions under different constraints?					
The ability to *explain* principles of Science (Physics & Chemistry). Example: can you explain the principle of gravity?					
The ability to *explain* principles of Engineering (taught in IE courses). Example: can you explain the concept of continuous improvement?					
The ability to *solve* complex engineering problems by applying principles from Mathematics, Science, and Engineering. Example: can you explain the roles of logistic management in a supply chain?					
The ability to apply engineering design to produce solutions to a problem. Example: given a problem of a simply supported beam where the beam supports an object, can you specify the material and the geometry of the beam?					
The ability to justify a design based on specified needs and various non-technical aspects. Example: pick any available product in the market (let us say a passenger car), can you justify whether that car is a good product (in both technical and economic sense)?					
The ability to identify written and oral communication methods. Example: can you differentiate how to write or talk to your peer and to your supervisor (lecturer)? Can you differentiate the writing style of laboratory report and email to your peer?					

Table 1. Questionnaire to be Distributed to IE Graduates (continued).

Skill set	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The ability to express ideas and arguments effectively to a range of audiences. Example: during a discussion or when you present your work, do you think others are able to comprehend what you are trying to say?					
The ability to describe ethical and professional responsibility in engineering situations. Example: suppose you are working on an engineering project that potentially affects the ecosystem, can you explain your responsibility as an engineer?					
The ability to assess global, economic, environmental, societal, and cultural context in relation to engineering judgments. Example: suppose a new battery factory is opened in DKI Jakarta; whether you agree or not, can you come up with a reason to support your choice (to agree or not agree)?					
The ability to recognize and carry out personal role and responsibility as an equally contributing member of a team. Example: clear enough.					
The ability to collaborate effectively on a team to achieve goals. Example: clear enough.					
The ability to demonstrate initiatives and leadership. Example: clear enough.					
The ability to perform experiments to acquire data. Example: given an experiment module, can you perform the experiment on your own or with little help from the operator for a dangerous process?					
The ability to analyze data based on mathematics, science, and engineering principles. Example: given an experiment, can you construct relation between two sets of data, identify and draw control chart? or you can identify and apply queuing model in your daily life.					

Table 1. Questionnaire to be Distributed to IE Graduates (continued).

Skill set	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The ability to draw conclusions based on evaluation and interpretation of data. Example: given an investigation of complex problems: Use research based knowledge and research methods including design of experiments , analysis and interpretation of data and synthesis of the information provide valid conclusion.					
The ability to identify and utilize various available resources and learning strategies to independently acquire new knowledge. Example: suppose you are given a task to simulate a physical system in MATLAB, can you list your strategy to learn quickly in two days?					
The ability to apply new knowledge according to needs. Example: there must be at least one experience in IE where you need to learn something new on your own for a project. Did you succeed with that project?					

Tabel 2. Questionnaire to be Distributed to Employers in Companies or Institutions.

Skill set	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Comments
Do our graduates have the ability to analyze and design industrial systems and solve complex engineering problems? Note: If the job scope is not related to Industrial Engineering, please write your comments in the last column. You can also write your related testimony in the last column.						
Do our graduates have the moral integrity? Note: You can also write your related testimony in the last column.						
Do our graduates have high ethical standard? Note: You can also write your related testimony in the last column.						
Are our graduates able to work in a team? Note: You can also write your related testimony in the last column.						
Do our graduates exhibit leadership characteristics? Note: You can also write your related testimony in the last column.						
Do our graduates exhibit independence to learn new skills and knowledge? Note: You can also write your related testimony in the last column.						

4. Graduate Profile (GP) & Program Learning Outcomes (PLOs)

4.1. Graduate Profile

The Graduate Profile (GP) or PEO (Program Educational Objectives) of the IE Study Program is developed based on the inputs from the stakeholders. The GP is aligned with the input from IAB where the GP needed is the one that can cover many prospectuses career lines in the industrial engineering area. This GP, recommended by BKS-TI, is then adopted into GP of IE Study Program with some modification (see Table 3, GP1). GP1 is the hard skills of IE graduates, and it must be complemented with the soft skills as the supporting profile. These soft skills are enlisted in **Table 3** as GP2 and GP3. With these three GPs, the IE graduates have the superior skills in Industrial Engineering, and they also have soft skills that support them in contributing to the society that always changes. The ability to continuously contribute to the society is also aligned with the inputs from the stakeholders.

The benchmarking between GP of 2022 Curriculum with GPs from other universities are given in Table 3a. It shows the comparison of GPs between IE Study Program of SU, Universitas Telkom, and Universitas Trisakti. We can see that GPs of both Universitas Telkom and Universitas Trisakti are based on specific career lines and the characteristics of the graduates. We can also see from Table 3a that GPs of SU are more compact and straightforward. As a note, the vision and mission of SU are clearly reflected in the GPs.

Tabel 3. Graduate Profiles and Descriptions.

No	Graduate Profile	Description	Missions Addressed
GP1	Technical Engineer and Manager.	Competent to work and/or to manage in various industrial and service sectors and have the capability to design, analyze, implement, and improve integrated systems of people, materials, machines, and information.	M1, M4
GP2	Researcher / Academician.	Capable of performing life-long learning by self-study, doing research, or continuing education in the field of Industrial Engineering and related disciplines.	M2, M4
GP3	Entrepreneur.	Possess the entrepreneurial spirit to engage in businesses in the field of industrial engineering and related disciplines.	M3, M4

Table 3a. Comparison of GPs with other local universities (IE Study Program).

No	Sampoerna University	Universitas Telkom	Universitas Trisakti
GP1	Technical Engineer and Manager. Competent to work and/or to manage in various industrial and service sectors and have the capability to design, analyze, implement, and improve integrated systems of people, materials, machines, and information.	Pegawai profesional dalam bidang Teknik Industri. Memiliki kemampuan untuk bekerja sebagai anggota/pemimpin di manajemen tingkat awal dengan menerapkan kompetensi di bidang Teknik Industri, yaitu: 1. Efektif menggunakan metode untuk melakukan perancangan dan perbaikan proses dan sistem terintegrasi, berbasis ICT. 2. Terampil dalam melakukan pemasangan (installation) proses dan sistem terintegrasi yang telah dirancang pada sebuah organisasi, berbasis ICT.	Mampu merancang, memperbaiki, dan memasang sistem terintegrasi dalam bidang manufaktur dan jasa untuk meningkatkan produktivitas dan kualitas produk atau jasa.
GP2	Researcher / Academician. Capable of performing life-long learning by self-study, doing research, or continuing education in the field of Industrial Engineering and related disciplines.	Studi lanjut. Memiliki kemampuan untuk mengembangkan pengetahuan dan ketrampilan secara terus-menerus serta mampu untuk melanjutkan studi kejenjang yang lebih tinggai dibidang Teknik Industri atau bidang lain masih sesuai dengan kompetensi Teknik Industri.	Mampu melakukan riset dalam hal identifikasi, formulasi, dan analisis masalah rekayasa pada sistem terintegrasi.
GP3	Entrepreneur. Possess the entrepreneurial spirit to engage in businesses in the field of industrial engineering and related disciplines.	Wirausahawan. Memiliki jiwa entrepreneur, yang mampu membuat lapangan kerja untuk dirinya sendiri dan orang lain, yang memiliki kemampuan untuk membuat usaha dengan menerapkan kompetensi dibidang teknik industri.	Mampu menciptakan lapangan kerja dan mendapatkan penghasilan dengan usaha mandiri; membentuk dan mengembangkan usahanya berbasiskan teknologi, dan meningkatkan keterampilan technopreneurship secara berkelanjutan.

4.2. Formulation of PLOs (Program Learning Outcomes)

PLOs of the Study Program are defined to ensure the graduates have the characteristics mentioned in the GP (see **Table 4**). Specifically, GP1 is supported by six PLOs (PLO1 thru PLO6), GP2 is supported by four PLOs (PLO3, PLO4, PLO6, and PLO7), lastly GP3 is supported by three PLO's (PLO3, PLO4, and PLO5).

The PLOs are defined based on the guidance from IABEE (Indonesian Accreditation Board for Engineering Education) and BKS-TI. In this case, BKS-TI transforms the engineering curriculum guidance from IABEE to industrial engineering curriculum. The PLOs are also defined by considering the outcomes based on KKNI's criteria.

The IE Study Program, like other study programs at Sampoerna University, adopts the General Education Sampoerna University Core (GenEd SU Core) Curriculum for the basic science courses and general courses. These courses are mathematics, physics, chemistry, and general courses such as Bahasa Indonesia, English language courses, Religion, etc. To ensure the achievement of the PLOs of Study Program, a mapping matrix between the PLOs of GenEd SU Core and PLOs of Study Program is needed.

The relation between PLOs of the 2022 Curriculum and PLOs from IABEE, BKS-TI, KKNI, and GenEd SU Core can be seen in **Tables 5 – 8**. We can see that the matrices in **Tables 5** and **6** are similar. This is because PLOs recommended by BKS-TI are based on IABEE's PLOs. We can also see that PLOs of Study Program number 2, 3, 4, 6, and 7 are mapped one to one to the PLOs from IABEE and BKS-TI. Meanwhile, PLO1 of Study Program covers three PLOs from IABEE and BKS-TI, and PLO5 of Study Program covers two PLOs from IABEE and BKS-TI.

Table 4. PLOs of IE Study Program.

No	Description of Program Learning Outcome (PLO)	GP1	GP2	GP3
PLO 1	An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.	✓		
PLO 2	An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.	✓		
PLO 3	An ability to communicate effectively with a range of audiences.	✓	✓	✓
PLO 4	An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.	✓	✓	✓
PLO 5	An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.	✓		✓
PLO 6	An ability to develop and conduct appropriate experimentation, analyze, and interpret data, and use engineering judgment to draw conclusions.	✓	✓	
PLO 7	An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.		✓	

Table 5. Relation between PLOs of Study Program and PLOs recommended by IABEE.

No	PLOs from IABEE	PLO of Study Program						
		1	2	3	4	5	6	7
1	Ability to apply knowledge of mathematics, natural and/or materials sciences, information technology and engineering to acquire comprehensive understanding of engineering principles.	✓						
2	Ability to design components, systems, and/or processes to meet desired needs within realistic constraints in such aspects as law, economic, environment, social, politics, health and safety, sustainability as well as to recognize and/or utilize the potential of local and national resources with global perspective.		✓					
3	Ability to design and conduct laboratory and/or field experiments as well as to analyze and interpret data to strengthen the engineering judgment.						✓	
4	Ability to identify, formulate, analyze, and solve complex engineering problems.	✓						
5	Ability to apply methods, skills, and modern engineering tools necessary for engineering practices.	✓						
6	Ability to communicate effectively in oral and written manners.			✓				
7	Ability to plan, accomplish, and evaluate tasks under given constraints.					✓		
8	Ability to work in multidisciplinary and multicultural teams.					✓		
9	Ability to be accountable and responsible to the society and adhere to professional ethics in solving engineering problems.				✓			
10	Ability to understand the need for life-long learning, including access to the relevant knowledge of contemporary issues.							✓

Table 6. Relations between PLOs of Study Program and PLOs recommended by BKS-TI.

No	PLOs from BKS-TI	PLO of Study Program						
		1	2	3	4	5	6	7
1	Mastering the theoretical concepts of natural science, engineering mathematics applications; engineering fundamentals, engineering science, and engineering design required for the analysis and design of integrated systems.	✓						
2	Mastering the principles and techniques of integrated system design with a systems approach.		✓					
3	Mastering knowledge of technical/engineering communication and the latest and latest technological developments.			✓				✓
4	Mastering the latest principles and issues in terms of economics, society, and ecology in general.		✓		✓			✓
5	Able to apply mathematics, science, and engineering principles to solve complex engineering problems in integrated systems (including people, materials, equipment, energy, and information).	✓	✓					
6	Able to identify, formulate and analyze complex engineering problems on integrated systems based on analytical, computational, and/or experimental approaches.						✓	
7	Able to formulate solutions for complex engineering problems in integrated systems by considering economic, public health and safety, cultural, social, and environmental factors (environmental considerations).		✓		✓			
8	Able to design integrated systems under applicable technical standards, environmental safety, and health by considering aspects of performance and reliability, ease of application, and sustainability and considering economic, social, and cultural factors.		✓					
9	Able to research and investigate complex engineering problems on integrated systems using basic engineering principles and by carrying out research, analysis, data interpretation, and information synthesis to provide solutions.						✓	✓
10	Able to choose resources and utilize appropriate engineering design and analysis tools based on information technology and computing to carry out engineering activities.						✓	

Table 6. Relations between PLOs of Study Program and PLOs Recommended by BKS-TI (continued).

No	PLOs from BKS-TI	PLO of Study Program						
		1	2	3	4	5	6	7
11	Able to communicate effectively in writing and orally.			✓				
12	Understand professional responsibilities and aspects of professional ethics.				✓			
13	Able to recognize needs and manage lifelong self-learning.							✓
14	Able to collaborate in a workgroup.					✓		

Table 7 shows the mapping of IE Study Program PLOs with those of KKNI. This list was taken from the 2019 Curriculum. The result shows all the 7 PLOs matched well.

Table 7. Relations between PLOs of Study Program and PLOs based on KKNI.

No	PLO based on KKNI	PLO of Study Program						
		1	2	3	4	5	6	7
***Sikap*/ Attitude**								
S-1	Devoted to God Almighty and able to present a religious attitude;				✓			
S-2	Uphold humanistic values in carrying out duties based on religion, morals, and ethics;				✓			
S-3	Contribute in improving the quality of the community, citizenship and civilized progress based on the Pancasila;		✓					
S-4	Act as a citizen who is proud and loves his/her homeland, nationalistic and has a sense of responsibility to the state and the nation;				✓			
S-5	Appreciate cultural diversity, views, religions, beliefs, and other people's original opinions;					✓		
S-6	Able to cooperate, have social sensitivity, and care about the community and the environment;					✓		
S-7	Obey the law and discipline in being part of the community and in exercising citizenship;				✓			
S-8	Internalize values, norms, and academic ethics.				✓			
S-9	Demonstrate responsible attitude towards work in the field of expertise independently;				✓			
S-10	Internalize the spirit of independence, tenacity, and entrepreneurship;							✓
***Penguasaan Pengetahuan*/ Knowledge**								
PP-1	mastering the basic concepts of knowledge about differential-integral calculus, linear algebra, complex variables, physics and chemistry, applications of mathematics and technical analysis as basic material in the field of industrial engineering;	✓						
PP-2	mastering the principles of engineering (engineering fundamentals), engineering science and engineering design required for the analysis and design of industrial systems and the components required;	✓						

Table 7. Relation between PLOs of Study Program and PLOs based on KKNI (continued).

No	PLO based on KKNI	PLO of Study Program						
		1	2	3	4	5	6	7
PP-3	mastering the concepts of manufacturing control systems that support industrial systems;	✓						
PP-4	mastering the concept of knowledge in basic science practicums (physics, chemistry), computers, and manufacture;						✓	
PP-5	mastering the concepts and principles of environmental conservation;				✓			
PP-6	mastering the concepts and principles of Occupational Safety, Health, and Environment [Keselamatan, Kesehatan Kerja dan Lingkungan (K3L)] in the laboratory and in the field;						✓	
PP-7	mastering the principles and current issues in the economy and socio-culture in general;				✓			
PP-8	mastering general concepts, principles, and communication techniques for specific purposes;			✓				
PP-9	having insight into the latest and latest technological developments in the field of design, manufacturing processes, as well as the operation and maintenance of industrial systems and components needed;		✓					✓
PP-10	mastering factual knowledge, principles, and application methods of national and international codes and standards of maintenance, maintenance, repair, production of machine components and machine design; and		✓					
PP-11	mastering the concept of academic integrity in general and the concept of plagiarism, in terms of the types of plagiarism, the consequences of violations and efforts to prevent them.				✓			
***Keterampilan Umum*/ General Skills**								
KU-1	Able to implement logical, critical, systematic, and innovative thinking, within the context of development or implementation of science and technology that cares and applies the appropriate humanistic values related to his/her area of expertise;	✓			✓			✓
KU-2	Able to demonstrate the ability to work independently, with quality and measurable performance;	✓	✓			✓		

Table 7. Relation between PLOs of Study Program and PLOs based on KKNI (continued).

No	PLO based on KKNI	PLO of Study Program						
		1	2	3	4	5	6	7
KU-3	Able to review developmental areas or science and technology implementations which applies humanistic values in accordance with his/her expertise based on scientific rules, procedures, and ethics to improve solutions, ideas, designs, or artistic criticisms;	✓			✓			
KU-4	Capable of preparing scientific descriptions of the results produced in a thesis form or final project report, and upload them into the higher education website;			✓				
KU-5	Capable of making decisions appropriately to solve problem in his/her area of expertise based on the analysis of information and data;	✓			✓			
KU-6	Able to maintain and develop his/her working network with advisors, colleagues, and peers in both inside and outside his/her institution.			✓				
KU-7	Capable of taking responsibility for the group's work achievement by conducting appropriate supervision and evaluation towards work completion assigned to those who work under his/her responsibility;					✓		
KU-8	Able to conduct self-evaluation process related to the work of the group who is under his/her responsibility, and manage independent learning;					✓		✓
KU-9	Capable of documenting, storing, securing, and rediscovering data to ensure validity and prevent plagiarism;				✓			
KU-10	Demonstrate quantitative reasoning and develop graphical facility. Able to apply a deductive and/or inductive approach to inquiry and demonstrate methodical problem-solving skills;	✓						
KU-11	Able to write clearly and coherently; speak and listen interactively; and apply non-verbal communication techniques;			✓				
KU-12	Able to locate information, read and evaluate with a critical comprehension of information, and able to use it effectively to support an argument or solve a problem.	✓						✓

Table 7. Relation between PLOs of Study Program and PLOs based on KKNI (continued).

