ABET

Self-Study Report

for the

Electrical Engineering Study Program

at

Universitas Hasanuddin

Makassar, Indonesia

June 2019

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BACKGROUND INFORMATION

A Contact Information

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B Program History

The Electrical Engineering Study Program (EESP) at Universitas Hasanuddin, Makassar, Indonesia was founded in 1963 as a department of the Faculty of Engineering established a few years earlier. The campus was originally located at Baraya, near the downtown of Ujung Pandang which was the old name of the city of Makassar. In early 1980s, the university campus was relocated to Tamalanrea, about 10 km north-east of downtown Makassar. More than 30 years later, the Faculty of Engineering was relocated again to its new campus at Gowa, 20 km south of Tamalanrea, and the EESP - under the Department of Electrical Engineering - officially settled at its new facilities in the new campus at Gowa in 2017.

During the first years after its establishment in mid 1960s, most EESP students of Universitas Hasanuddin continued and completed their undergraduate degrees in 2 (two) major universities in Indonesia, namely Universitas Gajah Mada (UGM) in Yogyakarta and Institut Teknologi Bandung (ITB) in Bandung. The majority of the graduates from this period made their careers as academicians, or as engineers at the state-owned power company (PLN) and telecommunication (TELKOM), or started their own private companies related to electricity and telephone businesses. Among the first graduates of the EESP was the retired Prof. Muhammad Arief (Dean of Engineering, 1998-2002), graduated at July 7, 1975. The founder and the first chairman of the EESP was the late Ir. J. Pongrekun, M.Sc. who graduated from a US university

Table 1: Summary of Major Changes in the History of UNHAS.

Year	Events
1963	The Electrical Engineering Study Program (EESP) founded
1980	Split into 2 (two) sub-study programs: (1) Electrical Power Engineering Sub-Study Program (2) Telecommunication and Electronic Engineering Sub-Study Program
1984	Relocated from Baraya Campus to Tamalanrea Campus
1995	Split into 3 (three) concentrations: (1) Electrical Power Engineering (2) Telecommunication Engineering (3) Computer, Control and Electronic Engineering
2000	Minor Revisions of Curriculum
2005	Minor Revisions of Curriculum, competency-based curriculum (KBK)
2010	Minor Revisions of Curriculum, competency-based curriculum (KBK)
2012	Focus Group Discussion (FGD) on Curriculum 2015 established
2015	Relocated to the Faculty of Engineering Campus at Gowa Commencement of the Laboratory-based Education System (LBE)
2016	Implementation of the R&D-based Curriculum 2015
2017	Focus Group Discussion (FGD) on Curriculum 2015 dismissed

in the late 1950s. He was promoted to become the first Dean of Engineering, and his successor as the chairman of the EESP was the late Prof. Dr. Ir. R. Cambari Sakka, M.Eng.Sc., who studied in Australia and Germany for his continuing education. Prof. Salama Manjang is the current chairman, he succeeded Prof. Andani, Dr. Zahir Zainuddin, M.Sc. and Prof. Ansar Suyuti, consecutively.

The first major change of curriculum was implemented in 1980. The EESP was split into 2 (two) sub-study programs or concentrations, namely: (1) The Electrical Power Engineering and (2) The Telecommunication and Electronic Engineering. It was an 8 (eight) semester undergraduate engineering study program provided in 4 (four) academic years. In the first three semesters, the students took common courses on the fundamentals of Electrical Engineering and the required mathematics, physics and chemistry. Beginning at the fourth semester, the students voluntarily selected their preferences of concentration, and took different required and elective courses accordingly.

The next stage of curriculum development was started in 1995. A new concentration was established by dividing the Telecommunication and Electronic Engineering sub-study program into 2 (two), i.e. (1) The Telecommunication Engineering and Information Systems, and (2) The Computer, Control and Electronic Engineering sub-study programs. Common courses for both new concentrations were listed until the fourth semester. The basis of the curriculum establishment was the nationally decreed higher education curriculum development in Indonesia called the Competency-Based Curriculum (KBK).

Most recently, a major change in the EESP curriculum was made related to the campus relocation to Gowa in 2015. The new campus is designed to support the Laboratory-based Education (LBE) system adopted by the Faculty of Engineering. By this time the EESP has established its Masters and Doctoral Degree programs supported by no less than 20 research laboratories and working groups. The process of curriculum development was managed by a Focus Group Discussion (FGD) on Curriculum 2015 in a 5 (five) year working period from 2012 to 2017, with a tagline: "From Competency To Contribution".

The main idea of the recent curriculum change is to extend the competency-based

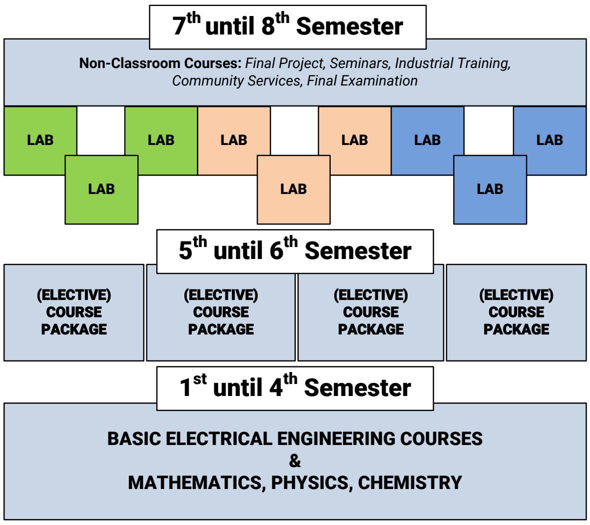

Figure 1: The Curriculum Structure.

curriculum previously implemented to a brand new curriculum called the "R&D-(research and development)-based curriculum". The existing (since 1995) three concentrations were discontinued and all merged back to only one EESP. The curriculum structure is now composed of 4 (four) semesters of fundamentals and 2 (two) semesters of (elective) course packages to develop the competency, and the final laboratory-based, or R&D-based, 2 (two) semesters to create some sort of contribution based on the competency developed in the previous 6 semesters .

The timeline of the EESP 55 year history is summarized in Table 1. After 1995, in fact the EESP curriculum has been revised every 5 (five) years, in 2000, 2005 and 2010 consecutively, but only with minor revisons. Complying with the national regulation on higher education, the EESP is periodically accredited by BAN-PT (the National Accreditation Body for Higher Education), recently with the highest level of accreditation "A" (BAN PT Decree Number 1644/SK/BAN-PT/Akred/S/V/2017 expired on May 30 2022).

Until the recent graduation in June 2019, the EESP has graduated 2782 Sarjana Teknik (S.T.), a degree equivalent to the BS in the US, as shown in Table 2.

Table 2: The Total Number of Graduates, 1975–2019.

Academic Year	Number of Graduates
1975–2016	2525
2016–2017	83
2017–2018	107
2018–2019	52
Total	2767

C Options

The main structure of the curriculum is shown by Figure 1. In the first 4 (four) semesters, freshmen and sophomores spend most of their time in classrooms and supporting teaching laboratories to develop their knowledge on required mathematics and basic sciences (physics and chemistry), and the Electrical Engineering fundamentals, especially the 4 (four) basics namely[1]: (1) Electric Circuits, (2) Electro-magnetics, (3) Solid-state Electronics and (4) Digital Logic Circuits. They also begin to develop their skills to conduct simple experiments, to analyse, interpret and present data, to enhance their knowledge on the required subjects.

After completing all basic and fundamental courses, in the third year the students are required to take at least one elective-course package per semester consisting of 3 to 4 courses in a specific area of Electrical Engineering that will - but not necessarily - lead to one of the research laboratories or working groups in the fourth year that they are interested to apply. Roughly 6 to 8 elective-course packages are offered each semester to juniors, covering the total of more than 50 elective-courses.

Beginning in the fifth semester, a junior should make a decision to choose **at least one** of the following 5 (five) options by solicitedly selecting the related package of elective courses:
Option 1: Electrical Power Engineering and Electricity
Option 2: Telecommunication Engineering and Information Systems
Option 3: Computer Engineering and Robotics
Option 4: Control Systems and Instrumentation
Option 5: Electronic Engineering

The ultimate learning process is at the final fourth year. Seniors are required to apply to one of the research laboratories or working groups. When a senior is admitted to a research laboratory or working group then he or she becomes a member of the laboratory or group by signing an annual contract with the head of the laboratory or the chairman of the group. The seniors will work together with professors and their associates and assistants, their fellows graduate and undergraduate students, to develop their ability to apply their knowledge and to design experiments, systems, processes and/or components to meet desired needs. They also learn how to work effectively not only as individuals but also in teams, either as leaders or members.

After completing all basic and fundamental courses, in the third year the students are supposed to take at least one elective-course package per semester consisting of 3 to 4 courses in a specific area of electrical engineering that will - but not necessarily – lead to one of the research laboratories or working groups in the fourth year that they are interested to apply. Roughly 6 to 8 elective-course packages are offered each semester to juniors, covering the total of more than 50 elective-courses.

In the seventh semester, the students are expected to learn how to identify and formulate a problem, present it and propose a final project in a seminar to solve it. They should be able to define the scope of the problem so that they could complete the solution within months in the next eighth semester.

The final examination at the end of eighth semester is a special occasion to give an opportunity for the final-year student to show their in-depth technical competence in at least one area of Electrical Engineering and to prove their academic contributions by demonstrating and defending their final undergraduate projects.

[1] Giorgio Rizzoni, "*Principles and Applications of Electrical Engineering*", Richard D. Irwin, Inc., Burr Ridge, IL, USA, 1993

Table 3: List of Available Research Laboratories and Working Groups in the Academic Year of 2018-2019.

Area	Laboratory (Lab) and Research Group (RG)
Electrical Power Engineering and Electricity	Electric Machines and Power Drives Power System Stability, Control and Protection Power Electronics High Voltage and Insulation Power System Distribution and Installation Renewable Energy and Intelligent Systems Energy and Power Systems Electricity Infrastructures Distributed Power Generation Electricity Market and Power Systems
Telecommunication Engineering	Antenna and Wave Propagation Radio Telecommunications and Microwave Wireless Communication Technology Transmission and Telecommunication Network Radio Engineering Multimedia Telecommunication and Artificial Intelligence Telematics, Radar and Satellite
Computer Engineering	Computer Engineering and Network (Lab)
Control Systems and Instrumentation	Control Systems and Instrumentation (Lab) RG: Cognitive, Social and Intelligent Robotics
Electronic Engineering	Electronics and Devices (Lab) RG: Industrial Electronics and Embedded Systems

D Program Delivery Modes

The Faculty of Engineering officially runs all academic activities in working hours 07:00 AM to 05:00 PM Monday to Friday, 2 (two) semesters per academic year, 16 weeks per semester. Traditional or regular lecture courses are delivered during these working hours, while other activities, including non-lecture activities, may be delivered in these working hours or in the other time.

An EESP graduate must complete at least 147 credit hours of courses, a total of 30 credits hours equivalent of those are non-lecture courses, including:

(a) The Undergraduate Final Project Report (called "*Skripsi*"), presented and defended in a Final Examination, 4 credit hours

(b) Seminar on the Undergraduate Final Project Results, 2 credit hours

(c) Seminar on the Undergraduate Final Project Proposal, 2 credit hours

(d) Community Services (called "*Kuliah Kerja Nyata*" or KKN), an off-campus 1 month activity run by the university, usually in a remote area or a village, 4 credit hours

(e) Practical (Industrial or "On Job") Training, an off-campus 1 to 2 month activity, typically in an industrial site, 2 credit hours

(f) Laboratory 1, an intra-laboratory or working-group R&D activity, semester 7, 8 credit hours, to develop an undergraduate final project proposal

(g) Laboratory 2, an intra-laboratory or working-group R&D activity, semester 8, 8 credit hours, to produce a contribution from the undergraduate final project

The remaining 117 credit hours are delivered as regular lecture courses in classrooms supported by prescribed syllabi and text books, and/or by conducting experiments in the teaching laboratories: *Basic Physics Laboratory, Basic Electrical Engineering Laboratory and Computer Software Laboratory.*

E Program Locations

All academic teaching and learning processes are located in the new Faculty of Engineering campus at Gowa, about 20 km to the south from the old campus at Tamalanrea, Makassar. The new campus is designed to accommodate the concept of Laboratory-based Education (LBE) adopted by the Faculty of Engineering. Common facilities such as classrooms, the central library and the Faculty of Engineering administrative offices, are located in the main area of campus. A four-storey building as seen in FIGURE 7.2 SECTION 7 functioned as classroom building and department building, contains 69 classes: 22 rooms for 100 students and 47 rooms for 50 students. Lecture theatres for an audience of hundreds of students are also available for general lectures. For smaller classes, less than 20 students, the seminar and meeting rooms in laboratories at the Electrical Engineering Department Building can be used, as shown in FIGURE 2.

(a) Outdoor Front View

(b) Outdoor Back View

(c) Indoor Floor View

(d) Entrance

FIGURE 2: THE EE DEPARTMENT BUILDING

(a) Front View

(b) Side View

FIGURE 3: THE STANDING BANNERS AROUND THE DEPARTMENT'S ADMINISTRATIVE OFFICE

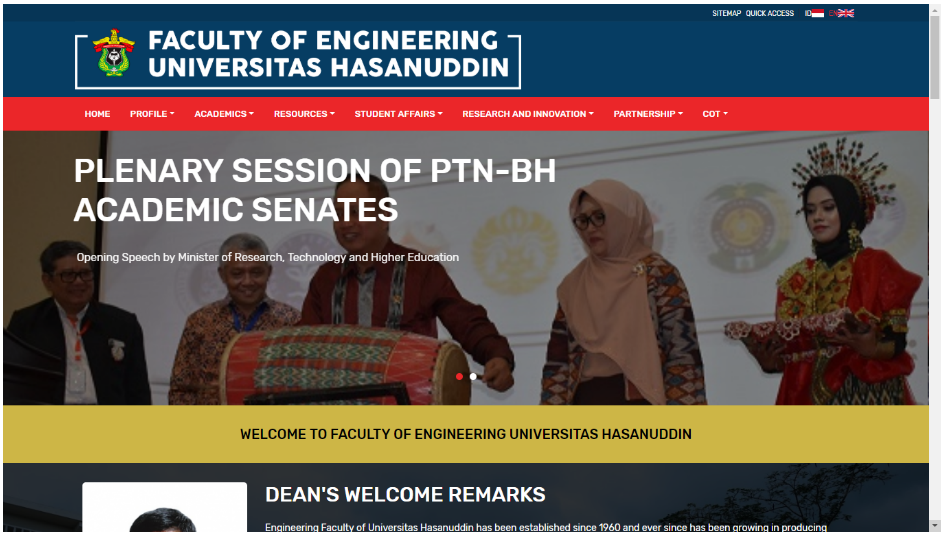

FIGURE 4: THE SCREEN-SHOT OF THE FRONT PAGE OF THE EESP OFFICIAL WEBSITE

F Public Disclosure

The information regarding the PEOs, SOs, annual student enrolment and graduation data, etc. is posted both on the standing banners in front of the Department's administrative office (see FIGURE 3) and in the official website of the EESP (see FIGURE 4): http://eng.unhas.ac.id/electrical/.