No	PLO based on KKNI	PLO of Study Program						
		1	2	3	4	5	6	7
***Keterampilan Khusus*/Specific Skills**								
KK-1	Able to apply basic concepts of knowledge about differential-integral calculus, linear algebra, complex variables, physics and chemistry, mathematical applications, and technical analysis to create or modify engineering models in the field of industrial systems;	✓						
KK-2	Able to apply the principles of engineering (engineering fundamentals), engineering science and engineering design required for the analysis and design of industrial systems (industrial systems) and the required components;		✓					
KK-3	Able to identify, formulate, analyze, and find the source of engineering problems in the field of industrial systems through a process of empirical investigation (experiment), theoretical analysis, data interpretation, and information based on engineering principles;	✓					✓	
KK-4	Able to provide the best solutions to solve engineering problems in the field of industrial systems based on engineering principles, considering factors of economic, security, public safety, and environmental sustainability;		✓					
KK-5	Able to design an industrial system and the necessary components, such as making engineering designs with an analytical approach and considering technical standards, aspects of performance, reliability, ease of application, and sustainability;		✓					✓
KK-6	Able to redesign and optimize processes, processing systems, and components required in engineering design in the field of existing industrial systems;		✓				✓	✓
KK-7	Able to select resources and utilize the most suitable, effective, and efficient engineering design and analysis tools in solving engineering problems in the field of industrial systems;		✓					
KK-8	Able to criticize the policy of solving industrial engineering problems that have been and/or are being implemented, and are stated in the form of scientific working papers;	✓	✓					

Table 8. Relation between PLOs of Study Program and PLOs of Sampoerna University's General Education (Gen-Ed).

No	PLOs from GenEd SU Core	PLO of Study Program						
		1	2	3	4	5	6	7
1	Critical Thinking (CT)	✓						
2	Effective Communication (EC)			✓				
3	Ethical Reasoning (ER)				✓			
4	Global Self Awareness (GSA)					✓		
5	Information Literacy (IL)							✓
6	Mathematical & Scientific Reasoning (MSR)	✓					✓	

Table 8 gives the mapping of the new seven PLOs with the PLOs of General Education (Gen-Ed) courses provided in Sampoerna University. We can see that PLO2 from the Study Program is not mapped to the GenEd PLOs and this is as expected since GenEd PLOs are not specific to the skills of the IE Study Program (PLO 2 of Study Program is about skills of developing engineering design).

4.3. Performance Indicator of PLOs

The PLOs of Study Program in Table 4 will be mapped to the courses. Each course has its specific SLOs (Subject Learning Outcomes) or CPMK (Capaian Pembelajaran Mata Kuliah) and PLOs of Study Program are achieved in stages by the entire courses' SLO's offered in the study program. We will see later in Table 11 that most courses cannot cover the entire aspects of the PLOs assigned to it. In other words, we need to split the aspects of the PLOs so that when the aspects of one PLO are too many to be covered by one course, two or more courses can be designed to be mapped to that PLO. Since essentially the offered courses are designed to achieve the SLOs, an index that bridges the PLOs and SLOs is needed. This index is called the Performance Indicator (PI). The PI for each PLO is given in **Table 9**.

The PI is defined based on the Bloom's Taxonomy:

1. **Remember**: recall facts and basic concepts. Selected-related keywords to this taxonomy are choose, define, find, list, recall, and label.
2. **Understand**: explain ideas or concepts. Selected-related keywords to this taxonomy are classify, perform, carry out, describe, generate, compare, explain, illustrate, expand, rephrase, identify, recognize, express.
3. **Apply**: use information in new situations. Selected-related keywords to this taxonomy are implement, apply, solve, plan, and utilize.
4. **Analyze**: draw connections among ideas. Selected-related keywords to this taxonomy are analyze, assume, examine, and question.

5. **Evaluate**: justify a stand or decision. Selected-related keywords to this taxonomy are assess, criticize, decide, evaluate, determine, prove, estimate, and conclude.
6. **Create**: produce new or original work. Selected-related keywords to this taxonomy are combine, compile, assemble, design, develop, modify, and propose.

Following is the description of Bloom's Taxonomy related to the PLOs of Study Program:

a. PLO1 of the Study Program has the main outcome as the ability of the graduate to solve complex engineering problems. To solve a problem, then one needs to understand the basic concepts and they need the ability to apply those concepts to solve the problem. Thus, PLO1 is related to Bloom's Taxonomy 2 and 3 (Understanding and Apply).
b. PLO2 of the Study Program has the main outcome as the ability of the graduate to produce solutions that meet certain criteria (engineering design). In producing the said solutions, one needs the ability to apply concepts of engineering design, to evaluate the design parameters, and to create or propose the solutions. Therefore, PLO2 is related to Bloom's Taxonomy 3, 5, and 6 (Apply, Evaluate, and Create).
c. PLO3 of the Study Program has the main outcome as the ability of the graduate to communicate effectively with a range of audiences. Effective means that the information conveyed must be understood properly by the audience. To achieve this, the graduate must have the ability to identify oral and writing communication methods and they must also have the ability to express their ideas and arguments effectively. Thus, PLO3 is related to Bloom's Taxonomy 2 and 3 (Understand and Apply).
d. PLO4 of the Study Program has the main outcome as the ability to identify the professional responsibility and the ability to make decisions. In short, PLO4 is related to Bloom's Taxonomy 2 and 5 (Understand and Evaluate).
e. PLO5 of the Study Program has the main outcome as the teamwork and project management abilities of the graduate. For teamwork, one needs to identify an individual's role in a team and the ability to collaborate. To manage a project, one needs initiative and leadership qualities. PLO5 is related to Bloom's Taxonomy 2 (Understand).
f. PLO6 of the Study Program has the main outcome as the ability to perform experimentation and to draw conclusions. Thus, one needs the ability to understand the experimentation steps, analyze the data, and to draw the conclusions. PLO6 is related to Bloom's Taxonomy 2, 4, and 5 (Understand, Analyze, and Evaluate).
g. PLO7 of the Study Program has the main outcome as the ability of the graduate to identify learning methods, acquire new knowledge, and the ability to apply the newly acquired knowledge. PLO7 is related to Bloom's Taxonomy 2 and 3 (Understand and Apply).

The PI's in **Table 9** will be used as the guidance in creating SLOs (Subject Learning Outcomes) and the examinations problem of the related courses.

Table 9. Performance Indicator and the related PLOs.

No	PLO of Study Program	Performance Indicator The ability to ...
PLO1	An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	A1. describe mathematics, science, and engineering principles A2. apply the principles of mathematics, science, and engineering principles to solve complex engineering problems
PLO2	An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	B1. apply engineering design to produce solutions to a problem B2. generate engineering drawings according to appropriate standards B3. produce components using appropriate tools and techniques B4. Justify a design based on specified needs and various non-technical aspects
PLO3	An ability to communicate effectively with a range of audiences	C1. identify written and oral communication methods C2. express ideas and arguments effectively to a range of audiences
PLO4	An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, societal, and cultural contexts	D1. Describe ethical and professional responsibility in engineering situations D2. assess global, economic, environmental, societal, and cultural context in relation to engineering judgments
PLO5	An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	E1. recognize and carry out personal role and responsibility as an equally contributing member of a team E2. collaborate effectively on a team to achieve goals E3. demonstrate initiatives and leadership
PLO6	An ability to develop and conduct appropriate experimentation, analyze, and interpret data, and use engineering judgment to draw conclusions	F1. perform experiments to acquire data F2. analyze data based on mathematics, science, and engineering principles F3. draw conclusions based on evaluation and interpretation of data
PLO7	An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	G1. identify and utilize various available resources and learning strategies to independently acquire new knowledge G2. apply new knowledge according to needs

5. Formulation of Body of Knowledge (BoK)

5.1. Description of BoK

Field of expertise developed in the study program are:

1. **Operations Research**
2. **Supply Chain Management**
3. **Manufacturing Systems**

In general, BoK is defined to develop the above field of expertise are:

1. Mathematics and Statistics, Physics, and Chemistry as the foundation in performing analysis and to solve engineering problems.
2. General Education, Social Science, and Environment courses to equip the students with soft skills and additional engineering skills.
3. Introduction to Engineering Probability and Statistics, Deterministic Operations Research, and Probabilistic Models in Operations Research courses are used to develop expertise in **Operations Research.**
4. Engineering Economy, Production System Analysis, Project Management, Supply Chain Management, Technical Sales and Marketing courses are used to develop expertise in **Supply Chain Management**.
5. Quality Control and Six Sigma, Computer Programs for Engineers, Embedded Computer Systems, Manufacturing Process for IE (+ Lab), and Integrated Manufacturing Systems courses are used to develop expertise in **Manufacturing Systems**.
6. Internship to let the students experience the industrial world and to let the students apply their academic knowledge in the real world.
7. Capstone Design courses to measure the ability of the students in using their academic knowledge to produce industrial engineering design and to explore the potential of the students in using their academic knowledge to perform design of complex product or to perform research (case dependent).

The Body of Knowledge (BoK) incorporated into the 2022 Curriculum can be seen in **Table 10**. This BoK is chosen by considering the curriculum guidance from IABEE and the 2020 BKS-TI Curriculum. Based on criteria from IABEE, the course group mathematics and basic science must be at least 20% of the total credits. Meanwhile, the course group in engineering must be at least 40% of the total credits. Lastly, the general courses must be less than 40% of the total credits.

Table 10. Industrial Engineering Body of Knowledge (BoK).

No	Body of Knowledge	Credit Hours	Percentage
BK1	General Education	19	13.1%
BK2	Basic Science	18	12.5%
BK3	Mathematics and Statistics	27	18.6%
BB4	Engineering Science	15	10.3%
BK5	Social Science	12	8.3%
BK6	Industrial Engineering Science	38	26.2%
BK7	Industrial Engineering Design	13	9.0%
BK8	Environment	3	2.0%
Total		**145**	**100%**

Table 11. Mapping of Body of Knowledge (BoK) to IE Courses.

BOK	BOK Code	Course Code	Course Name	Credits
General Education (19 Credit Hours)	BK-1	MK1	World Religions	3
		MK2	Composition I	3
		MK3	Composition II	3
		MK4	Pancasila	3
		MK5	Bahasa Indonesia	2
		MK6	Citizenship/Kewarganegaraan	2
		MK7	Technical Writing	3
Basic Sciences (18 Credit Hours)	BK-2	MK8	General Physics with Calculus I	4
		MK9	General Physics with Calculus I Lab	1
		MK10	General Physics with Calculus II	4
		MK11	General Physics with Calculus II Lab	1
		MK12	General Chemistry I	3
		MK13	General Chemistry I Lab	1
		MK14	General Chemistry II	3
		MK15	General Chemistry II Lab	1
Mathematics and Statistics (27 Credit Hours)	BK-3	MK16	Calculus & Analytical Geometry I	5
		MK17	Calculus & Analytical Geometry II	5
		MK18	Calculus & Analytical Geometry III	5
		MK19	Mathematical Foundations for IE	3
		MK20	Intro. to Engr. Probability & Statistics	3
		MK21	Deterministic Operations Research	3
		MK22	Probabilistic Models in Operations Research	3
Engineering Science (15 Credit Hours)	BK-4	MK23	Introduction to Engineering	3
		MK24	Computer Programs for Engineers	3
		MK25	Statics	3
		MK26	Software for Engineers	3
		MK27	Object Oriented Modeling & Design	3
Social Science (12 Credit Hours)	BK-5	MK28	Social Problems	3
		MK29	Principle of Macroeconomics	3
		MK30	Human Side of Organizations	3
		MK31	Indonesian Arts History	3

Table 11. Mapping of Body of Knowledge (BoK) to IE Courses (continued).

BOK	BOK Code	Course Code	Course Name	Credits
Industrial Engineering Science (38 Credit Hours)	BK-6	MK32	Introduction to Systems & Industrial Engr.	3
		MK33	Quality Control and Six Sigma	3
		MK34	Manufacturing Process	3
		MK35	Manufacturing Process Lab	1
		MK36	Integrated Manufacturing Systems	3
		MK37	Engineering Economy	3
		MK38	Production Systems Analysis	3
		MK39	Human Factor & Ergonomic in Design	3
		MK40	Simulation Modeling & Analysis	3
		MK41	Embedded Computer Systems	4
		MK42	Project Management (IE Elective)	3
		MK43	Supply Chain Management (IE Elective)	3
		MK44	Technical Sales & Marketing (IE Elective)	3
Industrial Engineering Design (13 Credit Hours)	BK-7	MK45	Engineering Experimental Design	3
		MK46	IE Colloquium	1
		MK47	Internship for IE	3
		MK48	Senior Capstone Project I	3
		MK49	Senior Capstone Project II	3
Environment (3 Credit Hours)	BK-8	MK50	Environmental Ethics	3

6. List of Courses in Study Program

The courses are formed based on the BoK and the PLOs mapped onto the BoK. The entire course must cover all PLOs. The mapping between the BoK and the corresponding course for each semester is given in **Table 11**. Then, the mapping between each course and the PLOs are given in **Table 12** in which the PLOs column entry is filled with the related KKNI's PLOs and the related PIs (see **Table 9**). The related PI is denoted with italic letters in brackets. The related GenEd PLOs are written next to the course name, in brackets with abbreviation (see **Table 8**).

Table 12. PLOs and Courses Mapping.

No	Course	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7
Semester 1								
1.	World Religions					S-1, S-5 (E1)		KU-12 (G1, G2)
2.	Composition I			KU-13 (C1, C2)				
3.	General Chemistry I	PP-1, KK-1 (A1, A2)						
4.	General Chemistry I Lab						PP-5, PP-7 (F1, F2)	
5.	Calculus & Analytical Geometry I	PP-1, KK-1 (A1, A2)						
6.	Introduction to Engineering				S-8, PP-12 (D1)			
Semester 2								
1.	Composition II			KU-13 (C1, C2)				
2.	General Physics with Calculus I	PP-1, KK-1 (A1, A2)						
3.	General Physics with Calculus I Lab						PP-4 (F1, F2)	
4.	General Chemistry II	PP-1, KK-1 (A1, A2)						
5.	General Chemistry II Lab						PP-4 (F1, F2)	
6.	Calculus & Analytical Geometry II	PP-1, KK-1 (A1, A2)						

No	Course	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7
7.	Computer Programs for Engineers	KU-1 (A2)						
Semester 3								
1.	Citizenship/Kewarganegaraan				S-2, S-4, S-7 (D1)			
2.	General Physics with Calculus II	PP-1, KK-1 (A1, A2)						
3.	General Physics with Calculus II Lab						PP-5, PP-7 (F1, F2)	
4.	Calculus & Analytical Geometry III	PP-1, KK-1 (A1, A2)						
5.	Indonesian Arts History	KU-1 (A1)			KU-5 (D1)	S-5, S-6 (E1)		
6.	Introduction to Systems & Industrial Engr.	PP-1, PP-2, KU-1, KK-1 (A1, A2)		PP-8, KU-11 (C1, C2)		KU-7 (E2)		
7.	Object Oriented Modeling & Design	PP-2 (A1, A2)	KK-4 (B1)	KU-11 (C1)				
Semester 4								
1.	Pancasila				S-1, S-4, S-8 (D2)			
2.	Bahasa Indonesia			KU-13 (C1)				
3.	Mathematical Foundations for IE			KK-4 (B1, B2)				
4.	Statics	KK-1, KK-2 (A1, A2)						
5.	Social Problems				S-8, KU-3 (D1, D2)	S-6 (E1)		
6.	Engineering Economy	KK-1, KK-2 (A1, A2)	KK-2, KK-4 (B1, B3)		S-8, PP-12 (D1)		KK-3 (F1, F2, F3)	
7.	IE Colloquium			KU-11 (C2)				S-10 (G1)
Semester 5								
1.	Technical Writing			KU-11 (C1, C2)	PP-11, (D1)			
2.	Intro. to Engr. Probability & Statistics	PP-1, KK-1 (A2)					KK-3 (F2, F3)	

No	Course	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7
3.	Deterministic Operations Research	PP-1, KK-1 (A1, A2)	KK-4 (B1-B4)				KK-3 (F2, F3)	
4.	Software for Engineers	PP-1, KK-1 (A1, A2)					KK-3 (F1, F2, F3)	KU-12, KK-5 (G1, G2)
5.	Manufacturing Process	PP-2 (A1, A2)	PP-10 (B3)					
6.	Manufacturing Process Lab	KK-3 (A2)				KU-7 (E1)	PP-5 (F1)	
7.	Environmental Ethics				PP-6 (D2)			
Semester 6								
1.	Probabilistic Models in Operations Research	KK-1 (A1, A2)	KK-2, PP-2 (B1)				KK-3 (F2, F3)	
2.	Principle of Macroeconomics	S5 (A2)	S6 (B1)		KU1 (D1, D2)	KU3 (E2)	KU5 (F1, F2)	
3.	Quality Control and Six Sigma	PP-2, KK-1 (A1, A2)	KK-4 (B1)		KU-3 (D1, D2)			
4.	Integrated Manufacturing Systems	PP-1, PP-2, KK-1 (A2)		KU-4 (C2)		KU-7, KU-8 (E1, E2)		
5.	General Psychology	S-5 (A1)	S-6 (B2)	KU-1 (C1, C2)	KU-3 (D1, D3)	KU-5 (E1, E3)		
6.	Production Systems Analysis		KK-4 (B1, B4)				KK-3 (F1, F2, F3)	
7.	Engineering Experimental Design		KK-4 (B3)				KK-3 (F1, F2, F3)	KK-5 (G01)
Semester 7								
1.	Human Side of Organizations	PP-1, KK-1 (A1, A2)		KU-11 (C2)				
2.	Human Factor & Ergonomic in Design	PP-1, KU-1, KK-1 (A1, A2)	KK-2, KK-4 (B1, B3)				KK-3 (F1, F2, F3)	
3.	Simulation Modeling & Analysis	KU-1, KK-1 (A1, A2)	KK-2, KK-4 (B1, B3)				KK-3 (F1, F2, F3)	
4.	Project Management (IE Elective)		KK-2, KK-4 (B1, B3)		S-8, PP-12 (D1)		KK-3 (F1, F2, F3)	
5.	Internship for IE	KU-10 (A2)		KU-11 (C2)				KU-12 (G2)

No	Course	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7
6.	Senior Capstone Project I	KU-10 (A2)		KK-8 (C2)	S-9, KU-9 (D2)			KU-12 (G2)
Semester 8								
1.	Embedded Computer Systems	PP-1, KK-1 (A1, A2)				KU-7 (E1, E2, E3)	KK-3 (F1, F2, F3)	KU-12, KK-5 (G1, G2)
2.	Supply Chain Management (IE Elective)	PP-2, KK-1 (A1, A2)	KK-2, KK-4 (B1, B3)				KK-3 (F1, F2, F3)	
3.	Technical Sales & Marketing (IE Elective)		KK-2, KK-4 (B1, B3)				KK-3 (F1, F2, F3)	
4.	Senior Capstone Project II	KU-10 (A2)		KK-8 (C2)	S-9, KU-9 (D2)			KU-12 (G2)

Table 13. Mapping of IE Courses to IE PLO's.

Course Name	Credits	Sem-ester	PLO						
			1	2	3	4	5	6	7
World Religions	3	1			✓		✓		
Composition I	3	1			✓		✓		
Composition II	3	2			✓		✓		
Pancasila	3	4				✓	✓		
Bahasa Indonesia	2	4			✓		✓		
Citizenship/Kewarganegaraan	2	3				✓	✓		
Technical Writing	3	5			✓		✓		
General Physics with Calculus I	4	2	✓	✓					
General Physics with Calculus I Lab	1	2		✓	✓				
General Physics with Calculus II	4	3	✓	✓					
General Physics with Calculus II Lab	1	3		✓	✓				
General Chemistry I	3	1	✓	✓					
General Chemistry I Lab	1	1		✓	✓				
General Chemistry II	3	2	✓	✓					
General Chemistry II Lab	1	2		✓	✓				
Calculus & Analytical Geometry I	5	1	✓	✓					
Calculus & Analytical Geometry II	5	2	✓	✓					
Calculus & Analytical Geometry III	5	3	✓	✓					
Mathematical Foundations for IE	3	4		✓					
Intro. to Engr. Probability & Statistics	3	5	✓						
Deterministic Operations Research	3	5		✓					
Probabilistic Models in Operations Research	3	6		✓					
Introduction to Engineering	3	1	✓		✓		✓		
Computer Programs for Engineers	3	2		✓					
Statics	3	4		✓			✓		

Software for Engineers	3	5		✓			✓		
Object Oriented Modeling & Design	3	3	✓		✓				
Social Problems	3	4			✓		✓		
Principle of Macroeconomics	3	6			✓		✓		
Human Side of Organizations	3	7			✓		✓		
Indonesian Arts History	3	3			✓		✓		
Introduction to Systems & Industrial Engr.	3	3	✓		✓		✓		
Quality Control and Six Sigma	3	6	✓	✓		✓			
Manufacturing Process	3	5	✓	✓			✓		
Manufacturing Process Lab	1	5		✓	✓			✓	
Integrated Manufacturing Systems	3	6	✓		✓		✓		
Engineering Economy	3	4		✓		✓		✓	
Production Systems Analysis	3	6		✓				✓	
Human Factor & Ergonomic in Design	3	7	✓	✓				✓	
Simulation Modeling & Analysis	3	7	✓	✓				✓	
Embedded Computer Systems	4	8		✓				✓	
Project Management (IE Elective)	3	7		✓		✓		✓	
Supply Chain Management (IE Elective)	3	8		✓				✓	
Technical Sales & Marketing (IE Elective)	3	8		✓				✓	
Engineering Experimental Design	3	6		✓				✓	✓
IE Colloquium	1	4			✓	✓			
Internship for IE	3	6	✓	✓		✓			
Senior Capstone Project I	3	7	✓	✓		✓			✓
Senior Capstone Project II	3	8	✓	✓		✓			✓
Environmental Ethics	3	5	✓		✓				
Object Oriented Modeling & Design	3	5	✓		✓				

Table 14. Mapping of IE Courses to IE PLO's by Semester.

Semester 1								
Course Name	**Credits**	**PLO**						
		1	**2**	**3**	**4**	**5**	**6**	**7**
World Religions	3			✓		✓		
Composition I	3			✓		✓		
General Chemistry I	3	✓	✓					
General Chemistry I Lab	1		✓	✓				
Calculus & Analytical Geometry I	5	✓	✓					
Introduction to Engineering	3	✓		✓		✓		
	18							

Semester 2								
Course Name	**Credits**	**PLO**						
		1	**2**	**3**	**4**	**5**	**6**	**7**
Composition II	3			✓		✓		
General Physics with Calculus I	4	✓	✓					
General Physics with Calculus I Lab	1		✓	✓				
General Chemistry II	3	✓	✓					
General Chemistry II Lab	1		✓	✓				
Calculus & Analytical Geometry II	5	✓	✓					
Computer Programs for Engineers	3		✓					
	20							

Semester 3								
Course Name	**Credits**	**PLO**						
		1	**2**	**3**	**4**	**5**	**6**	**7**
Citizenship/Kewarganegaraan	2				✓	✓		
General Physics with Calculus II	4	✓	✓					
General Physics with Calculus II Lab	1		✓	✓				
Calculus & Analytical Geometry III	5	✓	✓					
Indonesian Arts History	3			✓		✓		
Introduction to Systems & Industrial Engr.	3	✓		✓		✓		
Object Oriented Modeling & Design	3	✓		✓				
	21							

Table 14. Mapping of IE Courses to IE PLO's by Semester (continued).

Semester 4								
Course Name	**Credits**	**PLO**						
		1	**2**	**3**	**4**	**5**	**6**	**7**
Pancasila	3				✓	✓		
Bahasa Indonesia	2			✓		✓		
Mathematical Foundations for IE	3		✓					
Statics	3		✓			✓		
Social Problems	3			✓		✓		
Engineering Economy	3		✓		✓		✓	
IE Colloquium	1			✓	✓			
18								

Semester 5								
Course Name	**Credits**	**PLO**						
		1	**2**	**3**	**4**	**5**	**6**	**7**
Technical Writing	3			✓		✓		
Intro. to Engr. Probability & Statistics	3	✓						
Deterministic Operations Research	3		✓					
Software for Engineers	3		✓			✓		
Manufacturing Process	3	✓	✓			✓		
Manufacturing Process Lab	1		✓	✓			✓	
Environmental Ethics	3	✓		✓				
19								

Semester 6								
Course Name	**Credits**	**PLO**						
		1	**2**	**3**	**4**	**5**	**6**	**7**
Probabilistic Models in Operations Research	3		✓					
Principle of Macroeconomics	3			✓		✓		
Quality Control and Six Sigma	3	✓	✓		✓			
Integrated Manufacturing Systems	3	✓		✓		✓		
Production Systems Analysis	3		✓				✓	
Engineering Experimental Design	3		✓				✓	✓
18								

Table 14. Mapping of IE Courses to IE PLO's by Semester (continued).

Semester 7								
Course Name	**Credits**	**PLO**						
		1	**2**	**3**	**4**	**5**	**6**	**7**
Human Side of Organizations	3			✓		✓		
Human Factor & Ergonomic in Design	3	✓	✓				✓	
Simulation Modeling & Analysis	3	✓	✓				✓	
Project Management (IE Elective)	3		✓		✓		✓	
Internship for IE	3	✓	✓		✓			
Senior Capstone Project I	3	✓	✓		✓			✓
	18							

Semester 8								
Course Name	**Credits**	**PLO**						
		1	**2**	**3**	**4**	**5**	**6**	**7**
Embedded Computer Systems	4		✓				✓	
Supply Chain Management (IE Elective)	3		✓				✓	
Technical Sales & Marketing (IE Elective)	3		✓				✓	
Senior Capstone Project II	3	✓	✓		✓			✓
	13							

Table 15. IE Degree Plan.

INDUSTRIAL ENGINEERING DEGREE PLAN
AY 2022-2023

In collaboration with: SAMPOERNA UNIVERSITY, BROWARD COLLEGE, THE UNIVERSITY OF ARIZONA.

SEMESTER I

CODES	COURSE TITLE	CREDITS
GMAT1505	Calculus & Analytical Geometry I	5
GENG1301	Introduction to Engineering	3
GHUM1303	World Religions (Trads & Culture)	3
GSCI1303	General Chemistry I	3
GSCI1103L	General Chemistry I Lab	1
GCOM1304	Composition I (English)	3
	Total	**18**

SEMESTER II

CODES	COURSE TITLE	CREDITS
GMAT2506	Calculus & Analytical Geometry II	5
GSCI1405	General Physics with Calculus I	4
GSCI1105L	General Physics with Calculus I Lab	1
ENGR13031	Computer Programming for Engr Applications	3
GSCI2304	General Chemistry II	3
GSCI2104L	General Chemistry II Lab	1
GCOM1305	Composition II (English)	3
	Total	**20**

SEMESTER III

CODES	COURSE TITLE	CREDITS
GMAT2507	Calculus & Analytical Geometry III	5
GSCI2406	General Physics with Calculus II	4
GSCI2106L	General Physics with Calculus II Lab	1
IENG2301	Introduction to Systems & Industrial Engr	3
IENG2302	Object-Oriented Modeling & Design	3
GHUMXXXX	General Education (Arts and Humanities)	3
GHUM1207	Kewarganegaraan	2
	Total	**21**

SEMESTER IV

CODES	COURSE TITLE	CREDITS
IENG2304	Engineering Economy	3
IENG2305	Mathematical Foundations of IE	3
IENG2103	Industrial Engineering Colloquium	1
ENGR2302	Statics	3
GSOCXXXX	General Education (Individuals and Societies)	3
GHUM1208	Indonesian Language	2
GHUM1301	Pancasila (Trads and Culture)	3
	Total	**18**

SEMESTER V

CODES	COURSE TITLE	CREDITS
IENG3306	Introduction to Engr Probability & Statistics	3
IENG3307	Deterministic Operations Research	3
IENG3308	Software for Engineers	3
IENG3309	Manufacturing Process for IE	3
IENG3109L	Manufacturing Process for IE Lab	1
IENG3310	Technical Writing	3
ENGR3303	Environmental Ethics (Individuals and Societies)	3
	Total	**19**

SEMESTER VI

CODES	COURSE TITLE	CREDITS
IENG3311	Probabilistic Models in Operations Research	3
IENG3312	Integrated Manufacturing Systems	3
IENG3313	Production System Analysis	3
IENG3314	Engineering Experimental Design	3
IENG3315	Quality Control & Six Sigma	3
GSOCXXXX	General Education (Individual & Societies)	3
	Total	**18**

SEMESTER VII

CODES	COURSE TITLE	CREDITS
IENG4316	Simulation Modeling & Analysis	3
IENG4317	Human Factors & Ergonomics in Design	3
IENGXXXX	IE Technical Elective	3
IENG4319	Human Side Organization	3
STEM4302	Senior Capstone I	3
IENG 4301	Internship	3
	Total	**18**

SEMESTER VIII

CODES	COURSE TITLE	CREDITS
IENGXXXX	IE Technical Elective	3
IENG4321	Embedded Computer Systems	4
IENGXXXX	IE Technical Elective	3
STEM4303	Senior Capstone II	3
	Total	**13**

TOTAL CREDIT HOURS FOR DEGREE PROGRAM 145

IE TECHNICAL ELECTIVES					
IENG4318	Project Management	3	IENG4325	Reliability Engineering	3
IENG4320	Supply Chain Management	3	IENG4326	Survey of Optimization Methods	3
IENG4323	Engineering Decision Making Under Uncertainty	3	IENG4327	The Systems Engineering Process	3
IENG4322	Technical Sales and Marketing	3	IENG4328	Cost Estimation	3
IENG4324	Engineering Statistics	3	IENG4329	Engineering Entrepreneurship	3

General Education (Individual and Societies)			General Education (Art and Humanities)		
GSOC2303	General Psychology	3	VCDD3345	Indonesia Art History	3
GSOC2304	Social Problem	3	GHUM2305	Fundamental Art of Drawing	3
ENGR3303	Enviromental Ethics	3			
GSOC1301	Principles of Macroeconomics	3			

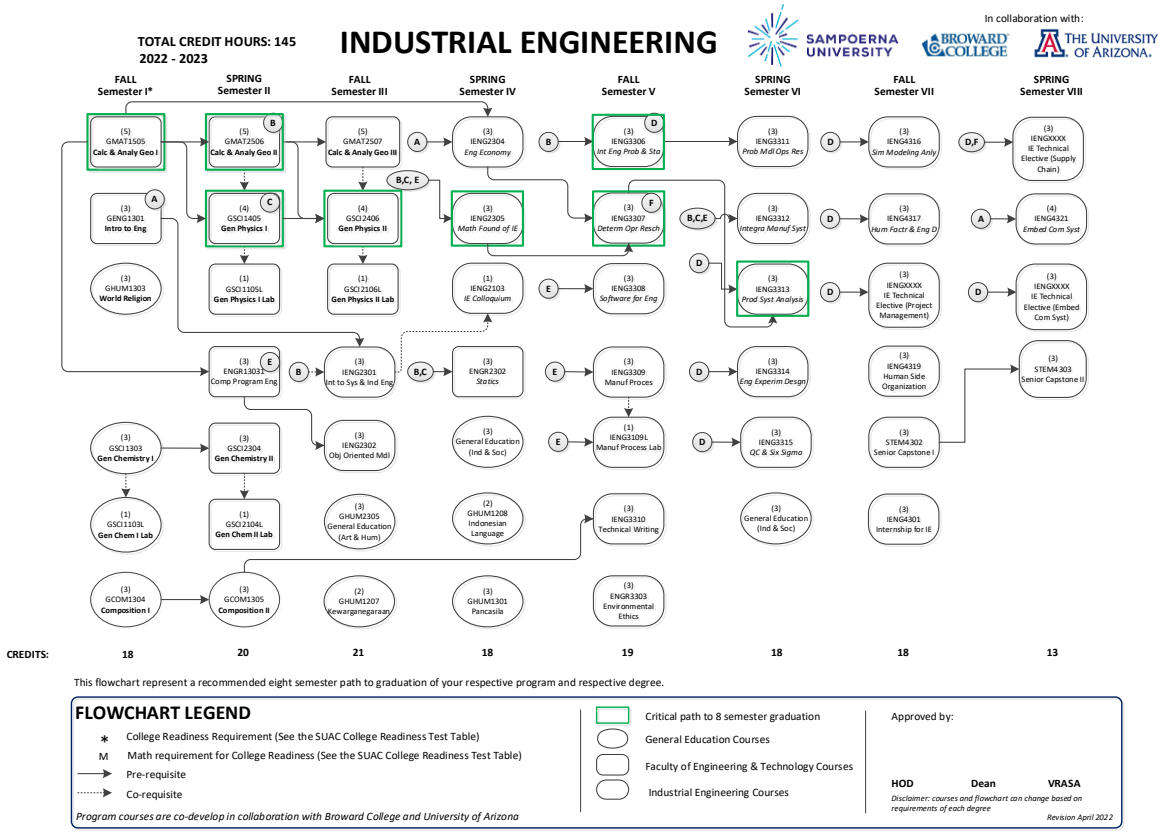

Figure 2. IE Flow Chart (AY 2022/2023)

7. Course Structure in the Curriculum

Table 16 summarizes the list of courses grouped based on the Compulsory, Elective, and Nationally Compulsory criteria. The course flowchart is shown in **Figure 2**.

Table 16. Matrix of the course structure in the curriculum of study program.