G Deficiencies, Weaknesses or Concerns from Previous Evaluation(s) and the Actions Taken to Address Them

This Self-Study Report is arranged for initial ABET accreditation of the EESP. There are no deficiencies, weaknesses nor concerns from the previous evaluation of the Readiness Report submitted on October 28, 2018 as stated in ABET's response letter dated November 1, 2018.

CRITERION 1

STUDENTS

Contents

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1.6 Graduation Requirements 13
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The Electrical Engineering Study Program (EESP) is designed to accommodate the admitted new students of various background from high schools in different regions of the country, and from overseas as well, to go through a rigorous learning process to attain the degree of Sarjana Teknik (S.T.) which is equivalent to the degree of B.S. in the USA. The duration of the program is 3 years and 8 months for the shortest period possible, up to the maximum period of 7 years.

1.1 Student Admissions

To apply for admission, a prospective new student should have been graduated from the high school within the previous 3 years indicated by passing the National Exam (Ujian Nasional) at the grade 12 level. The process of admission is held at the university level from May to June in every academic year. Prospective students are assessed for their academic potential using a standard scholastic potential test, and another academic competency test covering mathematics, physics, chemistry and biology.

The summary of the last five years of annual admission selectivity is shown in Table 1.1. In average, 103 out of 2286 applicants are admitted to the EESP yielding the selectivity of 1:22 or the best between 4% to 5%.

Table 1.1: The Selectivity of Five-Year Annual Admission Process.

Academic Year	Number of Applicants	Admitted	Selectivity
1918–2019	2145	126	1:17
2017–2018	2282	101	1:23
2016–2017	2090	80	1:26
2015–2016	2524	116	1:22
2014–2015	2391	90	1:27
Average	**2782**	**103**	**1:22**

The university sets the admission quota for the EESP, and then allows the proportion of the admitted number of students by applying the following schemes:

1. Minimum 20% of the quota are admitted through the SNMPTN, a standard national selection process carried out by inviting prospective high school graduates who are eligible for this process. A newly founded national institute called the LTMPTN under the Ministry of Research, Technology and Higher Education carries-out this selection process.

2. Minimum 50% of the quota are admitted through the SBMPTN, the National Admission Selection for Public University, held also by the LTMPTN. The applicants should take a nationally carried out computer-based entrance examination.

3. Maximum 30% of the quota are admitted through a university-held selection process based on various criteria.

Table 1.2: The Annual Enrolment, Student Body and Graduates Fluctuation.

Academic Year	Enrolment	Student Body	Graduates
1918–2019	111	349	67
2017–2018	84	372	107
2016–2017	70	385	83
2015–2016	88	375	78
2014–2015	82	419	126

Table 1.2 shows how the enrollment, the student body and the graduates fluctuates annually. From this table, rough estimation of the EESP's efficiency can be calculated based on the enrollment 4 years before the graduation, for example: the graduates of this academic year of 2018–2019 is 67 and the enrollment at the academic year of 2014–2015 is 82, so the efficiency is roughly 82%.

The enrollment in the academic year of 2016-2017 was relatively low because the university set the quota very low at the time. This is due to the establishment of the new Department of Informatics, when a quite number of EESP staff were listed as the faculty of the new department. The university tried to keep the ratio of faculty to student body normal by lowering the quota. Recently, after moving to the new campus, the quota is increased again by the university, expecting the enrollment to approach 125 to 150 new students in the coming years.

Table 1.3: Student Performance Evaluation Tools for Non-Lecture Courses.

Non-Lecture Course	Credit Hours	Evaluators	Evaluation Tools
The Undergraduate Final Project Report (called *Skripsi*)	4	2 supervisors + 2 examiners	(1) Communication Skills: Technical/Scientific Writing, Oral Presentation, (2) Research Methodology, (3) Comprehensive Examination
Seminar on the Undergraduate Final Project Results	2	2 supervisors + 2 examiners	(1) Communication Skills: Technical/Scientific Writing, Oral Presentation, (2) Research Methodology
Seminar on the Undergraduate Final Project Proposal	2	Head of the Laboratory + staffs and/or 2 supervisors+2 examiners	(1) Communication Skills: Technical/Scientific Writing, Oral Presentation, (2) Research Methodology
Community Services (called "Kuliah Kerja Nyata" or KKN)	4	University Supervisors	Participation and Activities
Practical (Industrial or "On Job") Training	2	1 internal supervisor + 1 external supervisor	Report and Attendance List
Laboratory 1, an intra-laboratory or working-group R&D activity	8	Head of the Laboratory + staffs	(1) Outcome: Undergraduate Final Project Results, (2) Learning Process: Participation and Activities, (3) Attendance: minimum 4 hours per working day in 16 weeks
Laboratory 2, an intra-laboratory or working-group R&D activity	8	Head of the Laboratory+staffs and/or 2 supervisors + 2 examiners	(1) Outcome: Undergraduate Final Project Results, (2) Learning Process: Participation and Activities, (3) Attendance: minimum 4 hours per working day in 16 weeks

1.2 Evaluating Student Performance

The EESP recent Curriculum 2015 requires a student to complete at least 147 credit hours of courses with a total of 30 credits hours equivalent of those are Non-Lecture Courses. The student performance taking Non-Lecture Courses is evaluated using specific tools characterized by each course, as seen in Table 1.3.

Regular Lecture Courses are delivered in classrooms supported by prescribed syllabus and text books. Most of these courses are taught by teams of at least 2 instructors. Each instructor conducts the student evaluation by giving exercises, projects (for project courses), homework, quiz, a midterm and a final examination that will be summed up at the end of semester to produce the students' final grades according to the university guideline shown in Table 1.4. The students' final grades are uploaded by the instructors to the university's on-line system at the end of semester.

The performance of every student in a semester is measured by his or her performance index called Index Prestasi (IP) which is quite similar to the Grade Point Average (GPA) in general. The student's IP at the end of a semester will determine the maximum credit hours he or she could take in the next semester. The cumulative IP called Index Prestasi Kumulatif (IPK) at the graduation is one of the requirements to attain honorary predicates such as summa cum laude, cum laude, satisfactory, etc.

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Table 1.4: The University of Grading System.

Numerical Grade (N)	Qualitative Grade	Conversion (for Performance Index/Indicators)
N$\geq$ 85	A	4.00
80$\leq$ N $<$ 85	A-	3.75
75$\leq$ N $<$ 80	B+	3.50
70$\leq$ N $<$ 75	B	3.00
65$\leq$ N $<$ 70	B-	2.75
60$\leq$ N $<$ 65	C+	2.50
50$\leq$ N $<$ 60	C	2.00
40$\leq$ N $<$ 50	D	1.00
N $<$ 40	E	0.00

the university guideline shown in Table 1.4. The students' final grades are uploaded by the instructors to the university's on-line system at the end of semester.

Several lecture courses provide supporting teaching laboratories to facilitate students to conduct experiments related to the theories learned in the classrooms. These teaching laboratories are for instance: Basic Physics Laboratory, Basic Electrical Engineering Laboratory and Computer Software Laboratory. Other laboratories also have teaching facilities, in addition to their main R&D activities to support the lecture courses. The student evaluation for these kinds of lecture courses is either made separately or embedded with their supporting laboratory activities.

1.3 Transfer Students and Transfer Courses

In the recent years no transfer students have been admitted and no transfer course from other institution is available.

1.4 Advising and Career Guidance

Faculty members also serve as academic advisors whose main function is to provide students recommendations in selecting courses prior to registering for the next semester. These recommendations include the strategy to select courses related to prospective jobs after graduation.

EESP carries out academic dialogues regularly to obtain inputs and to find solutions for students' obstacles in the study process. Moreover, these academic dialogues discuss employment opportunities for graduating students. Periodically, once or twice a year, the EESP also invites some members of the alumni association (IATEL) or other external parties to make presentations on any new information in the real world, especially up-dated information on jobs and other opportunities.

The curriculum also requires students to take courses on entrepreneurship to urge them to become creative graduates who are not merely job-seeking, but also job-creating graduates. "The best way to predict your future is to create it" [Abraham

Lincoln]. The EESP expects its alumni to be able to create jobs at least for themselves, and for others if possible.

At the Faculty of Engineering level (supervised by the Vice Dean for Students and Alumni Affairs) and at the university level (coordinated by the Directorate of Alumni and Career Preparation) special occasions such as job-fairs are held regularly for students and alumni.

1.5 Work in Lieu of Courses

Basically the EESP does not implement the requirements and process for awarding credit hours for work in lieu of courses. However, the curriculum requires students to take 2 (two) courses delivered “Off Campus”, namely (1) Community Services (called “Kuliah Kerja Nyata” or KKN), an off-campus 1 month activity run by the university, usually in a remote area or a village for 4 credit hours and (2) Practical (Industrial or “On Job”) Training, an off-campus 1 to 2 month activity, typically in an industrial site for 2 credit hours.

Those two “Off Campus” Courses give the students real world experiences. The Practical (Industrial or “On Job”) Training, called “Kerja Praktek” or KP, may lead to a long term (6 months) internship program if the corporate management thinks it necessary, or in some cases the student could develop his or her final undergraduate project as an extended version of his or her KP report.

1.6 Graduation Requirements

At the Commencement Day, the degree of “Sarjana Teknik (S.T.)” - equivalent to BS degree in the US - is conferred upon a graduate together with all honors, rights and privileges belonging to that degree. It means that the graduate has completed at least 147 credit hours of courses, a total of 30 credit hours equivalent of those are Non-Lecture Courses, with a cumulative GPA or IPK no less than 2.00 out of 4.00.

The end stage of the study program is the Undergraduate Final Examination. This is an oral examination, held for an hour or two, attended only by 4 (four) instructors: two of them are the co-supervisors of the student’s Undergraduate Final Project, and the other two act as the examiners. This Undergraduate Final Examination mainly serves as a comprehensive examination to measure the student’s competency in the field. In this examination, the student should also present and defend his or her Undergraduate Final Project Report, called *Skripsi* (4 credit hours). As the pre-requisite, prior to the Undergraduate Final Examination, the students should complete at least 143 credit hours of courses composed of the following courses:

1. Non-Lecture Courses: Laboratory 1 (8 credit-hours), Laboratory 2 (8 credit-hours), KKN (4 credit-hours), KP (2 credit-hours), Seminar on Proposal (2 credit-hours) and Seminar on Results (2 credit-hours), Final Project Report (4 credit-hours), total: 30 credit-hours.

2. General Education Courses, total: 14 credit-hours

3. Mathematics, total: 18 credit-hours
4. Sciences, total: 16 credit-hours
5. Electrical Engineering Cores (obligatory), total: 49 credit-hours
6. Electrical Engineering Breadth (elective), minimum: 18 credit-hours
7. Electrical Engineering Technical/Depth (elective), minimum: 2 credit-hours

Other graduation requirements also include several administrative and financial terms such as the payment of tuition fee, the submission of corrected and completed copies of *Skripsi*, clearances from laboratories and libraries, etc.

1.7 Transcripts of Recent Graduates

An example of a recent graduate's academic transcript can be found in the attachments. The academic transcript shows the personal information of the graduate (such as the birth date and place and his or her student ID number), the list of all completed courses with all their grades converted to the cumulative IPK, the final IPK, the graduation predicate and also the title of the *Skripsi*. However, the academic transcript does not reveal the chronological history of the student performance during his or her tenure in the EESP. The transcript is signed both by the Dean of Engineering and the Rector of Universitas Hasanuddin.

CRITERION 2

PROGRAM EDUCATIONAL OBJECTIVES

Contents

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2.4 Program Constituencies 18

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2.1 Mission Statement

Universitas Hasanuddin (occasionally abbreviated as UNHAS) is an autonomous state and/or public university. Its mission is prescribed by the Indonesian government regulation (*Peraturan Pemerintah*, PP) Number 53/2015 on the Statute of *Universitas Hasanuddin*. The university is visioned to become "*a center of excellence for the Indonesian maritime-based development of humanity, sciences, technology, arts, and cultures*". Its missions are stated as

1. to provide quality learning environment to develop the capacity of innovative and proactive learners;

2. to preserve, develop, explore, and create sciences, technology, arts, and cultures; and

3. to implement and disseminate sciences, technology, arts, and cultures for the prosperity of the Indonesian maritime society.

In fulfilling the university's vision and missions, the academic society of *Universitas Hasanuddin* shall observe the following values in their academic life, i.e. (1) integrity: honesty, courage, responsibility, determination, (2) innovation: creativity, quality-orientation, independence, pioneering, (3) catalytic: bravery, determination, dedication, competitiveness, and (4) wisdom: appropriateness, fairness and civilizedness, holism, and adaptability.

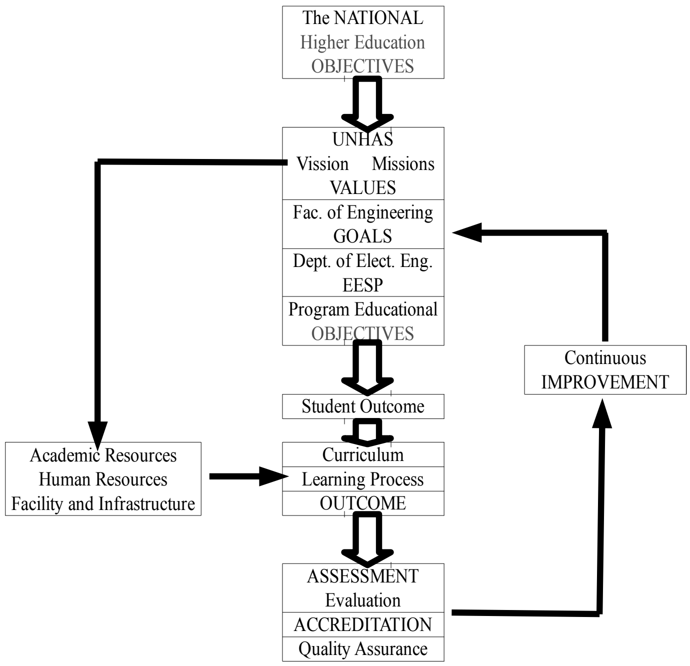

Figure 2.1: Systematic Derivation of National Higher Education Objectives into the EESP's PEOs.

Those institutional vision, missions and values are translated into the Faculty of Engineering's educational objectives, derived into the Department of Electrical Engineering's mission statements and finally described as the EESP Program Educational Objectives (PEO). The derivation is systematically shown by the diagram in Figure 2.1. Due to its public or state university status the source and the basis of the university mission statements should not be different from the national goals of the higher education system in Indonesia. Consequently, the Faculty of Engineering should derive its mission statements from the university vision, missions and values, because all academic and human resources, as well as all facilities and infrastructures, are administered and managed at the university level.

2.2 Program Educational Objectives

The EESP's Program Educational Objectives (PEO) are established according to systematic mechanism shown in Figure 2.1. The main reference of this process of establishment is the national mission statements of the higher-education system in Indonesia, which was translated into the vision of *Universitas Hasanuddin*, missions and values, as stated in the Statute of *Universitas Hasanuddin*, PP Number 53/2015, which is a legal document issued by the Government of Indonesia as a government regulation. The Faculty of Engineering derived its mission statements (consists of vision, missions and goals) from the university mission statements and documented them in a “strategic plan” (called RENSTRA 2016-2020) validated and legalized by the Senate of the Faculty of Engineering.

Referring to the university’s and Faculty of Engineering’s mission statements, then the EESP staff formulated the EESP’s mission statements also consisting of its vision, missions and goals, to further derive the Program Educational Objectives as presented in TABLE 2.1.