Sem.	Credits	# of Courses	Undergraduate Courses (Credit Hours)		
			Compulsory Courses	Elective Courses	Nationally Compulsory Courses
I	18	6	1. Composition I (3) 2. Gen. Chemistry I (3) 3. Gen. Chemistry I Lab (1) 4. Calculus & Analytical Geometry I (5) 5. Intro. to Engineering (3)		1. World Religions (3)
II	20	7	1. Composition II (3) 2. Gen. Physics with Calculus I (4)		

Sem.	Credits	# of Courses	Undergraduate Courses (Credit Hours)		
			Compulsory Courses	Elective Courses	Nationally Compulsory Courses
			3. Gen. Physics with Calculus I Lab (1) 4. Gen. Chemistry II (3) 5. Gen. Chemistry II Lab (1) 6. Calculus & Analytical Geometry II (5) 7. Computer Programs for Engineers (3)		
III	21	7	1. Gen. Physics with Calculus II (4) 2. Gen. Physics with Calculus II Lab (1) 3. Calculus & Analytical Geometry III (5) 4. Introduction to Systems & Industrial Engr. (3) 5. Object Oriented Modeling & Design (3)	Arts & Hum. Electives (choose 1): 1. Indonesian Arts History (3) 2. Fundamental Art of Drawing (3)	1. Kewarganegaraan (2)
IV	18	7	1. Mathematical Foundations for IE (3) 2. Statics (3) 3. Engineering Economy (3) 6. IE Colloquium (1)	Indiv. & Soc. Electives (choose 1): 1. Social Problems (3) 2. Principle of Macroeconomics (3) 3. Environmental Ethics (3) - required General Psychology (3)	1. Pancasila (3) 2. Bahasa Indonesia (2) 2.
V	19	7	1. Technical Writing (3) 2. Intro. to Engr. Probability & Statistics (3) 3. Deterministic Operations Research (3) 4. Software for Engineers (3) 5. Manufacturing Process (3) 6. Mfg. Process Lab (1)	Indiv. & Soc. Electives (choose 1): 1. Social Problems (3) 2. Principle of Macroeconomics (3) 3. Environmental Ethics (3) – required 4. General Psychology (3)	
VI	18	6	1. Probabilistic Models in Operations Research (3) 2. Quality Control and Six Sigma (3) 3. Integrated Mfg. Systems (3) 4. Production Systems Analysis (3) 5. Engineering Experimental Design (3)	Indiv. & Soc. Electives (choose 1): 1. Social Problems (3) 2. Principle of Macroeconomics (3) 3. Environmental Ethics (3) – required 4. General Psychology (3)	
VII	18	6	1. Human Side of Organizations (3) 2. Human Factor & Ergonomic in Design (3)	IE Electives (choose 1): 1. Project Management (3) 2. Supply Chain Management (3)	

Sem.	Credits	# of Courses	Undergraduate Courses (Credit Hours)		
			Compulsory Courses	Elective Courses	Nationally Compulsory Courses
			3. Simulation Modeling & Analysis (3) 4. Internship for IE (3) 5. Senior Capstone Project I (3)	3. Technical Sales & Marketing (3) 4. Engineering Decision Making Under Uncertainty (3) 5. Engineering Statistics (3) 6. Reliability Engineering (3) 7. Survey of Optimization Methods (3) 8. The Systems Engineering Process (3) 9. Cost Estimation (3) 10. Engineering Entrepreneurship (3)	
VIII	13	4	1. Embedded Computer Systems (4) 2. Senior Capstone Project II (3)	IE Electives (choose 1): 1. Project Management (3) 2. Supply Chain Management (3) 3. Technical Sales & Marketing (3) 4. Engineering Decision Making Under Uncertainty (3) 5. Engineering Statistics (3) 6. Reliability Engineering (3) 7. Survey of Optimization Methods (3) 8. The Systems Engineering Process (3) 9. Cost Estimation (3) 10. Engineering Entrepreneurship (3)	
Total	145	50	40	7	3

8. Distribution of Courses in Each Semester

Tables 17-24 tabulates all courses per semester which are categorized as Theory, Practicum, and Practice.

Table 17. Courses in Semester I.

SEMESTER I						
No	**Code**	**Course**	**Credit Hours**			
			Theory	**Laboratory**	**Practice**	**Total**
1	GHUM1303	World Religions (Trad & Cultr)	3			3
2	GCOM1304	Composition I (English)	3			3
3	GSCI1303	General Chemistry I	3			3
4	GSCI1103L	General Chemistry I Lab		1		1
5	GMAT1505	Calculus & Analytical Geometry I	5			5
6	GENG1301	Introduction to Engineering	3			3
Semester I Load			17	1		18

Table 18. Courses in Semester II.

SEMESTER II						
No	**Code**	**Course**	**Credit Hours**			
			Theory	**Laboratory**	**Practice**	**Total**
1	GCOM1305	Composition II (English)	3			3
2	GSCI1405	General Physics with Calculus I	4			4
3	GSCI1105L	General Physics with Calculus I Lab		1		1
4	GSCI2304	General Chemistry II	3			3
5	GSCI2104L	General Chemistry II Lab		1		1
6	GMAT2506	Calculus & Analytical Geometry II	5			5
7	ENGR1301	Comp. Programming for Engineers	2		1	3
Semester II Load			17	2	1	20

Table 19. Courses in Semester III.

SEMESTER III						
No	**Code**	**Course**	**Credit Hours**			
			Theory	**Laboratory**	**Practice**	**Total**
1	IENG2301	Intro. to Systems & Industrial Engr.	2		1	3
2	IENG2302	Object Oriented Modeling & Design	2		1	3
3	GHUM1207	Kewarganegaraan	2			2
4	GSCI2406	General Physics with Calculus II	4			4
5	GSCI2106L	General Physics with Calculus II Lab		1		1
6	GMAT2507	Calculus & Analytical Geometry III	5			5
7	VCDD3345	Indonesian Arts Hist. (Arts & Hum)	3			3
Semester III Load			18	1	2	21

Table 20. Courses in Semester IV.

SEMESTER IV						
No	**Code**	**Course**	**Credit Hours**			
			Theory	**Laboratory**	**Practice**	**Total**
1	IENG2103	IE Colloquium			1	1
2	IENG2304	Engineering Economy	3			3
3	IENG2305	Mathematical Foundations for IE	2		1	3
4	ENGR2302	Statics	2	1		3
5	GSOC2304	Social Problems (Indv & Soc)	3			3
6	GHUM1301	Pancasila (Trad and Cultr)	3			3
7	GHUM1208	Bahasa Indonesia	2			2
Semester IV Load			15	1	2	18

Table 21. Courses in Semester V.

SEMESTER V						
No	**Code**	**Course**	**Credit Hours**			
			Theory	**Laboratory**	**Practice**	**Total**
1	IENG3306	Intro. to Engr. Probability & Statistics	2		1	3
2	IENG3307	Deterministic Operations Research	2		1	3
3	IENG3308	Software for Engineers	2		1	3
4	IENG3309	Mfg. Processes for IE	3			3
5	IENG3109L	Mfg. Processes for IE Lab		1		1
6	IENG3310	Technical Writing	3			3
7	ENGR3303	Environmental Ethics (Indv & Soc)	2		1	3
Semester V Load			14	1	4	19

Table 22. Courses in Semester VI.

SEMESTER VI						
No	**Course**	**Course**	**Credit Hours**			
			Theory	**Laboratory**	**Practice**	**Total**
1	IENG3311	Prob. Models in Operations Research	2		1	3
2	IENG3312	Integrated Manufacturing Systems	2		1	3
3	IENG3313	Production Systems Analysis	2		1	3
4	IENG3314	Engineering Experimental Design	2		1	3
5	IENG3315	Quality Control and Six Sigma	2		1	3
6	GECO2301	Principle of Macroeconomics (Indv & Soc)	3			3
Semester VI Load			13		5	18

Table 23. Courses in Semester VII.

SEMESTER VII						
No	**Code**	**Course**	**Credit Hours**			
			Theory	**Laboratory**	**Practice**	**Total**
1	IENG4316	Simulation Modeling & Analysis	2		1	3
2	IENG4317	Human Factor & Ergonomic in Design	2		1	3
3	IENG4318	Project Management (IE Elective)	2		1	3
4	IENG4319	Human Side of Organizations	2		1	3
5	STEM4301	Internship			3	3
6	STEM4302	Senior Capstone Project I			3	3
Semester VII Load			8		10	18

Table 24. Courses in Semester VIII.

SEMESTER VIII						
No	**Code**	**Course**	**Credit Hours**			
			Theory	**Laboratory**	**Practice**	**Total**
1	IENG4320	Supply Chain Management (IE Elective)	2		1	3
2	IENG4321	Embedded Computer Systems	2	1	1	4
3	IENG4322	Technical Sales & Marketing (IE Elective)	2		1	3
4	STEM4303	Senior Capstone Project II			3	3
Semester VIII Load			6	1	6	13

TOTAL	108	7	30	145

9. Implementation Plan of Capstone Design and MBKM

9.1. Implementation of Capstone Design

The implementation of capstone design is applied in the integrated manufacturing system (IMS) class project that aims to revolutionize manufacturing processes by seamlessly integrating disparate systems. The IMS will establish a cohesive, efficient, and agile framework by leveraging cutting-edge technologies and methodologies. This framework will facilitate seamless coordination across design, production, supply chain management, and quality control, ensuring optimal performance and responsiveness to industry demands. Details of the project are provided in the capstone design project guideline document.

9.2. Implementation Model of MBKM

The following MBKM implementation in the Industrial Engineering Study Program is prepared in pursuant to PermenDikBud No. 3 Tahun 2020 (Standar Nasional Pendidikan Tinggi); Pasal 15 dan 18 on MBKM (Merdeka Belajar dan Kampus Merdeka).

The Industrial Engineering Study Program at Sampoerna University has a total of 145 credit hours in its degree plan Figure 3:

INDUSTRIAL ENGINEERING DEGREE PLAN
AY 2022-2023

In collaboration with: SAMPOERNA UNIVERSITY, BROWARD COLLEGE, THE UNIVERSITY OF ARIZONA

SEMESTER I

CODES	COURSE TITLE	CREDITS
GMAT1505	Calculus & Analytical Geometry I	5
GENG1301	Introduction to Engineering	3
GHUM1303	World Religions (Trads & Culture)	3
GSCI1303	General Chemistry I	3
GSCI1103L	General Chemistry I Lab	1
GCOM1304	Composition I (English)	3
	Total	**18**

SEMESTER II

CODES	COURSE TITLE	CREDITS
GMAT2506	Calculus & Analytical Geometry II	5
GSCI1405	General Physics with Calculus I	4
GSCI1105L	General Physics with Calculus I Lab	1
ENGR13031	Computer Programming for Engr Applications	3
GSCI2304	General Chemistry II	3
GSCI2104L	General Chemistry II Lab	1
GCOM1305	Composition II (English)	3
	Total	**20**

SEMESTER III

CODES	COURSE TITLE	CREDITS
GMAT2507	Calculus & Analytical Geometry III	5
GSCI2406	General Physics with Calculus II	4
GSCI2106L	General Physics with Calculus II Lab	1
IENG2301	Introduction to Systems & Industrial Engr	3
IENG2302	Object-Oriented Modeling & Design	3
GHUMXXXX	General Education (Arts and Humanities)	3
GHUM1207	Kewarganegaraan	2
	Total	**21**

SEMESTER IV

CODES	COURSE TITLE	CREDITS
IENG2304	Engineering Economy	3
IENG2305	Mathematical Foundations of IE	3
IENG2103	Industrial Engineering Colloquium	1
ENGR2302	Statics	3
GSOCXXXX	General Education (Individuals and Societies)	3
GHUM1208	Indonesian Language	2
GHUM1301	Pancasila (Trads and Culture)	3
	Total	**18**

SEMESTER V

CODES	COURSE TITLE	CREDITS
IENG3306	Introduction to Engr Probability & Statistics	3
IENG3307	Deterministic Operations Research	3
IENG3308	Software for Engineers	3
IENG3309	Manufacturing Process for IE	3
IENG3109L	Manufacturing Process for IE Lab	1
IENG3310	Technical Writing	3
ENGR3303	Environmental Ethics (Individuals and Societies)	3
	Total	**19**

SEMESTER VI

CODES	COURSE TITLE	CREDITS
IENG3311	Probabilistic Models in Operations Research	3
IENG3312	Integrated Manufacturing Systems	3
IENG3313	Production System Analysis	3
IENG3314	Engineering Experimental Design	3
IENG3315	Quality Control & Six Sigma	3
GSOCXXXX	General Education (Individual & Societies)	3
	Total	**18**

SEMESTER VII

CODES	COURSE TITLE	CREDITS
IENG4316	Simulation Modeling & Analysis	3
IENG4317	Human Factors & Ergonomics in Design	3
IENGXXXX	IE Technical Elective	3
IENG4319	Human Side Organization	3
STEM4302	Senior Capstone I	3
IENG 4301	Internship	3
	Total	**18**

SEMESTER VIII

CODES	COURSE TITLE	CREDITS
IENGXXXX	IE Technical Elective	3
IENG4321	Embedded Computer Systems	4
IENGXXXX	IE Technical Elective	3
STEM4303	Senior Capstone II	3
	Total	**13**

TOTAL CREDIT HOURS FOR DEGREE PROGRAM 145

SEMESTER IX

CODES	COURSE TITLE	CREDITS
STEM 4304	MBKM Internship	0
	Total	**0**

*Degree Plan is subject to change without prior notice

Note:

- Possible MBKM articulated courses
- Courses outside study program - GenEd
- Courses outside study program - Basic Science
- University of Arizona

Figure 3. IE Degree Plan (MBKM version).

Of which, the following is the breakdown:

GENERAL EDUCATION

CODES	COURSE TITLE	CREDITS	
GMAT1505*	Calculus & Analytical Geometry I	5	1
GSCI1303*	General Chemistry I	3	
GSCI1103L*	General Chemistry I Lab	1	
GHUM1303*	World Religions (Trads & Culture)	3	
GCOM1304*	Composition I (English)	3	
GSCI1405*	General Physics with Calculus I	4	2
GSCI1105L*	General Physics with Calculus I Lab	1	
GCOM1305*	Composition II (English)	3	
VCDD3345	Indonesia Art History (Arts and Humanities)	3	3
GHUM1207	Kewarganegaraan	2	
GSOC2303*	General Psychology (Individuals and Societies)	3	4
GHUM1208	Indonesian Language	2	
GHUM1301	Pancasila (Trads and Culture)	3	
ENGR3303	Environmental Ethics (Individuals and Societies)	3	5
GSOC2304*	Social Problems (Individual & Societies)	3	6
* BC Course	**Total**	**42**	

BASIC SCIENCE

CODES	COURSE TITLE	CREDITS	
GMAT2506*	Calculus & Analytical Geometry II	5	2
GSCI2304*	General Chemistry II	3	
GSCI2104L*	General Chemistry II Lab	1	
GMAT2507*	Calculus & Analytical Geometry III	5	3
GSCI2406*	General Physics with Calculus II	4	
GSCI2106L*	General Physics with Calculus II Lab	1	
* BC Course	**Total**	**19**	

SU INDUSTRIAL ENGINEERING COURSES

CODES	COURSE TITLE	CREDITS	
GENG1301*	Introduction to Engineering	3	1
ENGR1301	Computer Programming for Engr Applications	3	2
IENG2301	Introduction to Systems & Industrial Engr	3	3
IENG2302	Object-Oriented Modeling & Design	3	
IENG2304	Engineering Economy	3	4
IENG2305	Mathematical Foundations of IE	3	
IENG2103	Industrial Engineering Colloquium	1	
ENGR2302	Statics	3	
IENG3306	Introduction to Engr Probability & Statistics	3	5
IENG3309	Manufacturing Process for IE	3	
IENG3109L	Manufacturing Process for IE Lab	1	
IENG3310	Technical Writing	3	
IENG3313	Production System Analysis	3	6
IENG3312	Integrated Manufacturing Systems	3	
IENG3315	Quality Control & Six Sigma	3	
IENG 4301	Internship	3	X
IENG4319	Human Side Organization	3	7
STEM4302	Senior Capstone I	3	
STEM4303	Senior Capstone II	3	8
STEM4304	MBKM Internship	0-20	X
* BC Course	**Total**	**53**	

UA INDUSTRIAL ENGINEERING COURSES

CODES	COURSE TITLE	CREDITS	
IENG3307	Deterministic Operations Research	3	5
IENG3308	Software for Engineers	3	
IENG3311	Probabilistic Models in Operations Research	3	6
IENG3314	Engineering Experimental Design	3	
IENG4316	Simulation Modeling & Analysis	3	7
IENG4317	Human Factors & Ergonomics in Design	3	
IENG4318	Project Management	3	
IENG43222	Technical Sales & Marketing	3	8
IENG4321	Embedded Computer Systems	4	
IENG4320	Supply Chain Management	3	
	Total	**31**	

TOTAL CREDIT HOURS FOR DEGREE PROGRAM **145**

LEGEND	
	Possible MBKM articulated courses
	Courses outside study program - GenEd
	Courses outside study program - Basic Science
	University of Arizona

Figure 4. Breakdown of IE Degree Plan (MBKM version).

9.3. Courses taken at Other Study Programs at Sampoerna University (Maximum 12 Credit Hours)

General Education:

CODES	COURSE TITLE	CREDITS
GHUM2305	Fundamental Art of Drawing (Arts & Humanities)	3
VCDD3345	Indonesia Art History (Arts & Humanities)	3
GSOC2303	General Psychology (Individual & Society)	3
GSOC2304	Social Problems (Individual & Society)	3
ENGR3303	Environmental Ethics (Individual & Society)	3
GECO2301	Princ. of Macroeconomics (Individual & Society)	3
	Total	18

9.4. Courses taken at Other Institutions that can be Articulated as Sampoerna University's Courses (Maximum 40 Credit Hours)

General Education:

CODES	COURSE TITLE	CREDITS
GHUM1207	Kewarganegaraan	2
GHUM1208	Indonesian Language	2
GHUM1301	Pancasila	3
Total		7

SU Industrial Engineering:

CODES	COURSE TITLE	CREDITS
IENG3310	Technical Writing	3
IENG3312	Integrated Manufacturing Systems	3
IENG3315	Quality Control & Six Sigma	3
IENG4319	Human Side Organization	3
Total		21

University of Arizona:

CODES	COURSE TITLE	CREDITS
IENG3307	Deterministic Operations Research	3
IENG3308	Software for Engineers	3
IENG3311	Probabilistic Models in Operations Research	3
IENG3314	Engineering Experimental Design	3
IENG4316	Simulation Modeling & Analysis	3
IENG4317	Human Factors & Ergonomics in Design	3
IENG4318	Project Management	3
IENG4322	Technical Sales & Marketing	3
IENG4321	Embedded Computer Systems	4
IENG4320	Supply Chain Management	3
Total		31

9.5. Courses Taken at Industries or Other Institutions that can be Articulated as Sampoerna University's Courses (Maximum 20 Credit Hours)

SU Industrial Engineering:

CODES	COURSE TITLE	CREDITS
IENG3310	Technical Writing	3
IENG3312	Integrated Manufacturing Systems	3
IENG3315	Quality Control & Six Sigma	3
IENG4319	Human Side Organization	3
IENG 4301	Internship	3
STEM4302	Senior Capstone I	3
STEM4303	Senior Capstone II	3
STEM4304	MBKM Certified Internship	0 – 20
Total		21 – 41

9.6. Courses Offered by IE to Other Study Programs at Sampoerna University as MBKM Courses.

SU Industrial Engineering:

CODES	COURSE TITLE	CREDITS
IENG2304	Engineering Economy	3
IENG3306	Introduction to Engr Probability & Statistics	3
IENG3310	Technical Writing	3

9.7. Courses Offered by Sampoerna University to other Institutions as MBKM Courses.

SU Industrial Engineering (tentative):

CODES	COURSE TITLE	CREDITS
IENG2301	Introduction to Systems & Industrial Engr	3
IENG2304	Engineering Economy	3
IENG2305	Mathematical Foundations of IE	3
IENG3306	Intro. to Engr. Probability & Statistics	3
IENG3309	Manufacturing Process for IE	3
IENG3109L	Manufacturing Process for IE Lab	1
IENG3310	Technical Writing	3
IENG3312	Integrated Manufacturing Systems	3
IENG3315	Quality Control & Six Sigma	3
IENG4319	Human Side Organization	3
Total		40

9.8. Stipulations

Courses Cannot Be Double Counted:
Courses taken under sections I, II, or III, cannot overlap. In other words, you cannot claim the credit hours of the same course under different sections.

Capstone Courses:
Senior Capstones 1 & 2 can be taken entirely at a partner university, or it can be registered at SU while the project itself is done at a partner institution outside SU. When registered at SU but the students do the project at a partner institution, then it is the independent research scheme.

Internship (min 160 hours for a 3-hour course):
Internship can be done for a period of three months or six months. The 3-month internship is taken during Summer Semester between the 6th and 7th Semester. The 6-month internship can be done in two patterns:

(1) Three months summer semester + three months in 7th semester as Senior Capstone 1;
(2) Three to six months after Senior Capstone 2 defense and before the Judicium.

When a student is accepted for an internship program at a company for more than three months in the summer semester, the extra activities can be articulated into equivalent courses (Senior Capstone I and Senior Capstone II) offered at SU. For the extended internship to be counted as Senior Capstone I and/or II, students must have completed additional 160 hours (for Senior Capstone I) or 320 hours (for Senior Capstones I & II). The grade translation into one of these courses in SU is subject to the final report and oral examination assessments. The content of the final report, the oral examination, syllabus, as well as the grading standard are discussed before the internship is started.

The 6-month of MBKM Certified Internship at a company after Semester 8, the articulation of credits will not go towards the degree plan. Additional 20 credit hours, can be attained when the student is admitted into MBKM Certified Internship program after completing the Senior Capstone II defense and before the Judicium.

10. Management of Curriculum

Curriculum management is carried out by formulating the curriculum after the processes of evaluation and necessary revision of the previous curriculum have been done. In its supervision, a review of the RPS of each course subject is performed and its application is monitored. For example: the formulated CPL/SLO is reviewed for compliance with the relevant PLO by the curriculum team who understands the subject discussed in the meeting. The implementation of SLO is viewed from the assessment of SLO measurements i.e., PI (Performance Indicator), such as homework, quizzes, exams, presentations, final projects, etc. The implementation of the curriculum is reviewed by the measurement results a few times in a semester, which is usually discussed in the biweekly study program meetings. The Learning Management System by CANVAS platform is used for the monitoring of PLO achievement for every course. In the end of every semester, the results are presented and discussed among the permanent and non-permanent lecturers in Industrial Engineering Study Program.

CONCLUSION

The 2022 IE Study Program Curriculum is a result of revision of many elements in the 2019 Curriculum. The changes are made after the inputs from many parties, and it is hoped that the new curriculum can better help to ensure the learning outcomes are achieved by our graduates. The new curriculum is also hoped to make the curriculum management easier as each course is mapped to less learning outcomes and the learning outcomes mapped to courses are more focused compared to the 2019 curriculum. We believe that the new curriculum is not free from errors and the review of curriculum is still needed after one cycle in the future.

APPENDIX CURRICULUM DOCUMENT

INDUSTRIAL ENGINEERING

SAMPOERNA UNIVERSITY
CURRICULUM TEAM | JAKARTA

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PREFACE

This appendix is prepared to describe several aspects that are not covered in 2022 Industrial Engineering Curriculum but have already been implemented since the authorization of the curriculum. These three aspects are the (i) learning characteristics and (ii) learning assessment.

Jakarta, 18 April 2023
Team of Industrial Engineering Study Program

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APPENDIX A
LEARNING CHARACTERISTICS

IE study program implement the nine learning characteristics throughout its courses:

1. **Interactive**
   To reach its PLOs, IE Study Program focuses on the two-way interaction between the students and the lecturers. Examples include (i) case study discussions to deepen the understanding of concepts, (ii) interactive demonstrations of physical phenomena related to lecture material, and (iii) students are given assignments to explain concepts and discuss with other students.
2. **Holistic**
   IE Study Program adopts the learning process that fosters a comprehensive way of thinking. For example, the IE Study Program carries out (i) industrial visits to provide insight from various sides regarding the role of industry, academics, and the importance of studying at college as capital to contribute to the industrial world, (ii) learning with the help of teaching aids, such as ergonomic and biomechanic as well as smart production lab, thus initiating students' interest in industrial concepts, and students can immediately correlate the concepts studied with all the objects around them in everyday life.
3. **Integrative**
   PLOs of IE Study Program are achieved through integrated learning process by implementing inter-disciplinary and multi-disciplinary approaches. For example, project-based assessment is implemented in IE Study Program, where students form groups and work on lecture assignments that require integration of more than one field of knowledge. For example, in the Human Factors and Ergonomic Design course, students are given the task of creating or modifying the tools or equipment around them, so they meet the ergonomic principle. In the process, students apply the concept of manufacturing design which they learn independently.
4. **Scientific**
   IE Study Program prioritizes scientific approach in the learning process to achieve its PLOs. For example, in the Human Factors and Ergonomic Design course described in point 3 above, students are asked to explain the reasons for the modifications they made. Students may not make modifications without clear reasons. This reasoning must be built based on analysis or the concept of ergonomics so that students practice honing scientific reasoning competence.
5. **Contextual**
   The learning process at IE Study Program is designed in accordance with the needs to solve industrial engineering problems. For example, in the Simulation Modeling and Analysis course, students (assisted by lecturers) carry out simulation through ARENA Software in which they maximize the profit and optimize the queueing system. Analysis based on queueing theory was carried out to explain the results of the experiments carried out. This lecture activity is contextual because the efficiency of queue is everyone's concern when they come to a store or buy product through online marketplace.
6. **Thematic**
   The learning process at IE Study Program is designed in accordance with the scientific characteristics of the study program and it is linked to real-world problems. For example, in the Simulation Modeling and Analysis lecture, students are asked to discuss the activities that occur at the Mi Cazuela Restaurant; and in the end, students realize that simulation and queueing concepts are needed for the activities at the restaurant.

7. **Effective**
   The learning process at IE Study Program uses methods and tools such that the PLOs are achieved in an optimum time-duration. The learning process in the IE Study Program integrates technology, such as a hybrid classroom which is used when the lectures have to do online and offline at the same time. Apart from that, discussion of case examples or questions is carried out in class where students work on questions either individually or in groups and then present them in front of the class. After that, the lecturer provides assessments, comments and corrections.
8. **Collaborative**
   IE Study Program implements the learning process that involves the interaction between students to achieve the PLOs. For example, students form groups of 2 – 3 people to do group assignments. In this assignment, students are given a clear target, and they work together on the assignment. An example is the bridge group assignment in the Statics lectures, where students must collaborate to build a sturdy bridge from ice cream sticks capable of supporting the weight of a team member.
9. **Student Centered Learning (SCL)**
   The PLOs of IE Study Program are achieved through learning processes which prioritize the development of creativity, capacity, personality, students' needs, and lifelong learning. In SCL, students explore knowledge independently based on the title given by the lecturer, and the results of the exploration are presented and discussed.

The learning characteristics are applied through various teaching methods, including:

1. **Project Based**
   Project-Based Learning (PBL) is an instructional approach where students actively explore real-world problems and challenges through projects. In PBL, students work on a project over an extended period, which culminates in a final product or presentation. This method encourages critical thinking, problem-solving, collaboration, and self-management, providing students with opportunities to apply their knowledge in meaningful ways.
2. **Case Based**
   Case-Based Learning (CBL) is an instructional method where students learn by engaging with real or hypothetical cases that represent complex, often ambiguous problems. In CBL, students analyze and discuss these cases, typically working in groups, to explore different perspectives and develop solutions. This approach encourages critical thinking, problem-solving, and the application of theoretical knowledge to practical situations.
3. **Research Based**
   Approach where students actively engage in research activities as a central component of their learning process. In this approach, students are not just passive recipients of knowledge; instead, they are involved in the process of inquiry, investigation, and discovery, which helps them develop critical thinking, problem-solving, and independent learning skills. RBL often involves students conducting experiments, working on real-world projects, or participating in research projects, often in collaboration with faculty or other researchers.
4. **Lecturing Based**
   Method where the instructor primarily delivers information through verbal presentations, often supported by visual aids such as slides or a blackboard. The students typically play a passive role, mainly listening and taking notes, with limited interaction or engagement during

the lecture. This approach emphasizes the transmission of knowledge from the instructor to the student, often focusing on memorization and repetition.

5. **Flipped Learning**
   Flipped Learning is an educational approach in which traditional lecture-based instruction is reversed. Instead of introducing new concepts in class, students first encounter the material on their own, typically through reading assignments or pre-recorded lectures. Classroom time is then devoted to engaging activities that reinforce and apply the concepts, such as discussions, problem-solving, or collaborative projects. This method shifts the focus from teacher-centered instruction to student-centered learning, fostering greater engagement and understanding.

Table A.1 provides an overview of how these nine learning characteristics are implemented through various teaching methods in the IE study program. Furthermore, in Table A.2., each method is mapped to IE courses, demonstrating the integration of diverse pedagogical approaches to achieve the program's learning outcomes.

Table A.1. Learning characteristics implementation on primary learning method.

No	Learning Methods	Learning Characteristics								
		Interactive	Holistic	Integrative	Scientific	Contextual	Thematic	Effective	Collaborative	Student Centered Learning (SCL)
1	**Project Based**	✓	✓	✓	✓	✓	✓	✓	✓	✓
2	**Case Based**	✓	✓	✓	✓	✓	✓	✓	✓	✓
3	**Research Based**	✓	✓	✓	✓	✓	✓	✓	✓	✓
4	**Lecturing Based**	-	-	-	✓	-	-	Some-times	-	-
5	**Flipped Learning Based**	✓	✓	✓	✓	✓	✓	✓	✓	✓

Table A.2. Primary learning methods mapping for IE courses.

No	Course	Primary Learning Method				
		Project Based	Case Based	Research Based	Lecturing Based	Flipped Learning Based
1	Deterministic Operations Research		✓			
2	Software for Engineers		✓			
3	Social Problems		✓			
4	Manufacturing Process Lab		✓			
5	Human Factor & Ergonomic in Design					✓
6	Simulation Modeling & Analysis					✓
7	Embedded Computer Systems					✓
8	Project Management (IE Elective)					✓

No	Course	Primary Learning Method				
		Project Based	Case Based	Research Based	Lecturing Based	Flipped Learning Based
9	Supply Chain Management (IE Elective)					✓
10	Technical Sales & Marketing (IE Elective)					✓
11	Engineering Experimental Design					✓
12	World Religions				✓	
13	Composition I				✓	
14	Composition II				✓	
15	Pancasila	✓				
16	Bahasa Indonesia				✓	
17	Citizenship/Kewarganegaraan				✓	
18	General Physics with Calculus I				✓	
19	General Physics with Calculus I Lab				✓	
20	General Physics with Calculus II				✓	
21	General Physics with Calculus II Lab				✓	
22	General Chemistry I				✓	
23	General Chemistry I Lab				✓	
24	General Chemistry II				✓	
25	General Chemistry II Lab				✓	
26	Calculus & Analytical Geometry I				✓	
27	Calculus & Analytical Geometry II				✓	
28	Calculus & Analytical Geometry III				✓	
29	Mathematical Foundations for IE				✓	
30	Introduction to Engineering				✓	
31	Computer Programs for Engineers				✓	
32	Principle of Macroeconomics				✓	
33	Indonesian Arts History				✓	
34	Introduction to Systems & Industrial Engr.				✓	
35	Manufacturing Process				✓	
36	Engineering Economy				✓	
37	Production Systems Analysis				✓	
38	IE Colloquium				✓	
39	Technical Writing	✓				
40	Intro. to Engr. Probability & Statistics	✓				
41	Probabilistic Models in Operations Research	✓				
42	Statics	✓				
43	Object Oriented Modeling & Design	✓				
44	Quality Control and Six Sigma	✓				
45	Internship for IE	✓				

No	Course	Primary Learning Method				
		Project Based	Case Based	Research Based	Lecturing Based	Flipped Learning Based
46	Senior Capstone Project I	✓				
47	Senior Capstone Project II	✓				
48	Human Side of Organizations			✓		
49	Integrated Manufacturing Systems			✓		
50	Environmental Ethics			✓		

APPENDIX B
LEARNING ASSESSMENT

This part discusses (A) Assessment Principles, (B) Assessment Techniques, and (C) Implementation of Assessment.

A. Assessment Principles

The learning assessment (student learning processes and outcomes) at IE Study Program is carried out based on the following assessment principles:

1. Educative

Educative is an assessment that motivates students to be able to improve their planning and learning methods, and ultimately be able to achieve PLOs. For example, before the mid-term or final assessment is carried out, students are given an assessment in the form of a mini quiz which can measure how far SLOs has achieved certain material. Figures B.1 to Figure B.4 shows evidence of implementation on LMS Canvas that giving Quiz 1 (Pre-Test 1) helps students measure their mastery of SLOs 1, 2, and 3. Students are given feedback on their achievements, so that they have the opportunity to improve their learning outcomes and succeed in the mid-semester assessment which measures achievement of SLOs 1, 2, 4, and 5. Apart from that, in each lecture session, students are also invited to reflect on the learning process they have gone through. This reflection facilitates students to carry out self-assessment of what they have learned, what is interesting about the material or learning activities, what they do not understand and want to know more. That way, students can improve their learning methods so they can achieve a CPL in the course.