1. The EESP graduates should have a mastery in basic sciences and mathematics relevant to the basic competency in the field of electrical engineering (*Basic Science Skills*)

2. The EESP graduates should have an ability to anticipate, to formulate and to solve problems related to the field of electrical engineering (*Professional Skills*)

3. The EESP graduates should have the spirit of leadership and entrepreneurship, the academic attitude, and should have an ability to compete to work in various sectors all over the world, especially in Indonesia and Asia-Pacific region (*Entrepreneur Skills*)

4. The EESP graduates should have a capability to continue their study to the higher degree of education all over the world (*Research Skills*)

TABLE 2.1: THE EESP PROGRAM EDUCATIONAL OBJECTIVE (PEOS).

PEO Label	Program Educational Objective:
PEO-1	The EESP graduates have a mastery in basic sciences and mathematics relevant to the basic competency in the field of electrical engineering (Basic Science Skills)
PEO-2	The EESP graduates have an ability to anticipate, to formulate and to solve problems related to the field of electrical engineering (Professional Skills)
PEO-3	The EESP graduates have the spirit of leadership and entrepreneurship, the academic attitude, and have an ability to compete to work in various sectors all over the world, especially in Indonesia and Asia-Pacific region (Entrepreneur Skills)
PEO-4	The EESP graduates have capability to continue their study to higher degree of education all over the world (Research Skills)

These Program Educational Objectives are posted in the official website of the Department and also shown to visitors on standing banners in front of the Department’s administrative office.

2.3 Consistency of the Program Educational Objectives with the Mission of the Institution

The EESP is envisioned to become “*a leading and competitive center of technology development, application and implementation both at the national level as well as at the global level*”. This vision is derived consistently from the vision of *Universitas*

Hasanuddin to become"*a center of excellence for development of humanity, sciences, technology, arts, and cultures*". The development itself is envisioned by the university as a "maritime-based" development, which is consistently translated into the Faculty of Engineering' vision to become "*a leading institution in the field of engineering for the global sustainability with the spirit of maritime culture*".

Universitas Hasanuddin has stated its missions and values as described previously, which are consistently derived into the Faculty of Engineering's missions and goals. Based on these Faculty of Engineering's missions and goals, the EESP has stated its missions as the following:

1. Producing professional graduates who have capacity to develop their own knowledge and technical skills
2. Producing professional graduates who are adaptive to the progress of technology development with the spirit of entrepreneurship
3. Producing applicable scientific creations with the national as well as the global insight, that are beneficial to the society
4. Implementing the Electrical Engineering science; and technology to solve problems of the society

The first two EESP's mission statements, both to produce professional graduates, are translated into the four points of its Program Educational Objectives (PEOs) described in the previous section. The third and forth mission statements are applied to the other EESP's objectives related to the research and community service activities. This is consistent with the Indonesian national missions of the higher-education education called *Tri-Dharma Perguruan Tinggi* (Three Services of the Indonesian Higher Education System), namely: (1) Education, (2) Research and (3) Community Services.

2.4 Program Constituencies

Basically there are two categories of constituencies: the "internal" constituency and the "external" constituency. Both are considered very important in the process for establishing the Program Educational Objectives (PEO), so that the EESP regards them as its "stakeholders".

The "internal" constituency - commonly called the civitas academica - includes students and all faculty members. The supporting staffs, both laboratory technicians and administrative staff, are also parts of the "internal" constituency. The students are the beneficiaries of the programs served by the rest of the "internal" constituency. Therefore the whole "internal" constituency should make their best efforts to maintain the conducive academic atmosphere for the sake of the students' interests. The university has announced that all study programs should implement the what so called "Student-Centered Learning" (SCL) environment to focus on the students' best interests. The EESP has adopted a definition: "teaching is about providing opportunities for students to learn, (which is) both an interactive process and an intentional activity".[1]

[1] Malcolm J. Jones (ed), "Curriculum Development, S1 Engineering Programs in Indonesia", EEDP-DGHE, Jakarta, 2000.

Periodically, the EESP calls for an "academic dialogue" to get feedback from students regarding all academic matters and obstacles.

At the time of what so called the era of "disruption", the era of the emergence of entirely new kinds of businesses like Uber and Airbnb, it is almost impossible to predict, who or what will be the EESP's main "external" constituency in the future when the graduates start to enter the job market. Therefore, it is important to strengthen the basics, especially mathematics, basic sciences and basic electrical engineering, and the spirit of entrepreneurship that will give the graduates a strong self-confidence to face the new challenging world, and then successfully create jobs at least for themselves, and also for others.

Relying merely on the traditional "external" constituencies such as the state-owned enterprises in electrical power systems and electricity, telecommunication, general contractors and consultants, etc., has a potential to leave the graduates irrelevant in the future which is more dangerous than becoming out of job. The issue of relevance is the most important factor to be considered when stating the Program Educational Objectives above. The closest "external" constituency to hear from includes the students' parents, alumni and their employers. For the students' parents there is an association at the university level (**IOM-UNHAS**) while for the alumni there is a large organization at the university level (**IKA-UNHAS**) as well as the smaller one at the EESP level (**IATEL-UNHAS**). The social-media is very effective in gathering all information, updates and feedback from the "external" constituencies.

In order to strengthen and to enhance the communication between the "internal" and "external" constituencies, and among themselves, the EESP has established an Advisory Board as seen in Table 2.2.

The Advisory Board is supposed to represent the constituency, both "external" and "internal", and is also expected to have a regular meeting to discuss the grand strategy to achieve the realization of the Program Educational Objectives by implementing the curriculum.

2.5 Process for Review of the Program Educational Objectives

The EESP curriculum is subject to be reviewed periodically every five years since 1995. The process for review usually begins with a tracer study by surveying the alumnus's well-being and their views on the curriculum after they leave campus all that long. The alumnus's points of view are the most important consideration in the development of new curriculum. In the last tracer study in 2013, the alumni were asked what courses that they still remember after graduation. The alumnus's strong memory on specific courses indicates how important the courses are for them now, or how good the courses were delivered during their tenure as students in previous years. The tracer study in 2013, 50 years after its establishment in 1963, was aimed to build a strong foundation for a major change of curriculum in 2015, when the EESP planned to move to the entirely new campus.

There were two major recommendations derived from the analysis on the results of 2013 tracer study: (1) all basic (mathematics, physics, chemistry, electrical engineer-

Table 2.2: Member of Advisory Board

No	Name	Occupation	Entity
1	Abdul Salam	Operational Manager	PT. PLN (PERSERO) UIP SULBAGSEL
2	Irwan Thamrin Tantu	Managing Partner Managing Partner President Director Senior SCADA Advisor	tQ Automation, LLC tQ Solution, Inc tQ TantuTech, DBA Wartsila, Inc. ESS Unit
3	Rembiq FR	Senior Manager	PT. Semen Tonasa
4	Haris	Director of Renewable Energy	Ministry of Mineral, and Energy Resources
5	Bambang Yusuf	General Manager	PT. PLN (Persero) UIW SULSELRABAR
6	Bustanuddin	Head of Geology Division	Ministry of Mineral, and Energy Resources Makassar
7	Muammar	Manager Thermo Power Plant Operation	PT. Vale Indonesia Tbk
8	Daniel Picarima	General Super Intanden Diesel Power Plant	PT. Freeport Indonesia
9	Samuel Parura	Senior Manager Resident Engineering	PT. Pertamina
10	Jaizuludin Mahmud	General Manager	PT. PLN (Persero) UIW SULSELRABAR
11	A. Rahman	Marketing Manager	PT. LEN Industri
12	Iwan Soma BSB	Electronic Coordinator	PT. Bumi Sarana Beton
13	Rhiza Samsoe'oed Sadjad	Associate Professor (Head of Control Systems and Instrumentation Laboratory)	Universitas Hasanuddin
14	Faizal Arya Samman	Professor (Head of Electronics and Devices Laboratory)	Universitas Hasanuddin

ing) courses should be strengthen and their materials and methods of delivery should be continuously developed and updated, and (2) all advanced electrical engineering courses should be completed in the 4th, 5th and 6th semesters, all are delivered to develop the students' competency in the field of electrical engineering based on their own preferences and interests, so that they are well prepared and capable to make some sort of contribution when they work in the laboratories in the 7th and 8th semesters.

The purpose of reviewing of the Program Educational Objectives periodically is to maintain the continuous improvement of the study program. There are two processes of review: (1) a direct review on the learning process at the course level by updating the course profiles and evaluating the student outcomes, and (2) an indirect review based on surveys, including the tracer study (alumni surveys and the employer survey) and the exit survey before the graduation day. The results of both review processes determine the performance indicators of the study program, representing the student outcomes (quantitatively represented by value 1 to 4) and finally translated into the percentage of the Program Educational Objectives realization through a relational matrix. The relational matrix shows qualitatively the high (H), the medium (M) or the low (L) relation between the Student Outcomes (SO) and the Program Educational Objectives (PEO).

The indirect review process covers two kinds of activities: (1) the senior exit survey and (2) the tracer study. The senior exit survey is carried out before the commencement. *Universitas Hasanuddin* holds 4 periods of graduation in a year: the period of March, June, September and December. Until mid-2019, the senior exit survey has been carried out twice, in the period of March and in the period of June. As shown in Table 2.3, there are 22 indicators measured in the questionnaire, all of them are concerning the ability attained by the students during the tenure of their study in the EESP. The questions are arranged to allow the students to make their own self-assessment regarding their abilities attained just before their graduation.

Table 2.3: The EESP Senior/Student Exit Survey Questionnaire

SO Label	Senior Exit Surveys Questionnaire
SES-1	Ability to define and recognize learned electrical engineering subjects
SES-2	Ability to understand and grasp the meaning of the electrical engineering knowledge and problems
SES-3	Ability to analyze electrical engineering systems and problems
SES-4	Ability to design components and systems to solve electrical engineering problems
SES-5	Ability to analyze possible solutions to engineering problems
SES-6	Ability to design solution to solve engineering problems
SES-7	Ability to apply or implement engineering skills to actual conditions
SES-8	Ability to analyze effective speech structure to communicate idea
SES-9	Ability to arrange speech concept and structure
SES-10	Ability to present idea in real situation (in front of audience)
SES-11	Ability to know and recognize professional code of ethics
SES-12	Ability to comprehend professional code of ethics
SES-13	Ability to apply engineering ethics in real engineering design problems
SES-14	Ability to comprehend leadership skills in a project-based education
SES-15	Ability to design project plan in a simulated engineering project
SES-16	Ability to lead a team in real engineering projects
SES-17	Ability to analyze practically and interpret data to' draw conclusions
SES-18	Ability to design practical module and conduct experiment independently
SES-19	Ability to apply or implement engineering knowledge in laboratory scales
SES-20	Ability to identify new issues in electrical engineering fields of study
SES-21	Ability to analyze possible alternative solutions to solve a trending problem
SES-22	Ability to give novel scientific contribution to solve electrical engineering problems

In 2019, tracer study and surveys have been conducted by using online forms. Several questions, which are mostly related to the ABET criteria are given to Alumni. The following sections describe the tracer study and questionnaire surveys of the EESP Alumni.

The tracer study involves two groups of respondents: (1) the alumni and (2) the employers of the alumni. In the most recent tracer study held in 2019, questionnaires with questions to indicate the alumnus capabilities, capacities and level of skills, responsibility, etc. as well as the relationship between their working place with the area of electrical engineering field of study, as shown in Table 2.3, Table 2.4 and Table 2.5, are distributed to 287 alumni and 23 of their employers. The respondents were picked up pure randomly, no statistics method applied in the surveys.

Besides distributing questionnaires for determining the Student Outcomes, the alumni surveys were also used to obtain data on: (1) their waiting time before getting the first job (see Figure 2.2), (2) their position in their current jobs (see Figure 2.3), (3) the category of their current employers (see Figure 2.4) and (4) the field of their current work places (see Figure 2.5).

From the pie-chart shown in Figure 2.3, it is very clear that the majority of alumni (58,74%) got their first jobs within 4 months after their graduation. Almost 1 out of 5 alumni waited for their first jobs within a year after graduation, and 1 out of 8 alumni waited for a year to get their first jobs, while a very small number of alumni (less than 2%) should wait for their first jobs for 5 years or more. The average of waiting time before getting the first job is 8 months, which indicates the relatively high employability

Table 2.4: The EESP Alumni Survey Questionnaire

SO Label	Alumni Surveys Questionnaire
AS-1	The relationship between your working place with electrical engineering field of study
AS-2	Capability to identify, formulate and solve problem in your working place by applying electrical engineering skills and knowledge
AS-3	Capability to apply your engineering/technical skills to solve engineering problems in your workplace
AS-4	Capacity to communicate
AS-5	Capability to recognize ethics and professional responsibilities the impacts on your work place performance
AS-6	Capacity to collaborate in a team work
AS-7	Capacity to lead a team work
AS-8	Capability to develop and conduct project works in practice
AS-9	Capability to interprete or analyse data to draw conclusions
AS-10	Willingness or Capacity (estimated) to pursue graduate/post-graduate study (MSc/PhD)
AS-11	Capability to give scientific contributions (writing scientific article) related to engineering problem solving

Table 2.5: The Employer Survey Questionnaire

SO Label	Alumni Surveys Questionnaire
ES-1	Level of Technical Contribution
ES-2	Level of Communication Skills
ES-3	Demonstrated ability to work well on a team
ES-4	Level of Ethical and Social Responsibility
ES-5	Level of Contribution and Active Role (Leadership)
ES-6	Level of Success in Learning New Areas
ES-7	Level of Achievement in attending workshop, training, short course or conference

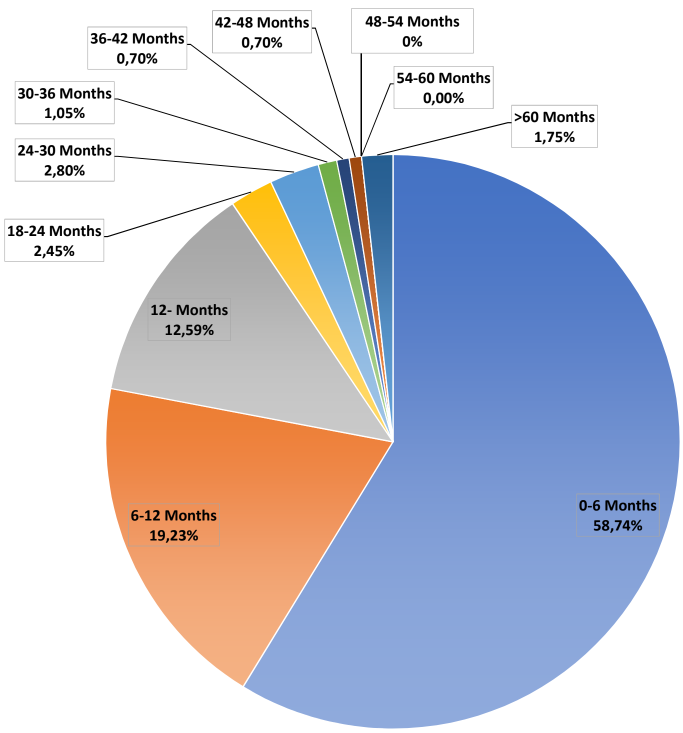

Figure 2.2: Pie Chart of Waiting Time for Alumni first job.