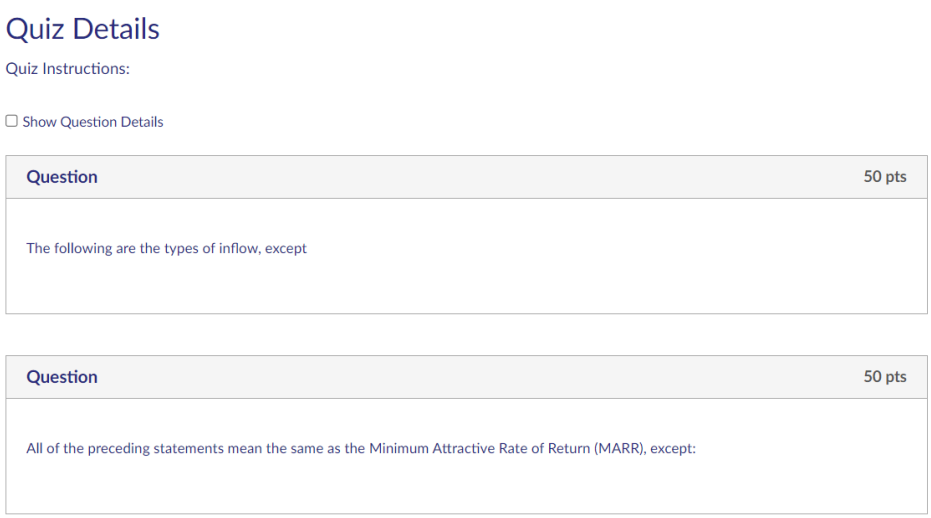


Figure B.1. Quiz 1 description

VIII. Assessment and Grading System

a. Assessment Type

The assessment of the defined SLOs will be conducted throughout the course, and consist of:

No	Assessment type	Frequency	Weight (%)	SLO/ *CPMK* measured	Remarks*
1	Pre-Test	12 times	15%	SLO-1,2,3,4,5	
2	Class Participation Homework	12 times	25%	SLO-1,2,3,4,5	
3	Midterm-Exam 1	1 time	15%	SLO-1,2,3,4,5	
4	Midterm-Exam 2	1 time	15%	SLO-1,2,3,4,5	
5	Final Exam	1 time	30%	SLO-1,2,3,4,5	
Total			100%		

Figure B.2. List of assessment

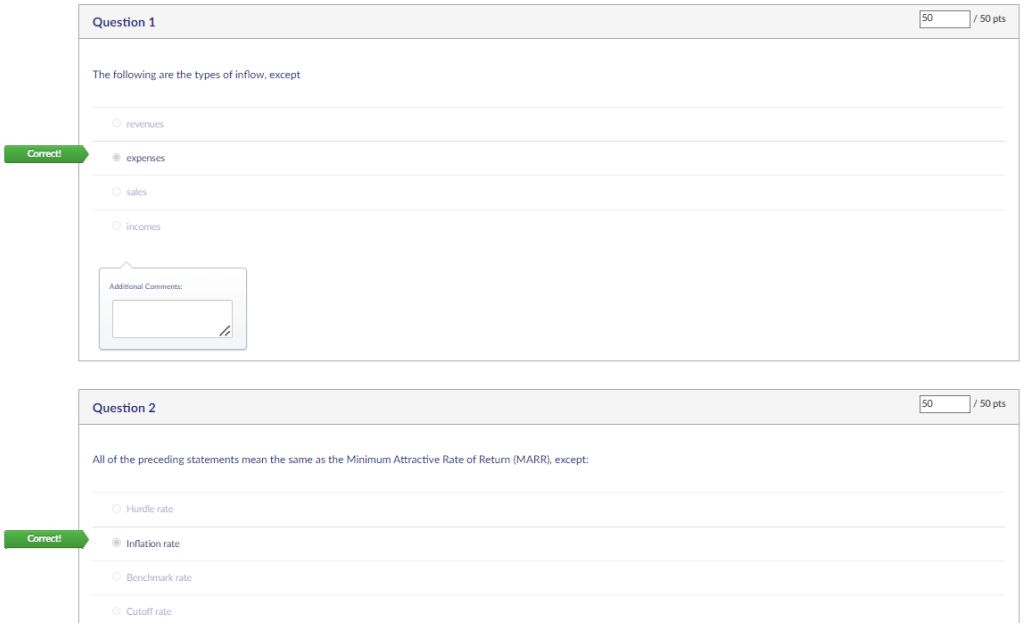
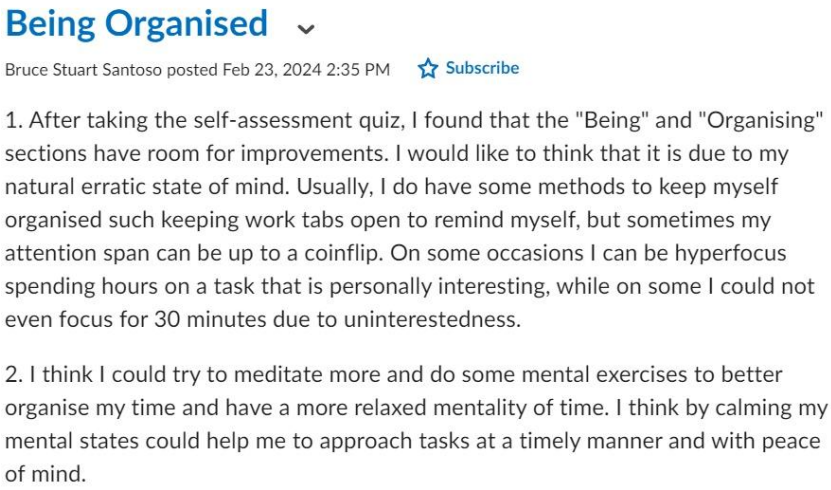


Figure B.3. Example of feedback on achievement of Quiz 1



Being Organised

Bruce Stuart Santoso posted Feb 23, 2024 2:35 PM Subscribe

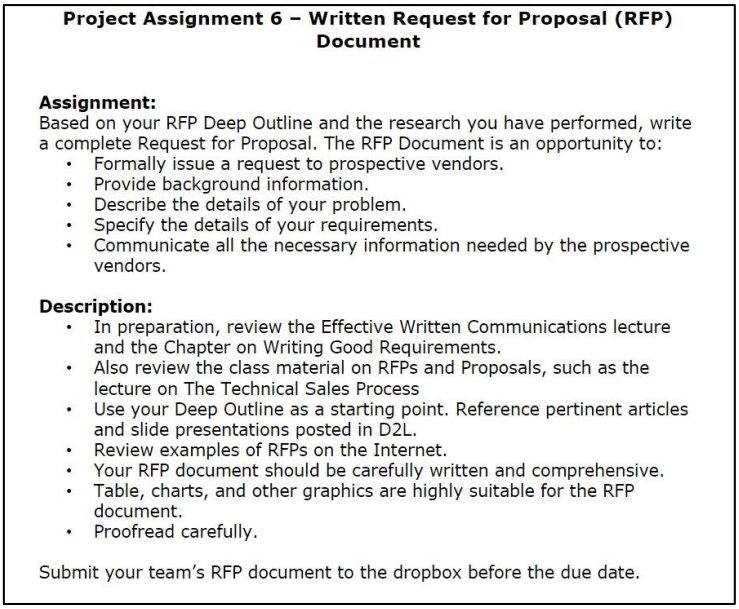
1. After taking the self-assessment quiz, I found that the "Being" and "Organising" sections have room for improvements. I would like to think that it is due to my natural erratic state of mind. Usually, I do have some methods to keep myself organised such keeping work tabs open to remind myself, but sometimes my attention span can be up to a coinflip. On some occasions I can be hyperfocus spending hours on a task that is personally interesting, while on some I could not even focus for 30 minutes due to uninterestedness.

2. I think I could try to meditate more and do some mental exercises to better organise my time and have a more relaxed mentality of time. I think by calming my mental states could help me to approach tasks at a timely manner and with peace of mind.

Figure B.4. Student's reflection at the end of learning

2. Authentic

Authentic assessment is an approach focused on a continuous learning process, with outcomes that reflect students' abilities throughout that process. An example of authentic assessment is when students are assigned a project to create a fictional company or business that partners with a vendor to solve a specific problem. This project includes tasks such as drafting an RFP proposal and developing a final company website, all of which are integral parts of the student's assessment. Students are required to update their project progress each week, detailing their work on the RFP, website, or vendor's design solutions, and submit it on the provided learning platform. Regular updates ensure that lecturers are informed about how students collaborate outside of class to successfully complete the project and develop solutions for the company's problem. Based on the students' progress, lecturers can assess aspects of student collaboration and problem-solving skills.



Project Assignment 6 – Written Request for Proposal (RFP) Document

Assignment:
Based on your RFP Deep Outline and the research you have performed, write a complete Request for Proposal. The RFP Document is an opportunity to:

- Formally issue a request to prospective vendors.
- Provide background information.
- Describe the details of your problem.
- Specify the details of your requirements.
- Communicate all the necessary information needed by the prospective vendors.

Description:

- In preparation, review the Effective Written Communications lecture and the Chapter on Writing Good Requirements.
- Also review the class material on RFPs and Proposals, such as the lecture on The Technical Sales Process
- Use your Deep Outline as a starting point. Reference pertinent articles and slide presentations posted in D2L.
- Review examples of RFPs on the Internet.
- Your RFP document should be carefully written and comprehensive.
- Table, charts, and other graphics are highly suitable for the RFP document.
- Proofread carefully.

Submit your team's RFP document to the dropbox before the due date.

Figure B.5. Description of assessment of making RFP for project

Section:	Points Possible	Points Received
Cover Letter	3	
Cover Page	1	
Table of Contents	1	
Exec Summary	8	
Intro/Company Overview	10	
Problem/Project Description	12	
Requirements	16	
Project Schedule	10	
Project cost/funding available	8	
Proposal requirements (eg outline of sections)	5	
Schedule of Events leading up to contract awd	10	
Weighted Selection criteria/Evaluation process	12	
Terms and Conditions	4	
TOTAL	100	

Figure B.6. Assessment rubric

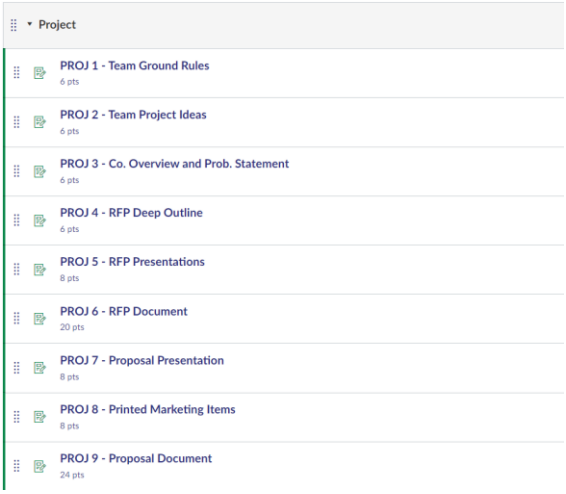


Figure B.7. Example of project progress

Figure B.8. Example of Proposal Project Paper

Figure B.9. Example of Project Website

3. Objective

Objective assessment is an assessment that is based on standards agreed between the lecturer and students and is free from the influence of the subjectivity of the assessor and those being assessed. All assessments in Industrial Engineering courses, both tests and non-tests, must include an assessment rubric that is integrated into LMS Canvas to ensure objective assessment. Students also have the opportunity to be assessed for their activeness and participation in a lecture. Furthermore, students are well informed regarding the assessment criteria for all assignments and tests given during one semester. They can also see

information related to the results of the lecturer's assessment and feedback on an assignment or test within a maximum period of two weeks after the deadline for submitting the assignment or carrying out the test. In this way, all students have the same opportunity to succeed in an assignment or test.

Figure B.9. Various rubric used on one course

GROUP PARTICIPATION SCORE CARD

Group #: _____

Name: _____

You need to assess the contributions and participations of your teammates. If you feel that he/she has contributed and participated just as much as everybody else in the group, give a score of **100**. Otherwise, adjust the score according to your assessment of his/her contributions and participations (between 0 – 99). **You cannot assess yourself**.

Name of Teammate	Contribution and Participation Score (0 – 100)

Figure B.10. Students' participation rubric

4. Accountable

Accountable is an assessment carried out in accordance with clear procedures and criteria, agreed upon at the start of the lecture, and understood by students. In the first lecture session, the lecturer must explain the Semester Learning Plan (RPS) including the types of assessments, procedures and criteria. Lecturers and students build class agreements together from the first lecture session. In this way, students understand how they are assessed and can be successful in the course.

Student Learning Recommendations:

- Read the Course Syllabus to know weekly learning.
- Use the Textbook References and the Video References regularly.
- Actively participate in the weekly in class activities.
- Complete the quizzes, assignments, and exams.
- Monitor for any updates and Announcements.

If you have any problems or concerns with the course or materials, please feel free to contact me. You can contact me via email at wira.redi@sampoerna.ac.id or via MS-Teams, or via Canvas's Inbox.

Figure B.11. Example of information on how students can be successful in the course

Late Work and Make-up Assessments

It is at the discretion of the instructor to offer a make-up activity and is not guaranteed. Make-up tests will only be considered under extenuating circumstances, and with prior notification and documentation (original funeral notice, original doctor note, etc.). Scheduling appointments and vacations are not valid reasons for requesting a make-up test. Any late submissions without any valid reason will be scored zero.

b. Grading System

Grade		Points/ weight	Grade Description (as stated in the Academic Policy)
A	Excellent / *Sangat Baik*	**4**	All SLOs have been fulfilled in an excellent way
B	Good / *Baik*	**3**	All SLOs have been fulfilled in a very good way
C	Average / *Cukup*	**2**	All SLOs have been fulfilled in a satisfactory way
D	Below Average / *Kurang*	**1**	All SLOs have been fulfilled in a sufficient way
F	Fail / *Tidak lulus*	**0**	All SLOs have not been fulfilled

To successfully pass this course, students must achieve a minimum final grade of **C**.

Figure B.12. Example of late assessment submission policy given in RPS

5. Transparent

Transparent is an assessment whose procedures and assessment results can be accessed by all stakeholders. Assessments can be accessed by the Head of PS, Dean, Vice Rector of Academic Affairs, and the Center for Excellence in Teaching and Learning (CETL) via LMS Canvas. Apart from that, in practice, DTPS also receives feedback from the Head of PS on mid and final semester assessments, both in the form of tests and non-tests. In the coming Academic Year, DTPS will be required to obtain approval from the Head of PS for mid-term and final semester assessments.

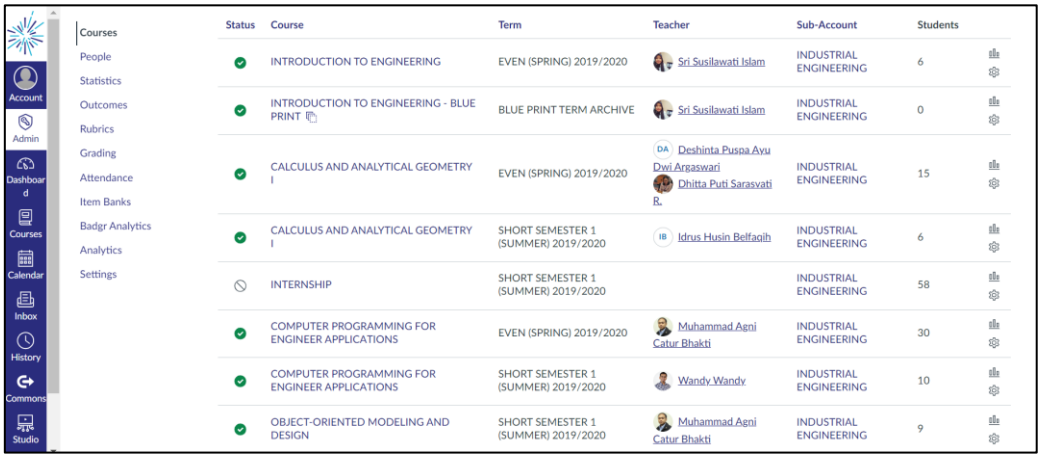
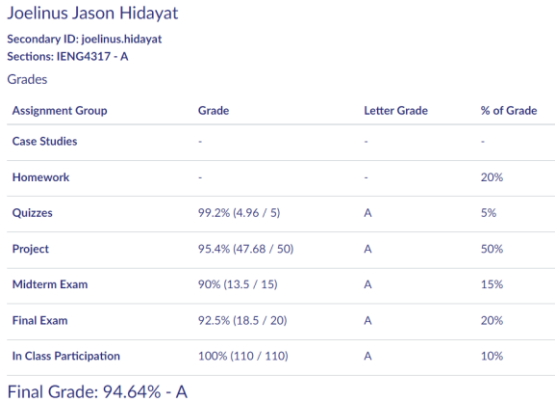


Figure B.13. Super admin view of LMS CANVAS

Figure B.14. View of assessment on Human Factors & Ergonomics in Design course

Based on this explanation, the assessment implementation at Sampoerna University's Industrial Engineering Study Program has implemented assessment principles and used various assessment techniques and instruments as well. Assessment reporting in the form of student success qualifications in taking a course is also delivered via LMS Canvas or academic portals in the form of a Student Study Result Card, as shown in the following figures.


Joelinus Jason Hidayat
Secondary ID: joelinus.hidayat
Sections: IENG4317 - A
Grades

Assignment Group	Grade	Letter Grade	% of Grade
Case Studies	-	-	-
Homework	-	-	20%
Quizzes	99.2% (4.96 / 5)	A	5%
Project	95.4% (47.68 / 50)	A	50%
Midterm Exam	90% (13.5 / 15)	A	15%
Final Exam	92.5% (18.5 / 20)	A	20%
In Class Participation	100% (110 / 110)	A	10%

Final Grade: 94.64% - A

Figure B.16. View of individual achievement of a student on a particular course

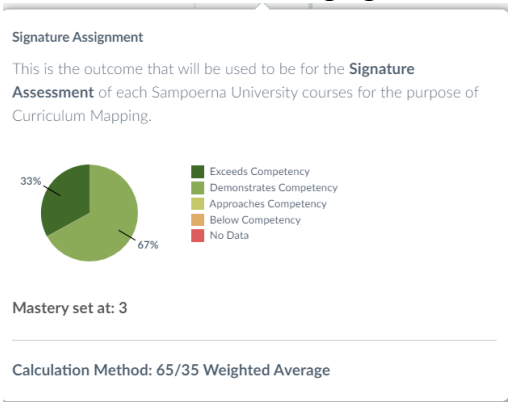


Figure B.17. View of achievement of all students on one course

B. Assessment Techniques

1. Observation

In practice, observation is one of the assessment techniques in the learning process in the Industrial Engineering Study Program. For example, students are asked to work on questions on the whiteboard, then the lecturer observes the process of working on the questions which can show students' thinking patterns. Generally, in this technique, lecturers provide direct feedback to students if there are misconceptions of the students' way of thinking. Observation techniques with output in the form of student grades are generally carried out on assignments that are presentations of project assignments, whether individual or group in nature. An example is the final presentation of Technical Sales and Marketing.

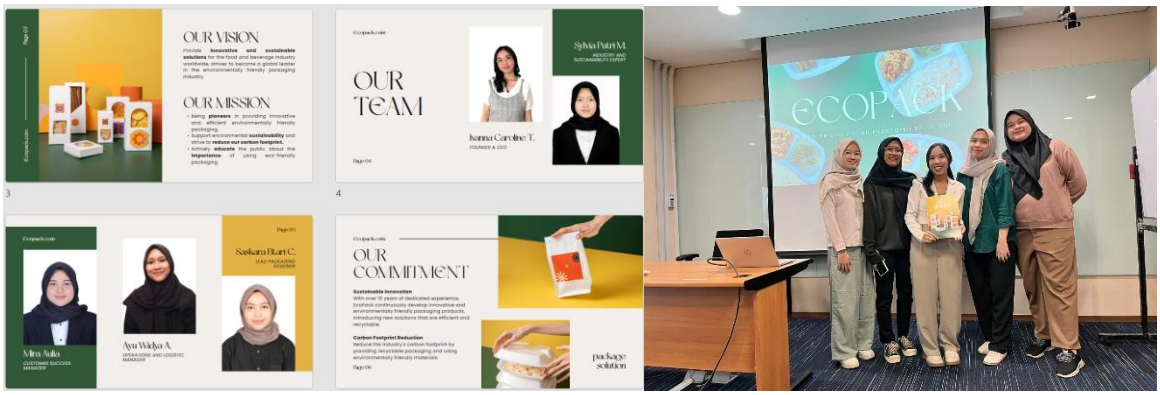


Figure B.19. Presentation of Technical Sales and Marketing class

2. Participation

Participation assessment techniques are aimed at attracting students' desire to learn actively. Active learning means discussing in class, answering questions, or working on questions voluntarily (without being appointed). One example is in the Simulation Modeling and Analysis course, the lecturer gives students an assignment to discuss a topic related to the concept restaurant simulations on a certain condition. Grades will be given to students who actively discuss in the session.

Figure B.20. Students' discussion in Simulation Modeling and Analysis class

GROUP PARTICIPATION SCORE CARD

Group #: _____

Name: _____

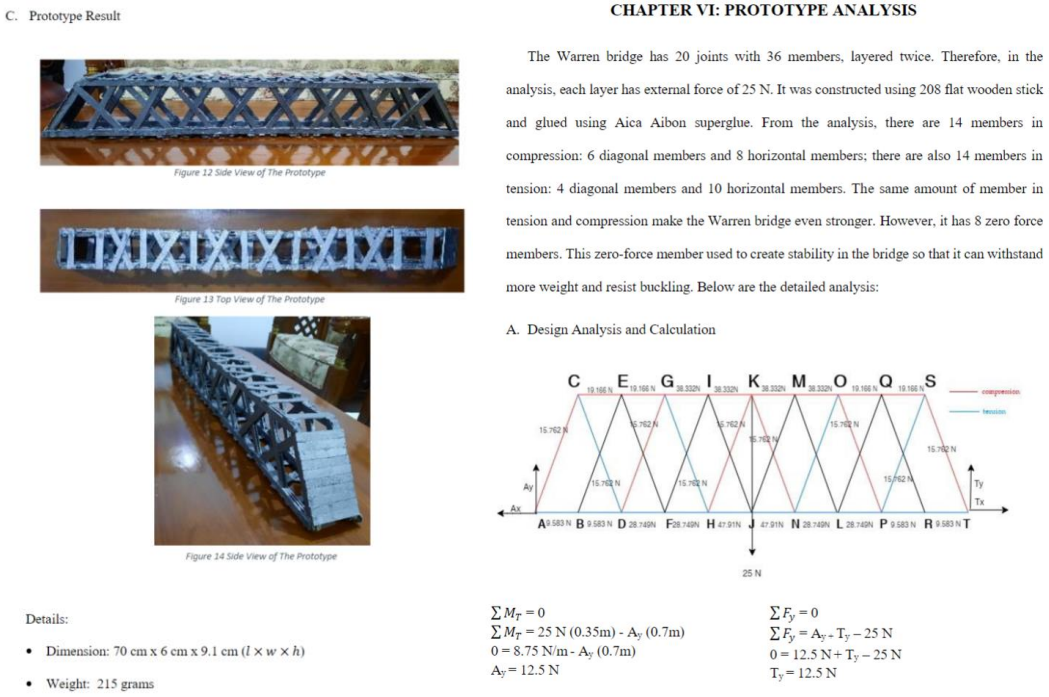
You need to assess the contributions and participations of your teammates. If you feel that he/she has contributed and participated just as much as everybody else in the group, give a score of **100**. Otherwise, adjust the score according to your assessment of his/her contributions and participations (between 0 – 99). **You cannot assess yourself**.

Name of Teammate	Contribution and Participation Score (0 – 100)

Figure B.21. Assessment based on the students' participation on the discussion

3. Performance (*Unjuk Kerja*)

For example, in the Statics course, students are asked to measure the tension on a bridge that they assemble themselves. They are required to test their bridge by standing on it for at least 15 seconds. By the end of the semester, students can perform scientific measurements and summarize their findings in a scientific report.



C. Prototype Result

Figure 12 Side View of The Prototype

Figure 13 Top View of The Prototype

Figure 14 Side View of The Prototype

Details:

- Dimension: 70 cm x 6 cm x 9.1 cm ($l \times w \times h$)
- Weight: 215 grams

CHAPTER VI: PROTOTYPE ANALYSIS

The Warren bridge has 20 joints with 36 members, layered twice. Therefore, in the analysis, each layer has external force of 25 N. It was constructed using 208 flat wooden stick and glued using Aica Aibon superglue. From the analysis, there are 14 members in compression: 6 diagonal members and 8 horizontal members; there are also 14 members in tension: 4 diagonal members and 10 horizontal members. The same amount of member in tension and compression make the Warren bridge even stronger. However, it has 8 zero force members. This zero-force member used to create stability in the bridge so that it can withstand more weight and resist buckling. Below are the detailed analysis:

A. Design Analysis and Calculation

C E G I K M O Q S

A B D F H J N L P R T

25 N

$\sum M_T = 0$
$\sum M_T = 25\ N\ (0.35m) - A_y\ (0.7m)$
$0 = 8.75\ N/m - A_y\ (0.7m)$
$A_y = 12.5\ N$

$\sum F_y = 0$
$\sum F_y = A_y - T_y - 25\ N$
$0 = 12.5\ N + T_y - 25\ N$
$T_y = 12.5\ N$

Figure B.22. Snapshot from the students report on measuring force and tension of their own bridge.

4. Written Test

Written tests are a very common assessment. For example, mid-semester exams and/or final semester exams. A snippet of the mid-semester exam answer from the Mathematical Foundations of Industrial Engineering class can be seen in Figure B.23.

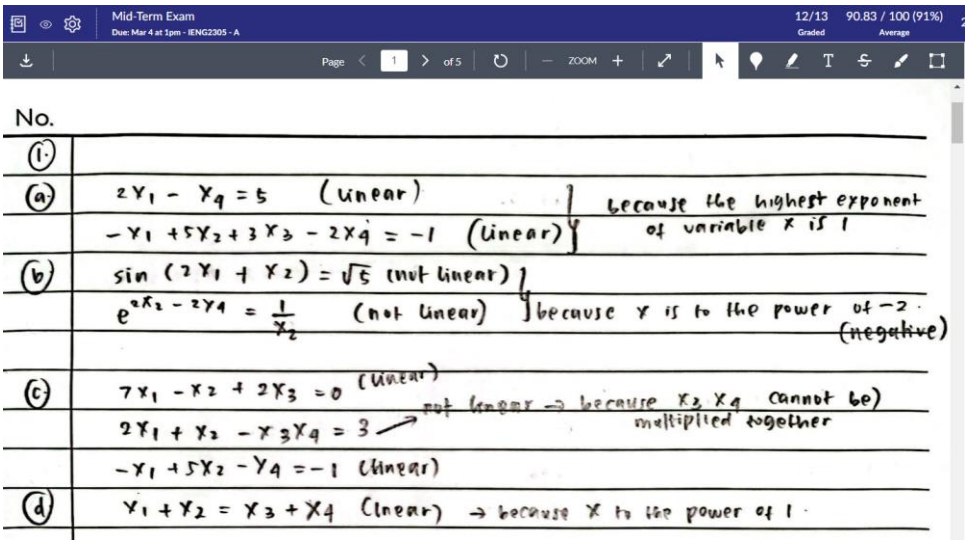


Figure B.23. Snapshot from Mathematical Foundations of Industrial Engineering's Final Exam

5. Oral Test

The oral test is one part of the knowledge assessment test. Oral tests can take the form of questions, orders, quizzes given by the lecturer orally and students respond to the questions directly. Oral tests have advantages such as: (1) they can assess students' abilities and level of knowledge, attitudes and personality because they are carried out face to face. In field implementation the oral test process is usually carried out at the Capstone or proposal and thesis examination which is carried out orally. Apart from that, oral tests are also often carried out in class by directly asking questions and listening to students' answers. An illustration of this oral test is given in Figure B.24 regarding the student's final assignment presentation.

Figure B.24. Example of oral test on final year project's presentation

6. Questionnaire

A questionnaire is a tool for assessing learning outcomes in the form of a written list of questions to gather information about something, such as students' views on assessments and ongoing lectures. This questionnaire was carried out in the form of filling out the EDOM as shown in Figure B.25.

Student Feedback

Semester	:	EVEN 2023/2024
Total Respondent	:	11
Total Class Participant	:	12
Detail of Respondent and Class Participants	:	

Study Program	Total Respondent	Total Class Participants
INDUSTRIAL ENGINEERING	10	11
SUAC-FST	1	1

Study Program	:	INDUSTRIAL ENGINEERING
Course Name	:	IENG2305 - Mathematical Foundations of Industrial Engineering
Section	:	A
Lecture Name	:	Anak Agung Ngurah Perwira Redi

PART A

ASPECT		AVERAGE PER SECTION
I. Student's Self- Reflection	Indicate the amount of work you did throughout the course!	4.00
	Rate the level of your involvement in the activities of this course!	4.18
	Rate how much knowledge and/or skills you gained from the course!	4.36
II. General Course Evaluation	The course objectives and learning outcomes were clearly provided.	4.09
	The course syllabus was clear to understand and useful.	4.09
	The learning activities and assignments support students to meet the learning outcomes of the course.	4.09
	The amount of learning materials was appropriate for this course.	4.09
	The course content was sufficiently challenging and stimulated students' interest.	4.18
	The Canvas module was well organized and helped students understand the underlying learning materials.	4.09

Figure B.25. Illustration of questionnaire's results at the end of semester

C. Implementation of Assessment

The implementation of assessment has the following components:

1. Contract of assessment plan

The assessment plan contract is essentially a collaborative agreement between lecturers and students that outlines the evaluation process for the course. The assessment plan contract was designed and agreed on the first day of class with an example shown in Figure B.26.

X. Assessment and Grading System

a. Assessment Type

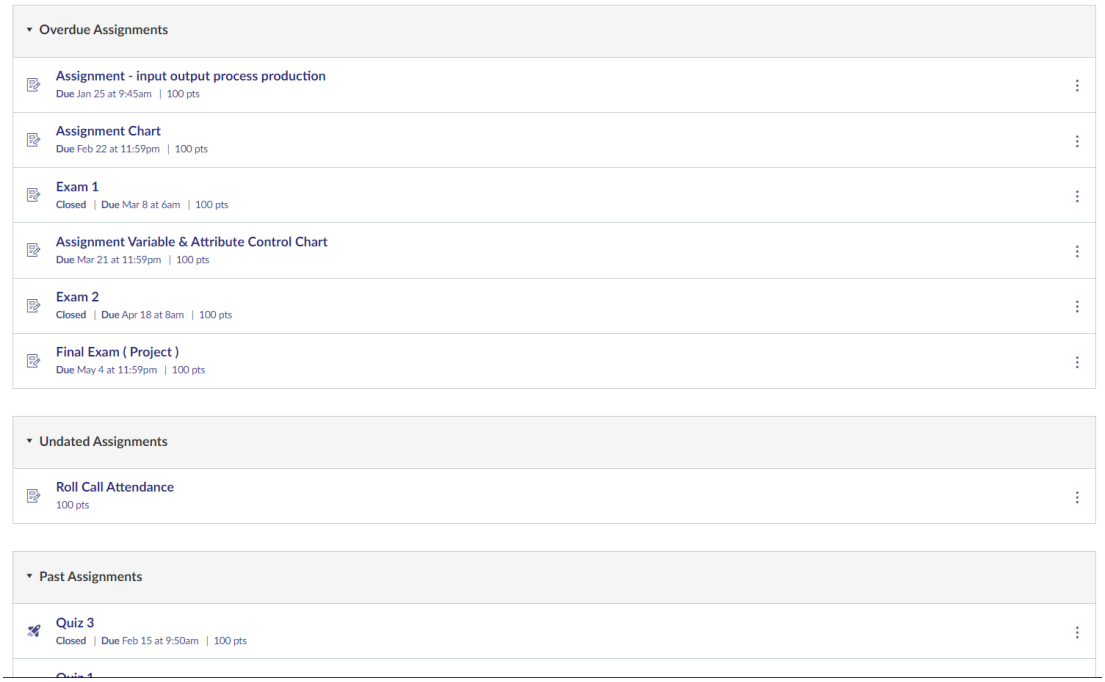
The assessment of the defined SLOs will be conducted throughout the course, and consist of:

No	Assessment Type	Frequency	Weight (%)	SLO/*CPMK* Measured	Remarks*
1	Class Participation & Attendance	28 times	10%	SLO-1 to SLO-5	
2	Homework	5 times	30%	SLO-1 to SLO-5	
3	Project (Project Assignment)	10 times	30%	SLO-1 to SLO-5	
4	Midterm	1 time	15%	Signature Assignment	
5	Final Exam	1time	15%	SLO-1 to SLO-5W	
	Total		100%		

Figure B. 26. Assessment plan contract from RPS

2. Implementation of assessment according to the contract

Student assessments are conducted in line with the agreed-upon contract, detailing the type, frequency, and percentage allocation for each assessment. Proof of the assessment carried out according to the contract can be shown on Canvas which is accessible to both students and lecturers. At the beginning of the lecture, the lecturer made assessment points according to the contract with percentage weights which are clearly shown in Figure B.27.



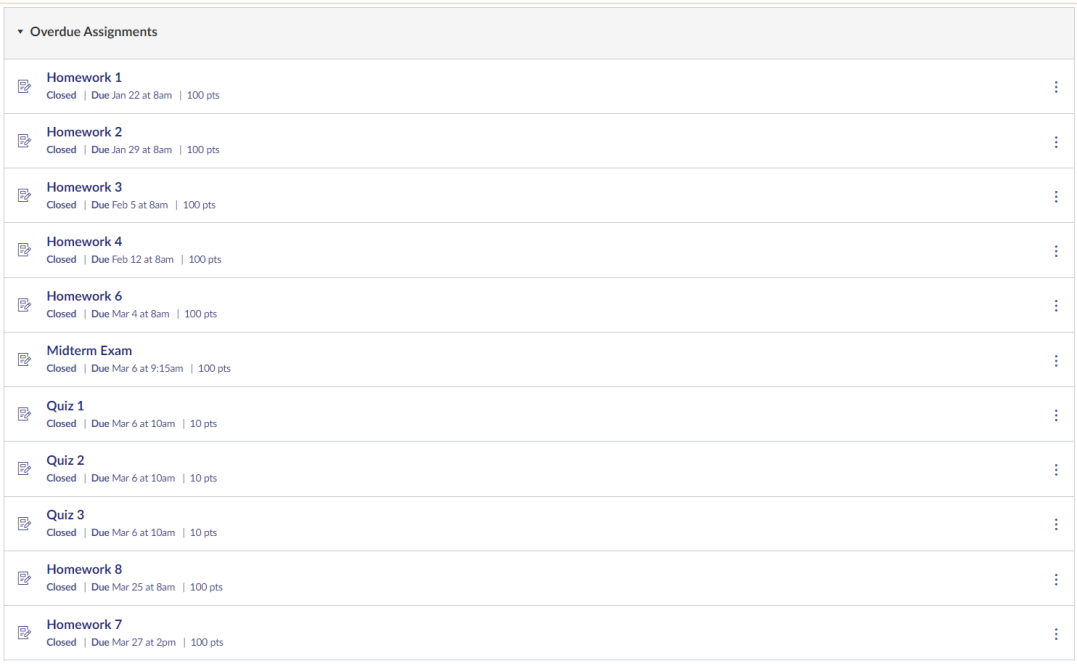


Figure B.27. Percentage of assessment which can be accessed by students on LMS

3. Feedback and appeal

Providing feedback or opportunities for students to ask about their results is very open. After the assessment process, the lecturer will return the assignments or work carried out and be given the opportunity to ask questions either online or in person. The form of feedback can be shown on the canvas as seen in Figure B.28.

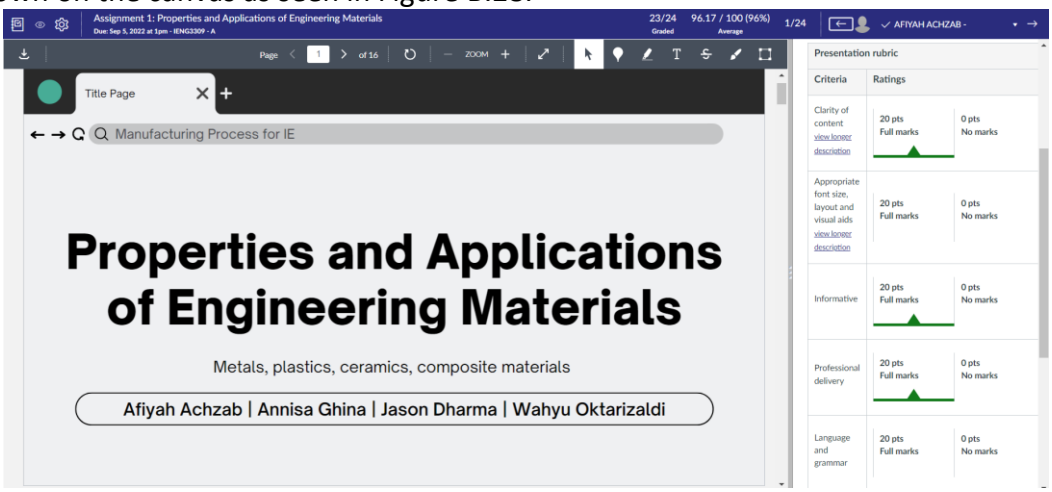


Figure B.28. Feedback on the submitted presentation

4. Documentation of assessment process

Documentation of student assessment results has been directly recorded on the canvas as shown in Figure B.29. All types of assessments down to percentages have also been clearly recorded, the results shown on this Canvas can also be downloaded.