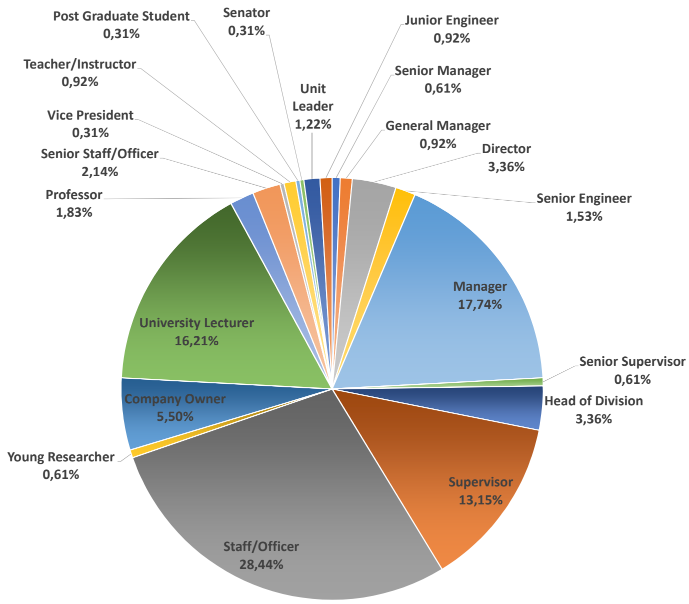

FIGURE 2.3: PIE CHART OF ALUMNI POSITION IN RECENT JOB PLACE.

of EESP's graduates.

The alumni who were picked up as respondents are in the good position in their current job, as shown by the pie-chart shown in FIGURE 2.3. Most of them (28,44%) are officers and staffs in their current jobs, then the positions of managers, lecturers in a university, and supervisors are the most favourable, respectively.

Most alumni work in a corporation, as shown by the pie-chart in FIGURE 2.4, more than a third (38,67%) in private companies and more than a fourth (26,90%) in state-owned enterprises. Another 13,10% preferred to be government civil servants. Only very small percentage of the alumni became entrepreneurs (less than 10%), and even less who work in universities and research institutes (6,55%) as academicians and researchers.

A better perspective is shown by the pie-chart in FIGURE 2.5. More than a half (51,54%) of the respondents still doing engineering in industry, eventhough only very small percentage of them (4,94%) work in R&D (Research and Development) activities. The percentage of alumni who earn their living in the field of education is exactly the same as the percentage of them who got jobs in commercial world.

The results of this tracer study may or may not represent the real condition, because the respondents were not picked-up based on any method of statistics. In the future, the tracer study should be carried out by picking up respondents based on a purposive sampling method to better represent thousands of the EESP alumni in the real world situation.

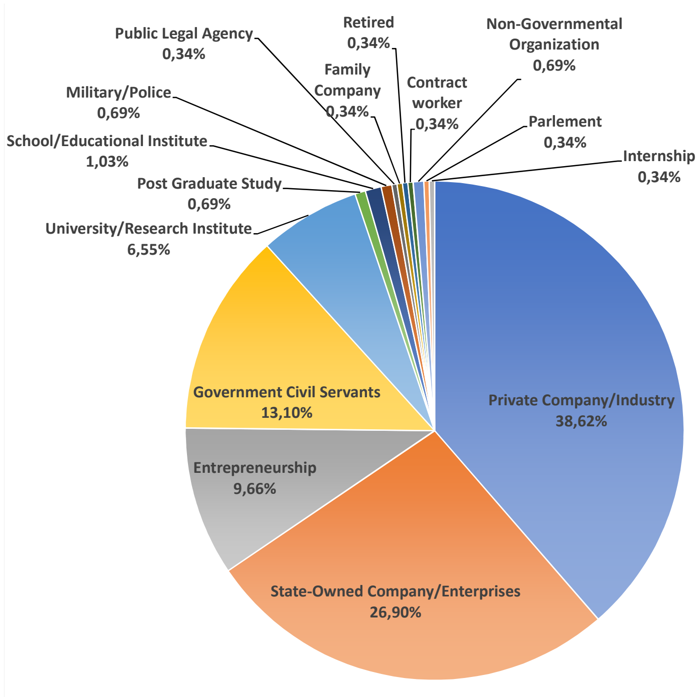

Figure 2.4: Pie Chart of Employer Category, where Alumni works.

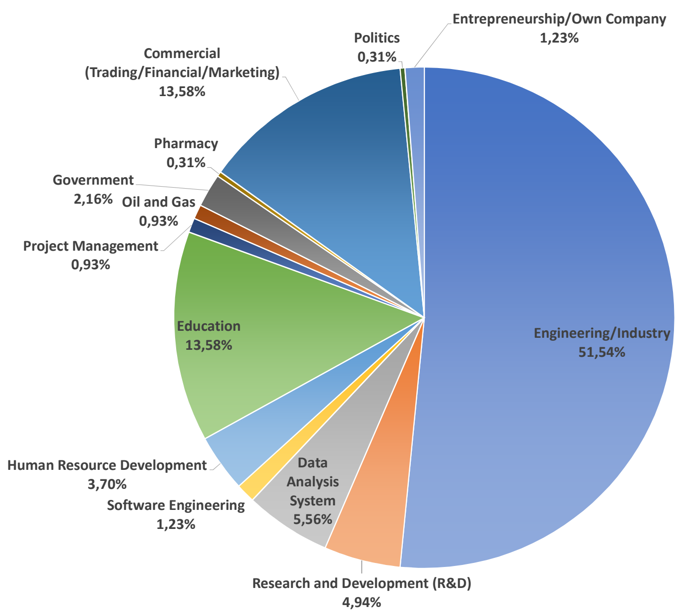

Figure 2.5: Pie Chart of Alumni's Field of Employment.

CRITERION 3

STUDENT OUTCOMES

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3.1 Process for the Establishment and Revision of the Student Outcomes

The Student Outcomes of the EESP are revised in line with the Program Curriculum Revision. The EESP revises regularly its Program Curriculum in every five year. The latest Program Curriculum revision was made in 2015. Hence, the next revision round should be in 2020. This year (2019), the EESP is planning to revise its Program Curriculum and the revision will be made based on the Program Evaluation result, which is also used in this ABET accreditation process. Therefore, the Program Evaluation Result including the EESP Student Outcomes presented in this Self-Study Report is made based on the 2015-Program Curriculum.

The decision to revise or to establish/re-establish the EESP Student Outcomes is undertaken by using the following reviews:

1. The evaluation review of the EESP Program Education Objective (PEO) by the faculty members of the EESP, where the Student Outcomes are also evaluated

using Direct and Indirect Assessment Method, which are discussed in detail in CRITERION 4;

2. The advice and review of the EESP Advisory Board members, where the Advisory Board meeting is taken place, is regularly scheduled in every four or five years;

3.2 Student Outcomes

The EESP evaluates its program educational objectives based on seven Student Outcomes (SO), which are presented in TABLE 3.1. Each SO has a label as presented in the table.

TABLE 3.1: THE EESP STUDENT OUTCOMES.

SO Label	Student Outcome:
SO-1	An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science and mathematics
SO-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
SO-3	An ability to communicate effectively with a range of audiences
SO-4	An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgements, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
SO-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
SO-6	An ability to develop and conduct appropriate experimentation, analyse and interpret data, and use engineering judgement to draw conclusions
SO-7	An ability to acquire and apply new knowledge (contribution) as needed, using appropriate learning strategies

By participating in various academic programs in EESP, the students will attain the basic competency in the field of electrical engineering, and at least one of the following options:

Option 1: Electricity and Electrical Power Engineering

- **OP1(a)**: An ability to design and to analyse electricity systems both technically and economically
- **OP1(b)**: A mastery in power system generation, installation, transmission and distribution, and power station operation

- **OP1(c)**: A mastery in electric machines applications, maintenance, control and operation

Option 2: Telecommunication and Information System

- **OP2(a)**: A mastery in system management and control of network, hardware and multimedia software applications in telecommunication and information systems

- **OP2(b)**: An ability to anticipate, to formulate and to solve problems related to the network, hardware and multimedia software applications in telecommunication and information systems

- **OP2(c)**: An ability to participate in the science and technology development, especially in the area of telecommunication and information systems, and always being adaptive to the advancement of science and technology in this area

Option 3: Computer Engineering and Robotics

- **OP3(a)**: An ability to utilize the computer software packages for modeling and simulation of various electrical engineering problems

- **OP3(b)**: A mastery in concepts, design and application of the digital computer hardware particularly for robotic applications

Option 4: Control Engineering

- **OP4(a)**: A mastery in the basic control theory, both classical and modern control theory, and its application in the control systems analysis and design

Option 5: Electronic Engineering

- **OP5(a)**: A mastery on the know-how to design electronic circuits and systems by using electronic devices, including the utilization of software packages

- **OP5(b)**: A mastery on the know-how to design integrated circuits or microelectronics circuit, including the utilization of software packages for integrated circuit layout and design

The aforementioned optional student outcomes of the EESP have been implicitly represented by the EESP Student Outcomes. They have strong relationship with the Student Outcomes SO-1, SO-2, SO-6 and SO-7. The optional student outcomes can be mapped also to the other EESP Student Outcome, however, the relationships are relatively weak.

3.3 Mapping of ABET's Student Outcomes to the EESP Student Outcomes (Criterion 3)

3.3.1 ABET Student Outcomes for Engineering Criteria

In addition to the specific the EESP Student Outcomes mentioned above, our B.Eng. degree programs, includes implicitly also the following 11 learning capabilities according to the ABET criteria as references. Each ABET Student Outcome is labeled as AECB-a through AECB-k.

The ABET Engineering Criteria for Baccalaureate Degree:

1. **AECB(a)**: an ability to select and apply the knowledge, techniques, skills, and modern tools of the discipline to broadly-defined engineering technology activities;
2. **AECB(b)**: an ability to select and apply a knowledge of mathematics, science, engineering, and technology to engineering technology problems that require the application of principles and applied procedures or methodologies;
3. **AECB(c)**: an ability to conduct standard tests and measurements; to conduct, analyze, and interpret experiments; and to apply experimental results to improve processes;
4. **AECB(d)**: an ability to design systems, components, or processes for broadly-defined engineering technology problems appropriate to program educational objectives;
5. **AECB(e)**: an ability to function effectively as a member or leader on a technical team;
6. **AECB(f)**: an ability to identify, analyze, and solve broadly-defined engineering technology problems;
7. **AECB(g)**: an ability to apply written, oral, and graphical communication in both technical and non-technical environments; and an ability to identify and use appropriate technical literature;
8. **AECB(h)**: an understanding of the need for and an ability to engage in self-directed continuing professional development;
9. **AECB(i)**: an understanding of and a commitment to address professional and ethical responsibilities including a respect for diversity;
10. **AECB(j)**: a knowledge of the impact of engineering technology solutions in a societal and global context
11. **AECB(k)**: a commitment to quality, timeliness, and continuous improvement.

Table 3.2 presents the relationship between Student Outcomes and the ABET Electrical Engineering Program Criteria.

Table 3.2: Relationship of the EESP Student Outcomes to the ABET Engineering Criteria

EESP Student Outcomes	ABET Engineering Criteria, AECB(a–k)										
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)
SO-1		X									
SO-2	X			X		X				X	
SO-3					X		X				
SO-4								X	X		X
SO-5					X			X			
SO-6	X		X								
SO-7		X		X		X	X			X	

3.3.2 ABET Student Outcomes for Electrical Engineering Criteria

The EESP curriculum is designed to enable the EESP program to prepare our graduates with some necessary engineering expertise for their careers in industries. They are prepared to fulfill some job levels from design, implementation, installation, assembly/manufacturing, operation and maintenance of electrical and/or electronic systems.

In the first and second year, our EESP program focuses on preparing our graduates with expertise in a broad spectrum of the electrical engineering field of study. But in the last two years, we prepare our graduates with in-depth but narrow expertise. Hence, the ESSP graduates should have the depth and breadth expertise that can be demonstrated in their job fields as part of the EESP program educational objectives. The EESP curriculum will prepare its graduates to have skills or competences in the following areas according to the ABET Electrical Engineering Program Criteria:

The ABET Electrical Engineering Criteria for Baccalaureate Degree:

1. **AEEC(1)**: the application of circuit analysis and design, computer programming, associated software, analog and digital electronics, and microcomputers, and engineering standards to the building, testing, operation, and maintenance of electrical/electronic(s) systems;

2. **AEEC(2)**: the application of natural sciences and mathematics at or above the level of algebra and trigonometry to the building, testing, operation, and maintenance of electrical/electronic systems;

3. **AEEC(3)**: the ability to analyze, design, and implement one or more of the following: control systems, instrumentation systems, communications systems, computer systems, or power systems;

4. **AEEC(4)**: the ability to apply project management techniques to electrical/-electronic(s) systems

5. **AEEC(5)**: the ability to utilize differential and integral calculus, as a minimum, to characterize the performance of electrical/electronic systems.

Table 3.3 presents the relationship between Student Outcomes and the ABET Electrical Engineering Program Criteria.

Table 3.3: Relationship of the EESP Student Outcomes to the ABET Electrical Engineering Criteria

EESP Student Outcome	ABET Electrical Engineering Criteria				
	AEEC(1)	AEEC(2)	AEEC(3)	AEEC(4)	AEEC(5)
SO-1		X			X
SO-2	X	X	X		
SO-3				X	
SO-4				X	
SO-5				X	
SO-6	X		X		
SO-7	X	X	X		X

3.4 Relationship of Student Outcomes to Program Educational Objectives

Asmentioned in Criterion 2, the program educational objectives of the EESP are as follows:

1. **PEO-1:** The EESP graduates have a mastery in basic sciences and mathematics relevant to the basic competency in the field of electrical engineering (Basic Science Skills)

2. **PEO-2:** The EESP graduates have an ability to anticipate, to formulate and to solve problems related to the field of electrical engineering (Professional Skills)

3. **PEO-3:** The EESP graduates have the spirit of leadership and entrepreneurship, the academic attitude, and have an ability to compete to work in various sectors all over the world, especially in Indonesia and Asia-Pacific region (Entrepreneur Skills)

4. **PEO-4:** The EESP graduates have capability to continue their study to higher degree of education all over the world (Research Skills)

The relationship between EESP Student Outcomes (SO-1 until SO-7) and the aforementioned PEOs are presented in Table 3.4. Relationship is represented in 3 kinds of symbol, i.e. H for High Relationship, M for Medium Relationship and L for Low Relationship. In the quantitative assessment and evaluation of the PEOs, the weight of multiplying value of the symbols is defined. In other word, an SO having higher relationship will contribute more significantly to PEO assessment data.

Program courses in the EESP curriculum that support the EESP Student Outcomes and Program Educational Objectives (PEOs) are presented in Table 3.5 for PEO-1, Table 3.6 for PEO-2, Table 3.7 for PEO-3 and Table 3.8 for PEO-4. In the table, the relationship between the PEOs and the SO as well as the ABET Engineering Criteria labeled as ABET(a) until ABET(k).

Table 3.4: Relationship of Student Outcomes to Program Educational Objectives

Student Outcomes	Program Educational Objectives			
	PEO-1	PEO-2	PEO-3	PEO-4
SO-1	H	M	L	H
SO-2	H	M	M	H
SO-3	L	L	H	L
SO-4	L	H	M	L
SO-5	L	L	H	M
SO-6	M	H	L	M
SO-7	M	L	L	H

TABLE 3.5: PROGRAM COURSES SUPPORTING STUDENT OUTCOMES AND **PEO-1**.

Program Educational Objective	*Program Student Outcome*	*ABET (a)-(k)*	*Program Courses Supporting the Program Outcome*
PEO 1	SO-1 (H)	(b)	[104D4112]; [205D4112]; [203D4112]; [202D4112]; [016U0033]; [020U0033]; [101D4113]; [017U0033]; [022U0033]; [105D4123]; [201D4113]; [204D4112]; [206D4112]; [106D4122]; [103D4112]; [102D4112]; [344D4122]; [321D4112]; [322D4113]; [354D4122]; [343D4122]; [304D4112]; [213D4122]; [212D4122]; [210D4123]; [211D4122]; [215D4122]; [216D4122]; [305D4112]; [306D4112]; [307D4112]; [308D4112]; [309D4112]; [310D4112]; [348D4122]; [349D4122]; [350D4122]; [351D4122]; [352D4122]; [312D4112]; [329D4113]; [330D4112]; [373D4122]; [337D4112]; [334D4112]; [379D4123]; [336D4113]; [380D4123]; [335D4113]; [319D4113]; [333D4113]; [331D4112]; [375D4122]; [353D4122]; [311D4113]; [303D4112]; [219D4121]; [217D4122]; [214D4122]
	SO-2; SO-6; SO-7 (M)	(a), (b), (c), (d), (f), (g), (j)	[212D4122]; [213D4122]; [301D4112]; [302D4112]; [303D4112]; [354D4122]; [321D4112]; [353D4122]; [342D4122]; [216D4122]; [109D4121]; [107D4122]; [106D4122]; [214D4122]; [215D4122]; [311D4113] [207D4111]; [208D4111]; [209D4111]; [307D4112]; [348D4122]; [349D4122]; [350D4122]; [352D4122]; [329D4113]; [330D4112]; [373D4122]; [337D4112]; [334D4112]; [336D4113]; [319D4113]; [333D4113]; [331D4112]; [372D4123]; [311D4113]; [218D4121]; [109D4121]; [108D4121]; [217D4122]; [219D4121]; [375D4122]; [335D4113]; [380D4123]; [379D4123] [304D4112]; [342D4122]; [343D4122]; [402D4112]; [330D4112]; [337D4112]; [334D4112]; [493D4122]; [211D4122]; [210D4123]; [206D4112]; [201D4113]; [022U0033]; [017U0033]; [372D4123]; [380D4123]; [379D4123]
	SO-3; SO-4; SO-5 (L)	(e), (g), (h), (i)	[010U0032]; [403D4112]; [492D4122]; [491D4124]; [401D4112]; [009U0032]; [493D4122] [401D4112]; [402D4112]; [344D4122]; [007U0032]; [008U0032]; [301D4112]; [345D4122] [011U0032]; [012U0032]; [403D4112]; [492D4122]; [401D4112]; [345D4122]; [218D4121]; [491D4124]; [493D4122]

TABLE 3.6: PROGRAM COURSES SUPPORTING STUDENT OUTCOMES AND **PEO-2**.

Program Educational Objective	*Program Student Outcome*	*ABET (a)-(k)*	*Program Courses Supporting the Program Outcome*
PEO 2	SO-4; SO-6 (H)	(a), (c), (h), (i),	[401D4112]; [402D4112]; [344D4122]; [007U0032]; [008U0032]; [301D4112]; [345D4122] [207D4111]; [208D4111]; [209D4111]; [307D4112]; [348D4122]; [349D4122]; [350D4122]; [352D4122]; [329D4113]; [330D4112]; [373D4122]; [337D4112]; [334D4112]; [336D4113]; [319D4113]; [333D4113]; [331D4112]; [372D4123]; [311D4113]; [218D4121]; [109D4121]; [108D4121]; [217D4122]; [219D4121]; [375D4122]; [335D4113]; [380D4123]; [379D4123]
	SO-1; SO-2 (M)	(a), (b), (d), (f), (j)	[104D4112]; [205D4112]; [203D4112]; [202D4112]; [016U0033]; [020U0033]; [101D4113]; [017U0033]; [022U0033]; [105D4123]; [201D4113]; [204D4112]; [206D4112]; [106D4122]; [103D4112]; [102D4112]; [344D4122]; [321D4112]; [322D4113]; [354D4122]; [343D4122]; [304D4112]; [213D4122]; [212D4122]; [210D4123]; [211D4122]; [215D4122]; [216D4122]; [305D4112]; [306D4112]; [307D4112]; [308D4112]; [309D4112]; [310D4112]; [348D4122]; [349D4122]; [350D4122]; [351D4122]; [352D4122]; [312D4112]; [329D4113]; [330D4112]; [373D4122]; [337D4112]; [334D4112]; [379D4123]; [336D4113]; [380D4123]; [335D4113]; [319D4113]; [333D4113]; [331D4112]; [375D4122]; [353D4122]; [311D4113]; [303D4112]; [219D4121]; [217D4122]; [214D4122] [212D4122]; [213D4122]; [301D4112]; [302D4112]; [303D4112]; [354D4122]; [321D4112]; [353D4122]; [342D4122]; [216D4122]; [109D4121]; [107D4122]; [106D4122]; [214D4122]; [215D4122]; [311D4113]
	SO-3; SO-5; SO-7 (L)	(b), (d), (e), (f) (g), (h), (j)	[010U0032]; [403D4112]; [492D4122]; [491D4124]; [401D4112]; [009U0032]; [493D4122] [011U0032]; [012U0032]; [403D4112]; [492D4122]; [401D4112]; [345D4122]; [218D4121]; [491D4124]; [493D4122] [304D4112]; [342D4122]; [343D4122]; [402D4112]; [330D4112]; [337D4112]; [334D4112]; [493D4122]; [211D4122]; [210D4123]; [206D4112]; [201D4113]; [022U0033]; [017U0033]; [372D4123]; [380D4123]; [379D4123]

TABLE 3.7: PROGRAM COURSES SUPPORTING STUDENT OUTCOMES AND **PEO-3**.

Program Educational Objective	*Program Student Outcome*	*ABET (a)-(k)*	*Program Courses Supporting the Program Outcome*
PEO 3	SO-3; SO-5 (H)	(e), (g), (h)	[010U0032]; [403D4112]; [492D4122]; [491D4124]; [401D4112]; [009U0032]; [493D4122] [011U0032]; [012U0032]; [403D4112]; [492D4122]; [401D4112]; [345D4122]; [218D4121]; [491D4124]; [493D4122]
	SO-2; SO-4 (M)	(a), (d), (f), (h), (i), (j)	[212D4122]; [213D4122]; [301D4112]; [302D4112]; [303D4112]; [354D4122]; [321D4112]; [353D4122]; [342D4122]; [216D4122]; [109D4121]; [107D4122]; [106D4122]; [214D4122]; [215D4122]; [311D4113] [401D4112]; [402D4112]; [344D4122]; [007U0032]; [008U0032]; [301D4112]; [345D4122]
	SO-1; SO-6; SO-7 (L)	(a), (b), (c), (d), (f), (g), (j)	[104D4112]; [205D4112]; [203D4112]; [202D4112]; [016U0033]; [020U0033]; [101D4113]; [017U0033]; [022U0033]; [105D4123]; [201D4113]; [204D4112]; [206D4112]; [106D4122]; [103D4112]; [102D4112]; [344D4122]; [321D4112]; [322D4113]; [354D4122]; [343D4122]; [304D4112]; [213D4122]; [212D4122]; [210D4123]; [211D4122]; [215D4122]; [216D4122]; [305D4112]; [306D4112]; [307D4112]; [308D4112]; [309D4112]; [310D4112]; [348D4122]; [349D4122]; [350D4122]; [351D4122]; [352D4122]; [312D4112]; [329D4113]; [330D4112]; [373D4122]; [337D4112]; [334D4112]; [379D4123]; [336D4113]; [380D4123]; [335D4113]; [319D4113]; [333D4113]; [331D4112]; [375D4122]; [353D4122]; [311D4113]; [303D4112]; [219D4121]; [217D4122]; [214D4122] [207D4111]; [208D4111]; [209D4111]; [307D4112]; [348D4122]; [349D4122]; [350D4122]; [352D4122]; [329D4113]; [330D4112]; [373D4122]; [337D4112]; [334D4112]; [336D4113]; [319D4113]; [333D4113]; [331D4112]; [372D4123]; [311D4113]; [218D4121]; [109D4121]; [108D4121]; [217D4122]; [219D4121]; [375D4122]; [335D4113]; [380D4123]; [379D4123] [304D4112]; [342D4122]; [343D4122]; [402D4112]; [330D4112]; [337D4112]; [334D4112]; [493D4122]; [211D4122]; [210D4123]; [206D4112]; [201D4113]; [022U0033]; [017U0033]; [372D4123]; [380D4123]; [379D4123]

Table 3.8: Program Courses supporting Student Outcomes and **PEO-4**.

Program Educational Objective	*Program Student Outcome*	*ABET (a)-(k)*	*Program Courses Supporting the Program Outcome*
PEO 4	SO-1; SO-2; SO-7 (H)	(a), (b), (d), (f), (g), (j)	[104D4112]; [205D4112]; [203D4112]; [202D4112]; [016U0033]; [020U0033]; [101D4113]; [017U0033]; [022U0033]; [105D4123]; [201D4113]; [204D4112]; [206D4112]; [106D4122]; [103D4112]; [102D4112]; [344D4122]; [321D4112]; [322D4113]; [354D4122]; [343D4122]; [304D4112]; [213D4122]; [212D4122]; [210D4123]; [211D4122]; [215D4122]; [216D4122]; [305D4112]; [306D4112]; [307D4112]; [308D4112]; [309D4112]; [310D4112]; [348D4122]; [349D4122]; [350D4122]; [351D4122]; [352D4122]; [312D4112]; [329D4113]; [330D4112]; [373D4122]; [337D4112]; [334D4112]; [379D4123]; [336D4113]; [380D4123]; [335D4113]; [319D4113]; [333D4113]; [331D4112]; [375D4122]; [353D4122]; [311D4113]; [303D4112]; [219D4121]; [217D4122]; [214D4122] [212D4122]; [213D4122]; [301D4112]; [302D4112]; [303D4112]; [354D4122]; [321D4112]; [353D4122]; [342D4122]; [216D4122]; [109D4121]; [107D4122]; [106D4122]; [214D4122]; [215D4122]; [311D4113] [207D4111]; [208D4111]; [209D4111]; [307D4112]; [348D4122]; [349D4122]; [350D4122]; [352D4122]; [329D4113]; [330D4112]; [373D4122]; [337D4112]; [334D4112]; [336D4113]; [319D4113]; [333D4113]; [331D4112]; [372D4123]; [311D4113]; [218D4121]; [109D4121]; [108D4121]; [217D4122]; [219D4121]; [375D4122]; [335D4113]; [380D4123]; [379D4123] [304D4112]; [342D4122]; [343D4122]; [402D4112]; [330D4112]; [337D4112]; [334D4112]; [493D4122]; [211D4122]; [210D4123]; [206D4112]; [201D4113]; [022U0033]; [017U0033]; [372D4123]; [380D4123]; [379D4123]
	SO-5; SO-6 (M)	(a), (c), (e), (h),	[011U0032]; [012U0032]; [403D4112]; [492D4122]; [401D4112]; [345D4122]; [218D4121]; [491D4124]; [493D4122] [207D4111]; [208D4111]; [209D4111]; [307D4112]; [348D4122]; [349D4122]; [350D4122]; [352D4122]; [329D4113]; [330D4112]; [373D4122]; [337D4112]; [334D4112]; [336D4113]; [319D4113]; [333D4113]; [331D4112]; [372D4123]; [311D4113]; [218D4121]; [109D4121]; [108D4121]; [217D4122]; [219D4121]; [375D4122]; [335D4113]; [380D4123]; [379D4123]
	SO-3; SO-4 (L)	(e), (g), (h), (i), (k)	[010U0032]; [403D4112]; [492D4122]; [491D4124]; [401D4112]; [009U0032]; [493D4122] [401D4112]; [402D4112]; [344D4122]; [007U0032]; [008U0032]; [301D4112]; [345D4122]

CRITERION 4

CONTINUOUS IMPROVEMENT

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This section summarizes the EESP the processes for regularly assessing and evaluating the extent to which the student outcomes are being attained. The assessment consists of some processes that identify, collect, and prepare the data necessary for evaluation. Evaluation is then made by interpreting the data acquired through the assessment processes to determine how well the student outcomes are being attained. All process are described in the following sections.

4.1 Documentation of Processes or Plan

Figure 4.1 presents the process of program curriculum evaluation. The EESP evaluation process is represented as a feedback assessment system. Students are considered as inputs to the system. The students take courses, learn knowledge and are taught based on the EESP curriculum. The EESP facilities (software and hardware) and faculty qualification (brainware) are supporting inputs to the systems.

The students and alumnae performances are then assessed to obtain quantitative data about the student performance indications. The EESP has 4 Program Educational Objectives (PEOs) and 7 Student Outcomes (SOs). The attained outcomes are evaluated by the advisory committee to improve the program, including the curriculum. The improvement can be made using the following (possible) actions, i.e. Improve the quality of course materials; (1) Invite international visiting lecturers; (2) Organize faculty staff's professional development; (3) Reform the curriculum structure; (4) Provide additional training for student.

To support the process, documenting the assessment data and developing tools (sheet software) for data processing are made by the EESP. The document of the grade points of all students is provided and collected from "Online Information Management System" (*Sistem Informasi Manajemen - SIM*) of *Universitas Hasanuddin*. The grade point data are then compiled to be a list of the number of students, who attain the certain grade level. The EESP faculty members or teaching team provides also their Course Portfolio, where the portfolio contains the performance indicator value of their taught course.

The EESP provides assessment sheets to process the assessment data. List of selected courses for direct assessment is provided. Questionnaires for Alumni, Employer and Senior/Student Exit Survey are arranged in such as a way that the Alumni performance can be gained from the questionnaires. For the sake of convenience, the questionnaires are labeled or coded.