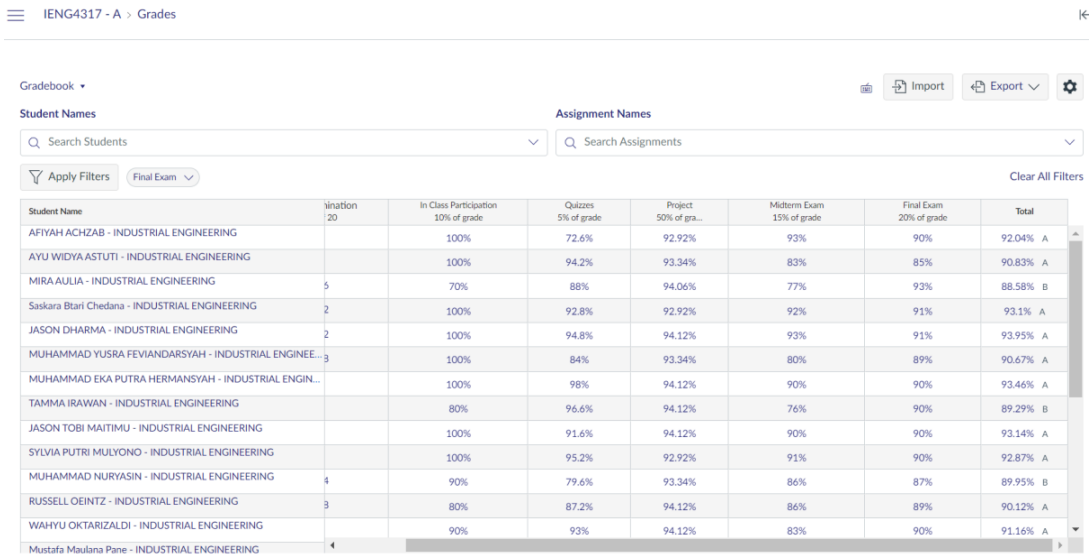


Figure B.29. Snapshot of assessment page which shows the grade for each student in each assignment

5. Procedure in the planning until final grading of the assessment

The planning procedure for assessment is explained at the beginning of the lecture which is illustrated in Figure B.30 which is carried out transparently and objectively.

b. Grading System

Grade		Points/ weight	**Grade Description** (as stated in the Academic Policy)
A	Excellent / *Sangat Baik*	**4**	All SLOs have been fulfilled in an excellent way
B	Good / *Baik*	**3**	All SLOs have been fulfilled in a very good way
C	Average / *Cukup*	**2**	All SLOs have been fulfilled in a satisfactory way
D	Below Average / *Kurang*	**1**	All SLOs have been fulfilled in a sufficient way
F	Fail / *Tidak lulus*	**0**	All SLOs have not been fulfilled

To successfully pass this course, students must achieve a minimum final grade of **C**.

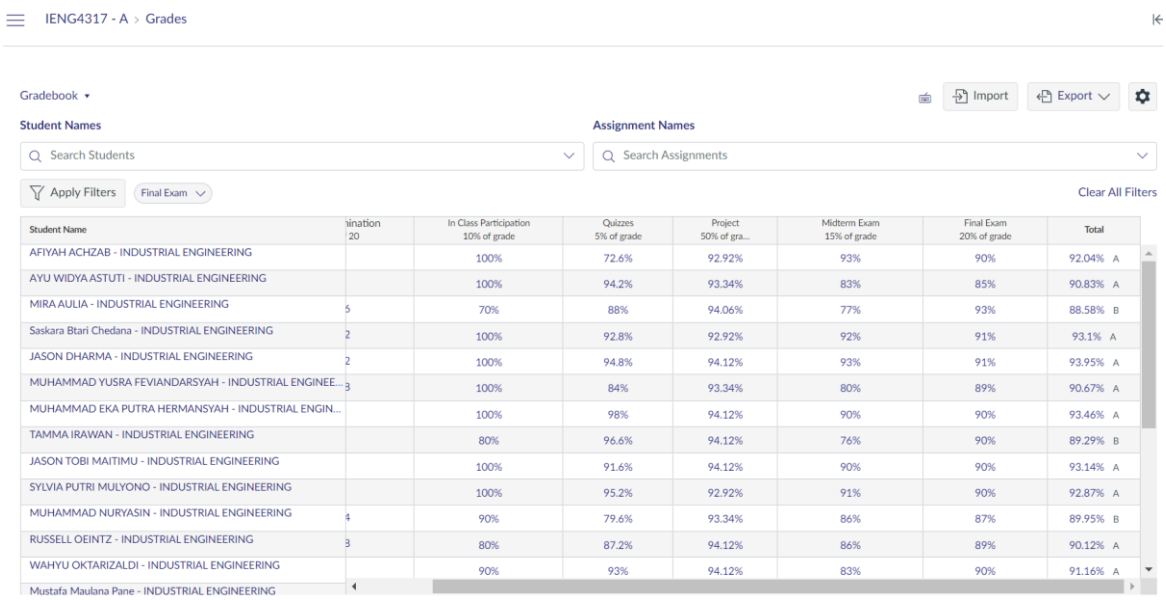
c. Grading Scale

Grade	Percentage
A	90% - 100%
B	80% - 89%
C	70% - 79%
D	60% - 69%
F	59% or below

Figure B.30. Documentation of the procedure in planning until grading of the assessment

6. Letter grading of courses

All courses in IE Study Program adopt letter grading which is shown in Figure B.31.



IENG4317 - A › Grades

Gradebook ▾ Import Export

Student Names: Search Students | Assignment Names: Search Assignments

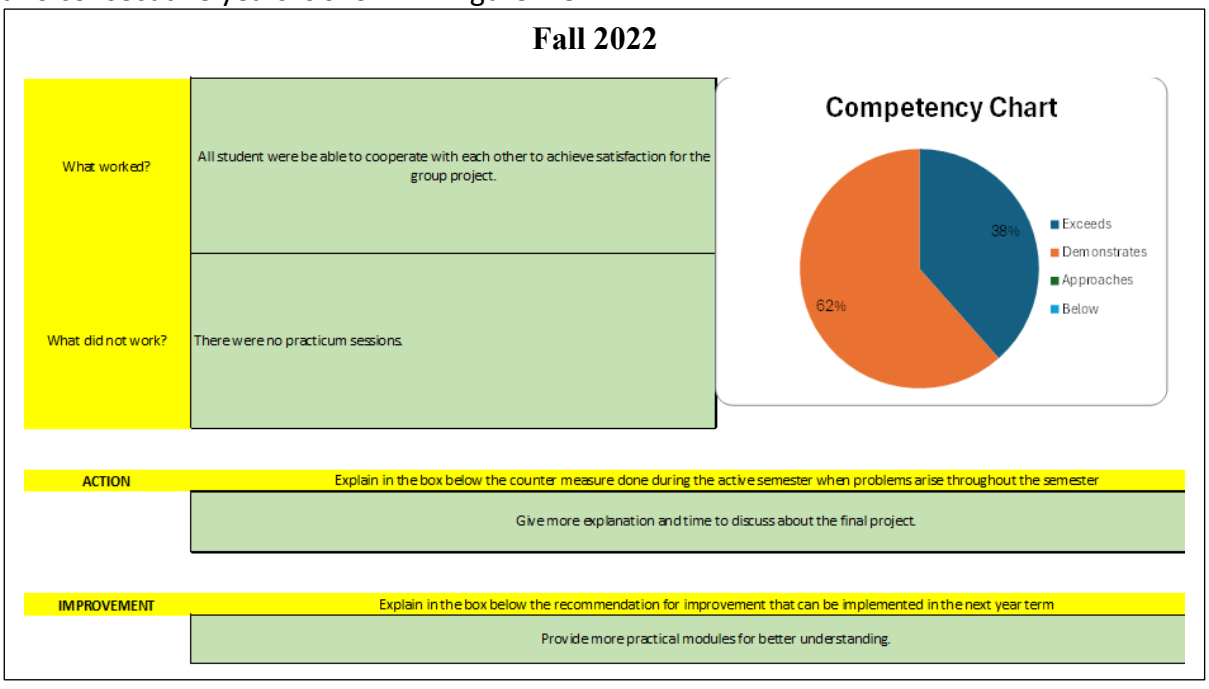
Apply Filters | Final Exam | Clear All Filters

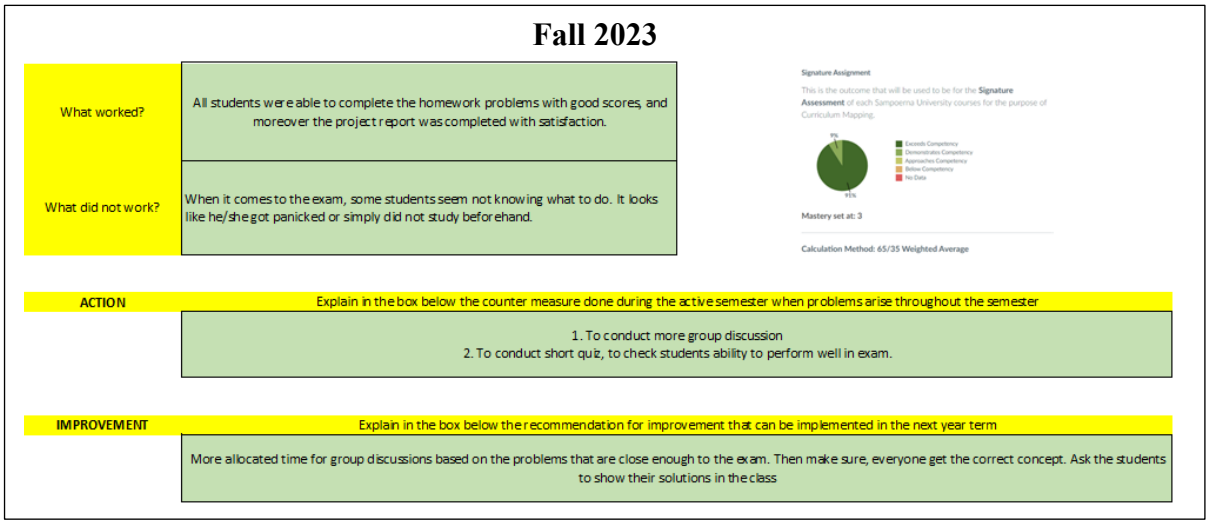
Student Name	ination 20	In Class Participation 10% of grade	Quizzes 5% of grade	Project 50% of gra...	Midterm Exam 15% of grade	Final Exam 20% of grade	Total
AFIYAH ACHZAB - INDUSTRIAL ENGINEERING		100%	72.6%	92.92%	93%	90%	92.04% A
AYU WIDYA ASTUTI - INDUSTRIAL ENGINEERING		100%	94.2%	93.34%	83%	85%	90.83% A
MIRA AULIA - INDUSTRIAL ENGINEERING	5	70%	88%	94.06%	77%	93%	88.58% B
Saskara Btari Chedana - INDUSTRIAL ENGINEERING	2	100%	92.8%	92.92%	92%	91%	93.1% A
JASON DHARMA - INDUSTRIAL ENGINEERING	2	100%	94.8%	94.12%	93%	91%	93.95% A
MUHAMMAD YUSRA FEVIANDARSYAH - INDUSTRIAL ENGINEE...	3	100%	84%	93.34%	80%	89%	90.67% A
MUHAMMAD EKA PUTRA HERMANSYAH - INDUSTRIAL ENGIN...		100%	98%	94.12%	90%	90%	93.46% A
TAMMA IRAWAN - INDUSTRIAL ENGINEERING		80%	96.6%	94.12%	76%	90%	89.29% B
JASON TOBI MAITIMU - INDUSTRIAL ENGINEERING		100%	91.6%	94.12%	90%	90%	93.14% A
SYLVIA PUTRI MULYONO - INDUSTRIAL ENGINEERING		100%	95.2%	92.92%	91%	90%	92.87% A
MUHAMMAD NURYASIN - INDUSTRIAL ENGINEERING	4	90%	79.6%	93.34%	86%	87%	89.95% B
RUSSELL OEINTZ - INDUSTRIAL ENGINEERING	3	80%	87.2%	94.12%	86%	89%	90.12% A
WAHYU OKTARIZALDI - INDUSTRIAL ENGINEERING		90%	93%	94.12%	83%	90%	91.16% A
Mustafa Maulana Pane - INDUSTRIAL ENGINEERING							

Figure B.31. Students' Grades based on Grading Policy

7. Evidence in planning and evaluation of assessment

For example, in the Human Factors & Ergonomic Design lecture, in the odd semester of the 2022/2023 academic year, it was concluded that students had difficulty abstracting from real-world problems due to insufficient practicums. So, in the odd semester of the 2023/2024 academic year, more practicums related to environmental awareness, therblig, as well as physiology were conducted. The cycle of Plan-Do-Check-Action (PDCA) of the assessment for two consecutive years is shown in Figure B.31.





Fall 2023

What worked?	All students were able to complete the homework problems with good scores, and moreover the project report was completed with satisfaction.
What did not work?	When it comes to the exam, some students seem not knowing what to do. It looks like he/she got panicked or simply did not study beforehand.

ACTION	Explain in the box below the counter measure done during the active semester when problems arise throughout the semester
	1. To conduct more group discussion 2. To conduct short quiz, to check students ability to perform well in exam.
IMPROVEMENT	Explain in the box below the recommendation for improvement that can be implemented in the next year term
	More allocated time for group discussions based on the problems that are close enough to the exam. Then make sure, everyone get the correct concept. Ask the students to show their solutions in the class

Figure B.32. PDCA notes on Human Factor and Ergonomics for Fall 2022 and Fall 2022 semesters

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Mapping Curriculum 2022

Category	BKSTI (K2)	Credit	SU	Credit
Mathematics and Basic Science	Calculus I	3	Calculus and Analytical Geometry I	5
	Linear Algebra	2	Mathematical Foundations of IE	3
	Calculus II	3	Calculus and Analytical Geometry II	5
	Statistics	4	Introduction to Engineering Probability and Statistics	3
	Physics	4	General Physics with Calculus I	4
	Physics Laboratory Work	1	General Physics with Calculus I Lab	1
	Others	12	General Chemistry I	3
			General Chemistry I Lab	1
			General Physics with Calculus II	4
			General Physics with Calculus II Lab	1
			General Chemistry II	3
			General Chemistry II Lab	1
			Calculus and Analytical Geometry III	5
Industrial Engineering Science	Engineering Mechanics	2	Statics	3
	Engineering Materials	2	Manufacturing Process for IE	3
	Engineering Drawing	2		
	Manufacturing Process	2		
	Engineering Drawing Practice	1	Manufacturing Process for IE Lab	1
	Manufacturing Process Practice	1		
	Introduction to Industrial Engineering	2	Introduction to Systems and Industrial Engineering	3
	Operations Research I	3	Deterministic Operations Research	3
	Operations Research II	3	Probabilistic Models in Operations Research	3
	Economics and Engineering Economics	3	Engineering Economy	3

Category	BKSTI (K2)	Credit	SU	Credit
	System Simulation	3	Simulation Modeling and Analysis	3
	Ergonomics	2	Human Factors and Ergonomics in Design	3
	Measurement and Design of Work System	2		
	Occupational Safety and Health	2		
	Quality Control and Assurance	3	Quality Control and Six Sigma	3
	Production Planning and Control	3	Production System Analysis	3
	System Modeling	2	Engineering Experimental Design	3
	Supply Chain System	2	Supply Chain Management (IE Technical Electives)	3
	Data Analytics	2	Software for Engineers	3
	Industrial Ecology	2	Environmental Ethics (Individual and Societies)	3
	Organizational Behavior	2	Human Side Organization (Social Science)	3
	Cost Analysis and Control	2	Technical Sales and Marketing (IE Technical Electives)	3
Information and Communication Technology	Computer Programming	2	Computer Programming for Engineering Applications	3
Industrial Engineering Design and Problem-based Experiments	Analysis and Design of Information System	2	Object-Oriented Modeling and Design	3
	Analysis and Design of Information System Practice	1		
	Industrial Organization Design and Management	3	General Psychology (Individual and Societies)	3
	Research Methodology	2	Technical Writing	3
	Integrated Laboratory Work	2	Integrated Manufacturing Systems	3
	Facilities Design	2		
	Facilities Design Practice	1		
	Product Design and Development	2	Project Management	3
Culminative Major Design	Undergraduate Thesis	4	Senior Capstone II	3

Category	BKSTI (K2)	Credit	SU	Credit
Expriences	Integrated System Design	2	Senior Capstone I (Integrated System Design)	3
Government Obligatory Courses	Religion	2	World Religions	3
	Citizenship	2	Kewarganegaraan	2
	Pancasila	2	Pancasila	3
	Indonesian	2	Indonesian Language	2

Excluded Courses	
Composition I (English)	3
Composition II (English)	3
Macroeconomics	3
Indonesia Art History (Arts and Humanities)	3
Industrial Engineering Colloquium	1
Internship	3
Embedded Computer Systems	4
Introduction to Engineering	3

Total Credits	145