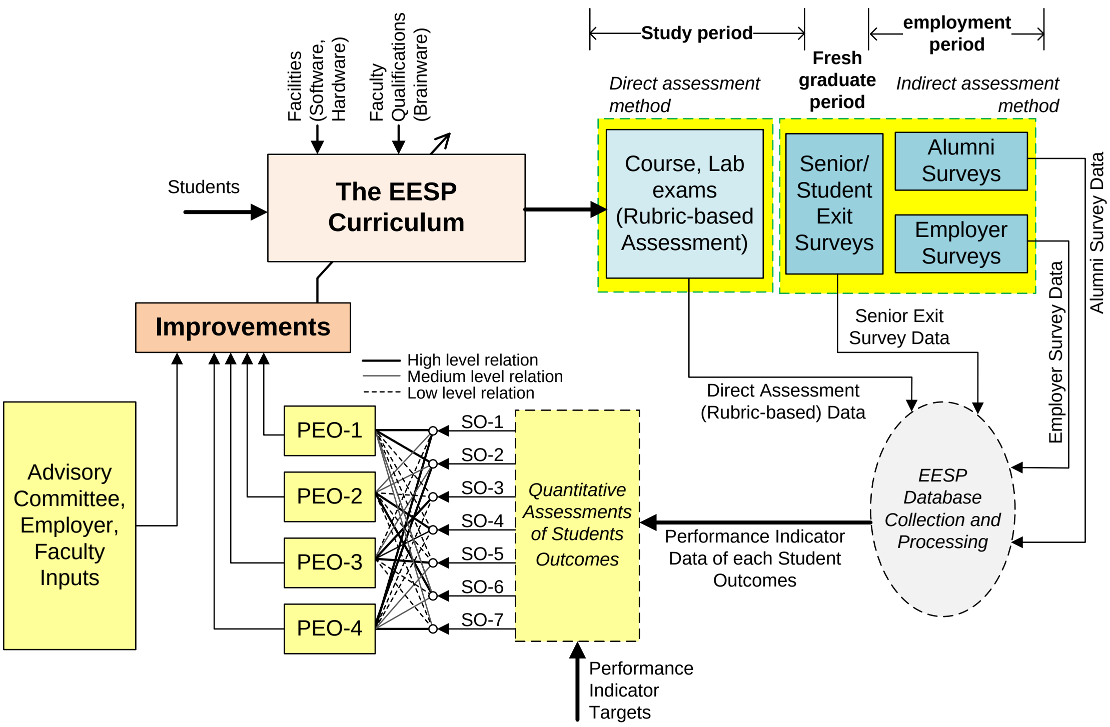


FIGURE 4.1: THE ASSESSMENT AND EVALUATION PROCESS OF THE EESP CURRICULUM.

4.2 Assessment Metrics and Methods of Student Outcomes

Two assessment methods used to measure the student outcomes or to collect assessment data are categorized into Direct Assessment and Indirect Assessment Method. Performance indicator values are used as metrics to measure the achievements of the student outcomes. The descriptions of the assessment methods and metrics used are given in the following subsections.

4.2.1 Direct Assessment

The direct assessment data are obtained principally from student achievements reflected from their grade points gained from their course examination results. The direct assessment values are formally collected from several course evaluation results. The course evaluation value is basically obtained from the average weighted grade points of students, who participate in the considered course. For each student outcome (SO), several performance indicators (PIs) are defined. Table 4.2 until Table 4.11.

In the tables, the performance indicators for each SO are also labeled as the combination of a number and alphanumeric number. We takes an example of the PIs for SO-1, which are shown in Table 4.2, Table 4.3 and Table 4.4. The SO-1 has 4 PIs, symbolized as 1K, 1C, 1A and 1D. The number 1 represents the related SO-number, and the alphanumeric K, C, A and D represent the degree of course performance indication. The following points show the degree of the course performance indication taxonomy.

- **K:** ability to know the considered topic, knowledge or skill.
- **C:** ability to comprehend the considered topic, knowledge or skill.
- **A:** ability to analyze the considered topic or problem.
- **D:** ability to design engineering solution to solve a problem.
- **I:** ability to design implement or to apply engineering solution to solve a problem.

In order to measure the performance indicator (PI) value of each course, a rubric is defined, which is used to measure the student learning outcome or student achievement. Each faculty teaching member or team, who teach/taught a course, made a rubric. The Table 4.1 presents a rubric that categorizes the student achievement into 9 levels. In general, the rubric is inline with the standard grade system of *Universitas Hasanuddin*, and is the basis to develop the rubric of each course.

Using the rubric categories shown in Table 4.1, learning outcome or achievement level or grade point of each student in each course is measured. Several courses are then collected or selected to determine the performance indicator values of each student outcome. In accordance with the rubric shown in Table 4.1, the student learning outcome value should be in the range of 0.00 until 4.00.

Table 4.12 through Table 4.14 present courses that are selected for PI data measurement or collection. The EESP accumulates the total PI data from several

TABLE 4.1: RUBRIC USED FOR THE DIRECT ASSESSMENT METHOD TO MEASURE STUDENT WORK PERFORMANCE IN A COURSE.

Achievement Level	Grade Point	Grade	Definition
Poor	0.00	E	Student's work evaluation is poor
Unsatisfactory	1.00	D	Student's work evaluation is not achieved
Marginal	2.00	C	Student's work evaluation is achieved in the minimum level
Marginal Plus	2.50	C+	Student's work evaluation is achieved slightly above the minimum level
Proficient Minus	2.75	B-	Student's work evaluation is achieved slightly below the minimum level
Proficient	3.00	B	Student's work evaluation is achieved in the average level
Proficient Plus	3.50	B+	Student's work evaluation is achieved slightly above the average level
Exceptional Minus	3.75	A-	Student's work evaluation is achieved slightly below the exceptional level
Exceptional	4.00	A	Student's work evaluation is achieved in the exceptional level

selected courses, and computes its average value. For example, to measure the PI value of the **1K** of the **SO-1**, N_{1K} number of courses are selected. The PI value of **1K** is calculated as

$$P(1K) = \sum_{k=1}^{N_{1K}} C_{1K}(k) \tag{4.1}$$

where $C_{1K}(k)$ is the performance indication value of the selected course k for the PI label **1K**.

To calculate, for example, the $C_{1K}(k)$ of the course k, the following formula is used.

$$C(1K)(k) = \frac{4N_{4,k} + 3.75N_{3.75,k} + 3.5N_{3.5,k} + 3N_{3,k} + 2.75N_{2.75,k} + 2.5N_{2.5,k} + 2N_{2,k} + N_{1,k}}{N_{S,k}} \tag{4.2}$$

where $N_{S,k}$ is the total number of students, who take the course k.
$N_{4,k}$ is the number of students, who pass the course with grade A.
$N_{3.75,k}$ is the number of students, who pass the course with grade A-.
$N_{3.5,k}$ is the number of students, who pass the course with grade B+.
$N_{3,k}$ is the number of students, who pass the course with grade B.
$N_{2.75,k}$ is the number of students, who pass the course with grade B-.
$N_{2.5,k}$ is the number of students, who pass the course with grade C+.
$N_{2,k}$ is the number of students, who pass the course with grade C.
$N_{1,k}$ is the number of students, who pass the course with grade D.
The performance indication value of the other PI values is calculated similar to EQU. 4.1.

The same formula is also used for the other **PI** of the **SO-1**, i.e. $P(1C)$, $P(1A)$ and $P(1D)$. For each PIs there are PI target value P_{Target}. In our evaluation, the PI target for all PIs is set to 3.00. The deviation between each measured PI and the targeted PI is defined as ΔP. For example, the deviation of PI label **1K** is calculated as

$$\Delta P(1K) = P_{Target} - P(1K) \tag{4.3}$$

The deviation of the other PI values is calculated similar to Equ. 4.3.

Each PI has different weight, which represents the contribution level of the PI to the considered SO. In the **SO-1** the contribution weights of its PIs are 0.1, 0.2, 0.3 and 0.4 for **1K**, **1C**, **1A** and **1D**, respectively. The contributing weight of the other PIs of the other SOs are also set. The performance indication label "K" has lowest contributing weight, while the performance indication label "I" has lowest contributing weight. But, the total contributing weight of the PIs of the same SO is 1.00. Thus, the achievement value of the **SO-1** is formulated as follows.

$$S(1) = P_{Target} - (0.1\Delta P(1K) + 0.2\Delta P(1C) + 0.3\Delta P(1A) + 0.5\Delta P(1D)) \tag{4.4}$$
$$S(2) = P_{Target} - (0.2\Delta P(2A) + 0.3\Delta P(2D) + 0.5\Delta P(2I)) \tag{4.5}$$
$$S(3) = P_{Target} - (0.2\Delta P(3A) + 0.3\Delta P(3D) + 0.5\Delta P(3I)) \tag{4.6}$$
$$S(4) = P_{Target} - (0.2\Delta P(4K) + 0.3\Delta P(4C) + 0.5\Delta P(4I)) \tag{4.7}$$
$$S(5) = P_{Target} - (0.2\Delta P(5C) + 0.3\Delta P(5D) + 0.5\Delta P(5I)) \tag{4.8}$$
$$S(6) = P_{Target} - (0.2\Delta P(6A) + 0.3\Delta P(6D) + 0.5\Delta P(6I)) \tag{4.9}$$
$$S(7) = P_{Target} - (0.2\Delta P(7C) + 0.3\Delta P(7A) + 0.5\Delta P(7I)) \tag{4.10}$$

Table 4.12, Table 4.13 and Table 4.14 present the map of the list of courses with its related performance indicator. The course (row) having the symbol "x" in its related SO/PI sheets (column) is selected for the PI measurement.

Table 4.2: Performance Indicators for Student Outcomes 1 (SO-1), its related courses, measurement frequency and other information.

Performance Indicators (PI) for this outcome	***Courses where PI exists (use a simple list)***	***Specific Method of Assessment (rubric, etc.)***	***Courses Assessed (where the PI and related data are collected)***	***Cycle of When the PI Assessed (how often)***	***Year & Semester when Data Were Collected***	***Performance Target for PI***
(1K) Ability to define and recognize learned electrical engineering subjects	[104D4112];	Rubric-based	[104D4112];	4 times within 4 years	2015(1), 2016(1), 2017(1), 2018(1)	3.00
	[344D4112];	Rubric-based	[344D4112];	3 times within 4 years	2015(2), 2016(2), 2017(2)	3.00
	[205D4112];	Rubric-based	[205D4112];	3 times within 4 years	2016(1), 2017(1), 2018(1)	3.00
(1C) Ability to understand and grasp the meaning of the electrical engineering knowledge and problems	[202D4112]; [203D4112]; [304D4112];[321D4112]; [324D4112]; [315D4112]; [332D4112];	Rubric-based	[202D4112]; [203D4112]; [304D4112];	3 times within 4 years	2016(1), 2017(1), 2018(1)	3.00
	[212D4122]; [213D4122]; [355D4122]; [358D4122]; [373D4122]; [416D4132]; [410D4132];	Rubric-based	[212D4122]; [213D4122];	Twice within 4 years	2016(1), 2017(2)	3.00
	[354D4122];	Rubric-based	[354D4122];	Once within 4 years	2017(2)	3.00
	[322D4113];	Rubric-based	[322D4113];	Twice within 4 years	2018(1), 2015(2)	3.00
	[321D4112];	Rubric-based	[321D4112];	Once within 4 years	2018(1)	3.00
	[343D4122];	Rubric-based	[343D4122];	Twice within 4 years	2015(2), 2017(2)	3.00
(1A) Ability to analyze electrical engineering systems and problems	[016U0033]; [020U0033]; [201D4113]; [206D4112]; [306D4112]; [310D4112]; [317D4112]; [320D4112]; [407D4132]; [411D4112];	Rubric-based	[016U0033]; [020U0033]; [201D4113]; [206D4112]; [306D4112]; [310D4112];	4 Times within 4 years	2015(1), 2016(1), 2017(1), 2018(1).	3.00
	[101D4113];	Rubric-based	[101D4113];	Once within 4 years	2015(2),2016(1),2017(1),2018(1)	3.00
	[204D4112];	Rubric-based	[204D4112];	3 Times within 4 years	2016(1),2017(1),2018(1)	3.00
	[017U0033]; [210D4123]; [211D4122]; [351D4122]; [352D4122];	Rubric-based	[017U0033]; [210D4123]; [211D4122]; [351D4122]; [352D4122];	3 Times within 4 years	2015(2), 2016(2), 2017(2)	3.00

TABLE 4.3: PERFORMANCE INDICATORS FOR STUDENT OUTCOMES 1 (SO-1), ITS RELATED COURSES, MEASUREMENT FREQUENCY AND OTHER INFORMATION (CONTINUED).

Performance Indicators (PI) for this outcome	***Courses where PI exists (use a simple list)***	***Specific Method of Assessment (rubric, etc.)***	***Courses Assessed (where the PI and related data are collected)***	***Cycle of When the PI Assessed (how often)***	***Year & Semester when Data Were Collected***	***Performance Target for PI***
	[215D4122]; [216D4122];	Rubric-based	[215D4122]; [216D4122];	Twice within 4 years	2016(2), 2017(2)	3.00
	[308D4112];	Rubric-based	[308D4112];	Twice within 4 years	2016(1), 2018(1)	3.00
	[309D4112];	Rubric-based	[309D4112];	Twice within 4 years	2016(1), 2017(1),	3.00
	[305D4112]; [307D4112];	Rubric-based	[305D4112]; [307D4112];	3 Times within 4 years	2016(1), 2017(1), 2018(1)	3.00
	[309D4112];	Rubric-based	[309D4112];	Twice within 4 years	2016(1), 2017(1).	3.00
	[348D4122];	Rubric-based	[348D4122];	Once within 4 years	2017(2)	3.00
	[022U0033]; [105D4123]; [373D4122]; [105D4123]; [215D4122];[350D4122];	Rubric-based	[022U0033]; [105D4123]; [373D4122]; [105D4123]; [215D4122];[350D4122];	Twice within 4 years	2016(2), 2017(2)	3.00
	[349D4122];	Rubric-based	[349D4122];	Once within 4 years	2016(2)	3.00
	[312D4112]; [329D4113]; [330D4112];	Rubric-based	[312D4112]; [329D4113]; [330D4112];	Once within 4 years	2018(1)	3.00
	[215D4122];	Rubric-based	[215D4122];	[215D4122];	2015(1)	3.00

Table 4.4: Performance Indicators for Student Outcomes 1 (SO-1), its related courses, measurement frequency and other information (Continued).

Performance Indicators (PI) for this outcome	***Courses where PI exists (use a simple list)***	***Specific Method of Assessment (rubric, etc.)***	***Courses Assessed (where the PI and related data are collected)***	***Cycle of When the PI Assessed (how often)***	***Year & Semester when Data Were Collected***	***Performance Target for PI***
(1D) Ability to design components and systems to solve electrical engineering problems	[336D4113];	Rubric-based	[336D4113];	Once within 4 years	2015(2)	3.00
	[353D4122];	Rubric-based	[353D4122];	Once within 4 years	2017(2)	3.00
	[106D4122]; [214D4122]; [219D4121];	Rubric-based	[106D4122]; [214D4122]; [219D4121];	Twice within 4 years	2016(2), 2017(2)	3.00
	[374D4122];	Rubric-based	[374D4122];	Twice within 4 years	2015(1), 2016(1)	3.00
	[102D4112]; [336D4113]; [425D4132]; [426D4132]; [405D4132]; [406D4132]; [435D4132];	Rubric-based	[102D4112];	4 Times within 4 years	2016(1), 2017(1), 2018(1), 2015(2)	3.00
	[335D4113]; [331D4112];	Rubric-based	[335D4113]; [331D4112];	Twice within 4 years	2016(1), 2018(1)	3.00
	[217D4112];	Rubric-based	[217D4112];	Twice within 4 years	2015(1), 2017(2)	3.00
	[379D4123]; [380D4123];	Rubric-based	[379D4123]; [380D4123];	Once within 4 years	2016(1)	3.00
	[337D4112]; [334D4112]; [319D4113]; [333D4113];	Rubric-based	[337D4112]; [334D4112]; [319D4113]; [333D4113];	Once within 4 years	2018(1)	3.00
	[103D4112];	Rubric-based	[103D4112];	4 Times within 4 years	2015(1), 2016(1), 2017(1), 2018(1)	3.00

Table 4.5: Performance Indicators for Student Outcomes 2 (SO-2), its related courses, measurement frequency and other information.

Performance Indicators (PI) for this outcome	***Courses where PI exists (use a simple list)***	***Specific Method of Assessment (rubric, etc.)***	***Courses Assessed (where the PI and related data are collected)***	***Cycle of When the PI Assessed (how often)***	***Year & Semester when Data Were Collected***	***Performance Target for PI***
(2A) Ability to analyze possible solutions to engineering problems	[301D4112]; [302D4112]; [303D4112]; [321D4112]; [416D4132]; [410D4132];	Rubric-based	[301D4112]; [302D4112]; [303D4112];	4 Times within 4 years	2015(1), 2016(1), 2017(1), 2018(1)	3.00
	[212D4122]; [213D4122];	Rubric-based	[212D4122]; [213D4122];	Twice within 4 years	2016(2), 2017(2)	3.00
	[354D4122]; [321D4112];	Rubric-based	[354D4122]; [321D4112];	Once within 4 years	2017(2)	3.00
(2D) Ability to design solution to solve engineering problems	[353D4122];	Rubric-based	[353D4122];	Once within 4 years	2017(2)	3.00
	[107D4122];	Rubric-based	[107D4122];	3 Times within 4 years	2015(2), 2016(2), 2017(2)	3.00
	[109D4121]; [216D4122];	Rubric-based	[109D4121]; [216D4122];	Twice within 4 years	2016(2), 2017(2)	3.00
	[342D4122];	Rubric-based	[342D4122];	Once within 4 years	2016(1)	3.00
	[302D4112]; [317D4112]; [406D4132]; [407D4132]; [411D4112];	Rubric-based	[302D4112];	4 Times within 4 years	2015(1), 2016(1), 2017(1), 2018(1)	3.00
(2I) Ability to apply or implement engineering skills to actual conditions	[106D4122]; [214D4122]; [214D4122];	Rubric-based	[106D4122]; [214D4122]; [214D4122];	Twice within 4 years	2016(2), 2017(2)	3.00
	[215D4122];	Rubric-based	[215D4122];	Once within 4 years	2015(1)	3.00
	[311D4113];	Rubric-based	[311D4113];	Once within 4 years	2016(1)	3.00

Table 4.6: Performance Indicators for Student Outcomes 3 (SO-3), its related courses, measurement frequency and other information.

Performance Indicators (PI) for this outcome	***Courses where PI exists (use a simple list)***	***Specific Method of Assessment (rubric, etc.)***	***Courses Assessed (where the PI and related data are collected)***	***Cycle of When the PI Assessed (how often)***	***Year & Semester when Data Were Collected***	***Performance Target for PI***
(3A) Ability to analyze effective speech structure to communicate idea	[010U0032];	Rubric-based	[010U0032];	Twice within 4 years	2016(2), 2017(2)	3.00
	[403D4112];	Rubric-based	[403D4112];	4 Times within 4 years	2016(1), 2017(1), 2016(2), 2017(2)	3.00
(3D) Ability to arrange speech concept and structure	[491D4124];	Rubric-based	[491D4124];	3 Times within 4 years	2016(1), 2015(2), 2016(2)	3.00
	[492D4122];	Rubric-based	[492D4122];	4 Times within 4 years	2016(1), 2017(1), 2016(2), 2017(2)	3.00
	[401D4112];	Rubric-based	[401D4112];	3 Times within 4 years	2015(1), 2016(1), 2017(1),	3.00
(3I) Ability to present idea in real situation (in front of audience)	[493D4124];	Rubric-based	[493D4124];	Once within 4 years	2017(2)	3.00
	[009U0032];	Rubric-based	[009U0032];	4 Times within 4 years	2015(1), 2016(1), 2017(1), 2018(1)	3.00

Table 4.7: Performance Indicators for Student Outcomes 4 (SO-4), its related courses, measurement frequency and other information.

Performance Indicators (PI) for this outcome	***Courses where PI exists (use a simple list)***	***Specific Method of Assessment (rubric, etc.)***	***Courses Assessed (where the PI and related data are collected)***	***Cycle of When the PI Assessed (how often)***	***Year & Semester when Data Were Collected***	***Performance Target for PI***
(4K) Ability to know and recognize professional code of ethics	[401D4112];	Rubric-based	[401D4112];	5 Times within 4 years	2015(1), 2016(1), 2017(1), 2015(2), 2016(2)	3.00
	[402D4112]	Rubric-based	[402D4112]	4 Times within 4 years	2015(1), 2016(1), 2017(1), 2018(1)	3.00
(4C) Ability to comprehend professional code of ethics	[007U0032];	Rubric-based	[007U0032];	Twice within 4 years	2016(2), 2017(2)	3.00
	[344D4122];	Rubric-based	[344D4122];	4 Times within 4 years	2016(1), 2015(2), 2016(2), 2017(2)	3.00
(4I) Ability to apply engineering ethics in real engineering design problems	[008U0032]; [301D4112];	Rubric-based	[008U0032]; [301D4112];	4 Times within 4 years	2015(1), 2016(1), 2017(1), 2018(1)	3.00
	[345D4122];	Rubric-based	[345D4122];	Twice within 4 years	2016(2), 2017(2)	3.00

Table 4.8: Performance Indicators for Student Outcomes 5 (SO-5), its related courses, measurement frequency and other information.

Performance Indicators (PI) for this outcome	***Courses where PI exists (use a simple list)***	***Specific Method of Assessment (rubric, etc.)***	***Courses Assessed (where the PI and related data are collected)***	***Cycle of When the PI Assessed (how often)***	***Year & Semester when Data Were Collected***	***Performance Target for PI***
(5C) Ability to comprehend leadership skills in a project-based education	[012U0032];	Rubric-based	[012U0032];	Twice within 4 years	2016(2), 2017(2)	3.00
	[403D4112];	Rubric-based	[403D4112];	4 Times within 4 years	2015(1), 2018(1), 2016(2), 2017(2)	3.00
	[011U0032];	Rubric-based	[011U0032];	4 Times within 4 years	2015(1), 2016(1), 2017(1), 2018(1)	3.00
(5D) Ability to design project plan in a simulated engineering project	[401D4112];	Rubric-based	[401D4112];	5 Times within 4 years	2015(1), 2016(1), 2017(1), 2015(2), 2016(2),	3.00
	[492D4122];	Rubric-based	[492D4122];	4 Times within 4 years	2016(1), 2017(1), 2016(2), 2017(2)	3.00
	[345D4112];	Rubric-based	[345D4112];	Twice Times within 4 years	2016(2), 2017(2)	3.00
(5I) Ability to lead a team in real engineering projects	[491D41240];	Rubric-based	[491D41240];	3 Times within 4 years	2016(1), 2015(2), 2016(2)	3.00
	[493D4124];	Rubric-based	[493D4124];	Once within 4 years	2017(2)	3.00
	[218D4121];	Rubric-based	[218D4121];	Twice within 4 years	2016(2), 2017(2)	3.00

Table 4.9: Performance Indicators for Student Outcomes 5 (SO-6-1), its related courses, measurement frequency and other information.

Performance Indicators (PI) for this outcome	***Courses where PI exists (use a simple list)***	***Specific Method of Assessment (rubric, etc.)***	***Courses Assessed (where the PI and related data are collected)***	***Cycle of When the PI Assessed (how often)***	***Year & Semester when Data Were Collected***	***Performance Target for PI***
(6A) Ability to analyze practically and interpret data to draw conclusions	[372D4123];	Rubric-based	[372D4123];	Once within 4 years	2015(2)	3.00
	[330D4112];	Rubric-based	[330D4112];	Once within 4 years	2018(1)	3.00
	[352D4122];	Rubric-based	[352D4122];	3 Times within 4 years	2015(2), 2016(2), 2017(2)	3.00
	[350D4122];	Rubric-based	[350D4122];	Twice within 4 years	2016(2), 2017(2)	3.00
	[349D4122];	Rubric-based	[349D4122];	Once within 4 years	2016(2)	3.00
	[348D4122];	Rubric-based	[348D4122];	Once within 4 years	2017(2)	3.00
	[208D4111]; [307D4112]; [406D4132];	Rubric-based	[208D4111]; [307D4112]; [317D4112];	4 Times within 4 years	2015(1), 2016(1), 2017(1), 2018(1)	3.00
	[329D4113];	Rubric-based	[329D4113];	Once within 4 years	2018(1)	3.00
	[207D4111];	Rubric-based	[207D4111];	4 Times within 4 years	2016(1), 2017(1), 2018(1), 2015(2)	3.00
	[209D4111];	Rubric-based	[209D4111];	3 Times within 4 years	2016(1), 2017(1), 2018(1)	3.00
(6D) Ability to design practical module and conduct experiment independently	[336D4113];	Rubric-based	[336D4113];	Once within 4 years	2015(2)	3.00
	[109D4121]; [218D4121];	Rubric-based	[109D4121]; [218D4121];	Twice within 4 years	2016(2), 2017(2)	3.00
	[334D4112]; [337D4112]; [319D4113];	Rubric-based	[334D4112]; [337D4112]; [319D4113];	Once within 4 years	2018(1)	3.00
	[331D4112]; [336D4113];	Rubric-based	[331D4112];	4 Times within 4 years	2016(1), 2017(1), 2018(1), 2015(2)	3.00
	[333D4113];	Rubric-based	[333D4113];	Once within 4 years	2015(2)	3.00
	[108D4121];	Rubric-based	[108D4121];	3 Times within 4 years	2015(1), 2016(2), 2017(2)	3.00
	[311D4113];	Rubric-based	[311D4113];	Twice within 4 years	2016(1), 2015(2)	3.00

Table 4.10: Performance Indicators for Student Outcomes 6 (SO-6-2), its related courses, measurement frequency and other information (Continued).

	[372D4123];	Rubric-based	[372D4123];	3 Times within 4 years	2015(2), 2016(2), 2017(2)	3.00
(6I) Ability to apply or implement engineering knowledge in laboratory scales	[217D4122];	Rubric-based	[217D4122];	Once within 4 years	2017(2)	3.00
	[219D4121];	Rubric-based	[219D4121];	Twice within 4 years	2016(2),2017(2)	3.00
	[335D4113];	Rubric-based	[335D4113];	Twice within 4 years	2016(1),2018(1)	3.00
	[375D4122];	Rubric-based	[375D4122];	3 Times within 4 years	2016(1),2016(2),2017(2)	3.00
	[380D4123]; [379D4123]	Rubric-based	[380D4123]; [379D4123]	Once within 4 years	2016(1)	3.00

Table 4.11: Performance Indicators for Student Outcomes 7 (SO-7), its related courses, measurement frequency and other information.

Performance Indicators (PI) for this outcome	*Courses where PI exists (use a simple list)*	*Specific Method of Assessment (rubric, etc.)*	*Courses Assessed (where the PI and related data are collected)*	*Cycle of When the PI Assessed (how often)*	*Year & Semester when Data Were Collected*	*Performance Target for PI*
(7C) Ability to identify new issues in electrical engineering fields of study	[304D4112]; [402D4112];	Rubric-based	[304D4112]; [402D4112];	4 Times within 4 years	2015(1), 2016(1), 2017(1), 2018(1)	3.00
	[330D4112];	Rubric-based	[330D4112];	Twice within 4 years	2015(1), 2018(1)	3.00
	[337D4112];	Rubric-based	[337D4112];	Twice within 4 years	2018(1), 2015(2)	3.00
	[342D4122];	Rubric-based	[342D4122];	4 Times within 4 years	2016(1), 2015(2), 2016(2), 2017(2)	3.00
	[343D4122];	Rubric-based	[343D4122];	Once within 4 years	2017(2)	3.00
(7A) Ability to analyze possible alternative solutions to solve a trending problem	[493D4122];	Rubric-based	[493D4122];	Once within 4 years	2017(2)	3.00
	[017U0033]; [211D4122]; [210D4123];	Rubric-based	[017U0033]; [211D4122]; [210D4123];	3 Times within 4 years	2015(2), 2016(2), 2017(2)	3.00
	[022UOO33];	Rubric-based	[022UOO33];	Twice within 4 years	2016(2), 2017(2)	3.00
	[334D4112];	Rubric-based	[334D4112];	Once within 4 years	2015(2)	3.00
	[201D4113]; [206D4112];	Rubric-based	[201D4113]; [206D4112];	4 Times within 4 years	2015(1), 2016(1), 2017(1), 2018(1)	3.00
(7I) Ability to give novel scientific contribution to solve recent problems/issues in electrical engineering field of study	[380D4123]; [379D4123];	Rubric-based	[380D4123]; [379D4123];	Once within 4 years	2016(1)	3.00
	[372D4123];	Rubric-based	[372D4123];	3 Times within 4 years	2015(2), 2016(2), 2017(2)	3.00

Table 4.12: List of Selected Courses for PI and SO Measurement.

NO	KODE	COURSE	YEAR	SEM.	STUDENT OUTCOMES																					
					SO-1				SO-2			SO-3			SO-4			SO-5			SO-6			SO-7		
					1K	1C	1A	1D	2A	2D	2I	3A	3D	3I	4K	4C	4I	5C	5D	5I	6A	6D	6I	7C	7A	7I
1	INDIRECT ASSESS-MENT	Student Exit Survey																								
2		Alumni Survey																								
3		Employer Survey																								
	DIRECT ASSESSMENT (RUBRIC-BASED ASSESSMENT METHOD)																									
1	011U0032	*Civic Education*	1	1											x			x								
2	009U0032	*Bahasa Indonesia*	1	1									x	x												
3	016U0033	*Calculus 1*	1	1			x																			
4	020U0033	*Physics 1*	1	1			x																			
5	101D4113	*Electrical Circuits 1*	1	1			x																			
6	102D4112	*Logic Circuits*	1	1				x																		
7	103D4112	*Engineering Drawing*	1	1				x																		
8	104D4112	*Advanced Chemistry*	1	1	x																					
9	012U0032	*State Ideology: Pancasila*	1	2											x			x								
10	010U0032	*English*	1	2								x	x													
11	017U0033	*Calculus 2*	1	2			x																		x	
12	022U0033	*Physics 2*	1	2			x																		x	
13	105D4123	*Electric Circuits 2*	1	2			x																			
14	106D4122	*Digital Systems*	1	2				x			x															
15	107D4122	*Computer Programming*	1	2						x																
16	108D4121	*Electric Circuits Laboratory*	1	2																		x				
17	109D4121	*Digital Systems Laboratory*	1	2						x												x				
18	008U0032	*Concept of Science and Technology*	2	1													x									
19	201D4113	*Advanced Mathematics 1*	2	1			x																		x	
20	202D4112	*Basic Electric Power (Systems)*	2	1		x																				
21	203D4112	*Basic Telecommunication (Systems)*	2	1		x																				
22	204D4112	*Basic Electronics*	2	1			x																			
23	205D4112	*Electric Material Physics*	2	1	x																					
24	206D4112	*Advanced Physics*	2	1			x																		x	
25	207D4111	*Basic Electric Power Laboratory*	2	1																	x					

TABLE 4.13: LIST OF SELECTED COURSES FOR PI AND SO MEASUREMENT (CONTINUED).

NO	KODE	COURSE	YEAR	SEM.	STUDENT OUTCOMES																					
					SO-1				SO-2			SO-3			SO-4			SO-5			SO-6			SO-7		
					1K	1C	1A	1D	2A	2D	2I	3A	3D	3I	4K	4C	4I	5C	5D	5I	6A	6D	6I	7C	7A	7I
26	208D4111	*Basic Telecommunication Laboratory*	2	1																	x					
27	209D4111	*Basic Electronics Laboratory*	2	1																	x					
28	007U0032	*Social Science of Maritime Culture*	2	2												x										
29	210D4123	*Advanced Mathematics 2*	2	2			x																		x	
30	211D4122	*Linear Systems*	2	2			x																		x	
31	212D4122	*Electric Machines*	2	2		x			x																	
32	213D4122	*Basic Multimedia*	2	2		x			x																	
33	214D4122	*Integrated Electronics*	2	2				x			x															
34	215D4122	*Microprocessor Systems and Interfaces*	2	2			x				x															
35	216D4122	*Basic Control Systems*	2	2			x			x																
36	217D4122	*Electric Installation + Laboratory*	2	2				x															x			
37	218D4121	*Integrated Electronics Laboratory*	2	2																x		x				
38	219D4121	*Microprocessor Systems and Interfaces Laboratory*	2	2				x															x			
39	301D4112	*Engineering Economics*	3	1					x								x									
40	302D4112	*Probability and Statistics*	3	1					x	x																
41	303D4112	*Electric Measurement*	3	1				x	x																	
42	304D4112	*Electromagnetics*	3	1		x																		x		
43	342D4122	*Numerical Methods*	3	2						x														x		
44	343D4122	*Energy Conversion*	3	2		x																		x		
45	344D4122	*Environmental Science*	3	2	x											x										
46	345D4122	*Management and Entrepreneurship*	3	2													x		x							
47	402D4112	*Research Methods and Scientific Writing*	3	2																				x		
48	305D4112	*Alternating Current Transmission Systems*	3	1			x																			
49	306D4112	*Electric Power System Analysis*	3	1			x																			
50	307D4112	*Electric Machines Analysis 1 + Laboratory*	3	1			x														x					
51	308D4112	*Electric Power Protection System 1*	3	1			x																			
52	309D4112	*Electric Power Generation Systems*	3	1			x																			
53	310D4112	*Power System Control and Stability*	3	1			x																			
54	348D4122	*Electric Power Distribution Systems + Laboratory*	3	1			x														x					

Table 4.14: List of Selected Courses for PI and SO Measurement (Continued).

NO	KODE	COURSE	YEAR	SEM.	STUDENT OUTCOMES																					
					SO-1				SO-2			SO-3			SO-4			SO-5			SO-6			SO-7		
					1K	1C	1A	1D	2A	2D	2I	3A	3D	3I	4K	4C	4I	5C	5D	5I	6A	6D	6I	7C	7A	7I
55	349D4122	*Electric Power Protection System 2 + Laboratory*	3	2			x														x					
56	350D4122	*Electric Machines Analysis 2 + Laboratory*	3	2			x														x					
57	351D4122	*Power Systems Operations*	3	2			x																			
58	352D4122	*High Voltage Engineering + Laboratory*	3	2			x														x					
59	311D4113	*Antenna and Propagation + Laboratory*	3	1				x			x											x				
60	312D4112	*Telecommunication Transmission Systems*	3	1			x																			
61	353D4122	*Cellular Communication*	3	2				x		x																
62	354D4122	*Wireless Technology*	3	2		x			x																	
63	322D4113	*Access Network Technology*	3	2		x																				
64	321D4112	*Data Communications*	3	1		x			x																	
65	329D4113	*Control Systems + Laboratory*	3	1			x														x					
66	330D4112	*Process Control Technology*	3	1			x														x			x		
67	373D4122	*Optimal Control Systems*	3	1			x														x					
68	372D4123	*Digital Control Systems + Laboratory*	3	2																		x				x
69	375D4122	*Control Systems Design*	3	2				x															x			
70	331D4112	*Industrial Robotics*	3	1				x														x				
71	333D4113	*Electronic Instrumentation Systems + Laboratory*	3	1				x														x				
72	319D4113	*Microprocessor-based Systems + Laboratory*	3	1				x														x				
73	335D4113	*Digital System Design + Laboratory*	3	1				x															x			
74	380D4123	*Embedded Systems Design + Laboratory*	3	2				x															x			x
75	336D4113	*Computer Architecture 1 + Laboratory*	3	1				x														x				
76	379D4123	*Power Electronics + Laboratory*	3	2				x															x			x
77	334D4112	*Computer Network-based SCADA*	3	1				x														x			x	
78	337D4112	*Industrial Automation + Laboratory (PLC)*	3	1				x														x		x		

Performance Indicator Code:	1K	1C	1A	1D	2A	2D	2I	3A	3D	3I	4K	4C	4I	5C	5D	5I	6A	6D	6I	7C	7A	7I
Number of Courses where Assessment Data (per PI) are collected:	3	9	28	19	7	6	4	1	2	1	2	2	3	2	1	1	11	11	6	6	7	3
Student Outcomes Code:	SO-1				SO-2			SO-3			SO-4			SO-5			SO-6			SO-7		
Number of Courses where Assessment Data (per SO) are collected:	59				17			4			6			4			28			16		

TABLE 4.15: THE DIRECT ASSESSMENT RESULTS FOR ACADEMIC YEAR 2015/2016, FIRST SEMESTER.

NO	KODE	COURSE	STUDENT OUTCOMES																					
			SO-1				SO-2			SO-3			SO-4			SO-5			SO-6			SO-7		
			1K	1C	1A	1D	2A	2D	2I	3A	3D	3I	4K	4C	4I	5C	5D	5I	6A	6D	6I	7C	7A	7I
1	011U0032	*Civic Education*											3.32			3.32								
2	009U0032	*Bahasa Indonesia*										3.55												
3	016U0033	*Calculus 1*			1.96																			
4	020U0033	*Physics 1*			3.26																			
7	103D4112	*Engineering Drawing*				3.74																		
8	104D4112	*Advanced Chemistry*	3.41																					
13	105D4123	*Electric Circuits 2*			2.50																			
16	108D4121	*Electric Circuits Laboratory*																		3.30				
18	008U0032	*Concept of Science and Technology*													3.82									
19	201D4113	*Advanced Mathematics 1*			2.42																		2.42	
24	206D4112	*Advanced Physics*			3.68																		3.68	
26	208D4111	*Basic Telecommunication Laboratory*																	0.13					
34	215D4122	*Microprocessor Systems and Interfaces*			1.42				1.42															
35	216D4122	*Basic Control Systems*			3.43			3.43																
36	217D4122	*Electric Installation + Laboratory*				2.34															2.34			
38	219D4121	*Microprocessor Systems and Interfaces Laboratory*				2.31															2.31			
39	301D4112	*Engineering Economics*					2.43								2.43									
40	302D4112	*Probability and Statistics*					2.38	2.38																
41	303D4112	*Electric Measurement*				2.75	2.75																	
46	345D4122	*Management and Entrepreneurship*													1.14		1.14							
47	402D4112	*Research Methods and Scientific Writing*																				2.87		
49	306D4112	*Electric Power System Analysis*			1.93																			
50	307D4112	*Electric Machines Analysis 1 + Laboratory*			1.93														1.93					
53	310D4112	*Power System Control and Stability*			3.08																			
58	352D4122	*High Voltage Engineering + Laboratory*			3.01														3.01					
66	330D4112	*Process Control Technology*			2.23														2.23			2.23		
69	375D4122	*Control Systems Design*				1.28															1.28			
		Number of Courses where Assessment Data (per PI) are collected:	1	0	12	5	3	2	1	0	0	1	1	0	3	1	1	0	4	1	3	2	2	0
		Total Assessment Value for each PI:	3.41	0.00	30.85	12.42	7.56	5.81	1.42	0.00	0.00	3.55	3.32	0.00	7.39	3.32	1.14	0.00	7.30	3.30	5.93	5.10	6.10	0.00
		Average Measured Assessment Value for each PI:	3.41	2.50	2.57	2.48	2.52	2.91	1.42	2.50	2.50	3.55	3.32	2.50	2.46	3.32	1.14	2.50	1.83	3.30	1.98	2.55	3.05	2.50
		Targeted PI Assessment Value:	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
		Deviation Between Target and Measured PI:	-0.41	0.50	0.43	0.52	0.48	0.09	1.58	0.50	0.50	-0.55	-0.32	0.50	0.54	-0.32	1.86	0.50	1.18	-0.30	1.02	0.45	-0.05	0.50
		Number of Students Assessed:	68,00	0.00	761.00	290.00	251.00	202.00	78.00	0.00	0.00	68.00	66.00	0.00	161.00	66,00	28,00	0.00	173.00	116.00	119.00	137.00	182.00	0.00
		Performance Indicator Code:	1K	1C	1A	1D	2A	2D	2I	3A	3D	3I	4K	4C	4I	5C	5D	5I	6A	6D	6I	7C	7A	7I
		Average Student Outcome Measured Value:	2.61				2.09			3.03			2.65			2.26			2.34			2.68		
		Student Outcomes Code:	SO-1				SO-2			SO-3			SO-4			SO-5			SO-6			SO-7		

Table 4.16: The Direct Assessment Results for Academic Year 2015/2016, Second Semester.

NO	KODE	COURSE	STUDENT OUTCOMES																					
			SO-1				SO-2			SO-3			SO-4			SO-5			SO-6			SO-7		
			1K	1C	1A	1D	2A	2D	2I	3A	3D	3I	4K	4C	4I	5C	5D	5I	6A	6D	6I	7C	7A	7I
5	101D4113	*Electrical Circuits 1*			2.51																			
6	102D4112	*Logic Circuits*				2.35																		
11	017U0033	*Calculus 2*			2.43																		2.43	
15	107D4122	*Computer Programming*						1.00																
25	207D4111	*Basic Electric Power Laboratory*																	3.32					
29	210D4123	*Advanced Mathematics 2*			2.30																		2.30	
30	211D4122	*Linear Systems*			1.83																		1.83	
43	342D4122	*Numerical Methods*						2.97														2.97		
44	343D4122	*Energy Conversion*		2.86																		2.86		
45	344D4122	*Environmental Science*	3.07											3.07										
48	305D4112	*Alternating Current Transmission Systems*			2.26																			
57	351D4122	*Power Systems Operations*			3.57																			
58	352D4122	*High Voltage Engineering + Laboratory*			2.41														2.41					
59	311D4113	*Antenna and Propagation + Laboratory*				1.00			1.00											1.00				
61	353D4122	*Cellular Communication*				2.66		2.66																
63	322D4113	*Access Network Technology*		3.32																				
68	372D4123	*Digital Control Systems + Laboratory*																		2.61				2.61
70	331D4112	*Industrial Robotics*				1.41														1.41				
71	333D4113	*Electronic Instrumentation Systems + Laboratory*				3.35														3.35				
75	336D4113	*Computer Architecture 1 + Laboratory*				2.06														2.06				
77	334D4112	*Computer Network-based SCADA*				4.00														4.00			4.00	
78	337D4112	*Industrial Automation + Laboratory (PLC)*				3.00														3.00		3.00		

Number of Courses where Assessment Data (per PI) are collected:	**1**	**2**	**7**	**8**	**0**	**3**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**2**	**7**	**0**	**3**	**4**	**1**
Total Assessment Value for each PI:	**3.07**	**6.18**	**17.31**	**19.83**	**0.00**	**6.63**	**1.00**	**0.00**	**0.00**	**0.00**	**0.00**	**3.07**	**0.00**	**0.00**	**0.00**	**0.00**	**5.73**	**17.43**	**0.00**	**8.83**	**10.56**	**2.61**
Average Measured Assessment Value for each PI:	**3.07**	**3.09**	**2.47**	**2.48**	**2.50**	**2.21**	**1.00**	**2.50**	**2.50**	**3.55**	**3.32**	**3.07**	**2.46**	**3.32**	**1.14**	**2.50**	**2.87**	**2.49**	**1.98**	**2.94**	**2.64**	**2.61**
Targeted PI Assessment Value:	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**
Deviation Between Target and Measured PI:	**-0.07**	**-0.09**	**0.53**	**0.52**	**0.50**	**0.79**	**2.00**	**0.50**	**0.50**	**-0.55**	**-0.32**	**-0.07**	**0.54**	**-0.32**	**1.86**	**0.50**	**0.14**	**0.51**	**1.02**	**0.06**	**0.36**	**0.39**
Number of Students Assessed:	**17.00**	**119.00**	**547.00**	**238.00**	**0.00**	**183.00**	**10.00**	**0.00**	**0.00**	**0.00**	**0.00**	**17.00**	**0.00**	**0.00**	**0.00**	**0.00**	**114.00**	**157.00**	**0.00**	**147.00**	**347.00**	**27.00**
Performance Indicator Code:	**1K**	**1C**	**1A**	**1D**	**2A**	**2D**	**2I**	**3A**	**3D**	**3I**	**4K**	**4C**	**4I**	**5C**	**5D**	**5I**	**6A**	**6D**	**6I**	**7C**	**7A**	**7I**
Average Student Outcome Measured Value:	**2.66**				**1.66**			**3.03**			**2.82**			**2.26**			**2.31**			**2.69**		
Student Outcomes Code:	**SO-1**				**SO-2**			**SO-3**			**SO-4**			**SO-5**			**SO-6**			**SO-7**		

Table 4.17: The Direct Assessment Results for Academic Year 2016/2017, First Semester.

NO	KODE	COURSE	STUDENT OUTCOMES																					
			SO-1				SO-2			SO-3			SO-4			SO-5			SO-6			SO-7		
			1K	1C	1A	1D	2A	2D	2I	3A	3D	3I	4K	4C	4I	5C	5D	5I	6A	6D	6I	7C	7A	7I
1	011U0032	*Civic Education*											3.57			3.57								
2	009U0032	*Bahasa Indonesia*										3.62												
3	016U0033	*Calculus 1*			2.91																			
4	020U0033	*Physics 1*			3.19																			
5	101D4113	*Electrical Circuits 1*			3.13																			
6	102D4112	*Logic Circuits*				2.88																		
7	103D4112	*Engineering Drawing*				3.54																		
8	104D4112	*Advanced Chemistry*	3.32																					
18	008U0032	*Concept of Science and Technology*													3.57									
19	201D4113	*Advanced Mathematics 1*			2.68																		2.68	
20	202D4112	*Basic Electric Power (Systems)*		3.32																				
21	203D4112	*Basic Telecommunication (Systems)*		3.68																				
22	204D4112	*Basic Electronics*			2.50																			
23	205D4112	*Electric Material Physics*	3.10																					
24	206D4112	*Advanced Physics*			3.68																		3.68	
25	207D4111	*Basic Electric Power Laboratory*																	3.00					
26	208D4111	*Basic Telecommunication Laboratory*																	3.50					
27	209D4111	*Basic Electronics Laboratory*																	2.85					
31	212D4122	*Electric Machines*		3.06			3.06																	
32	213D4122	*Basic Multimedia*		3.68			3.68																	
39	301D4112	*Engineering Economics*					2.77								2.77									
40	302D4112	*Probability and Statistics*					2.78	2.78																
41	303D4112	*Electric Measurement*				3.02	3.02																	
42	304D4112	*Electromagnetics*		2.58																		2.58		
43	342D4122	*Numerical Methods*						3.51														3.51		
45	344D4122	*Environmental Science*	2.00											2.00										
47	402D4112	*Research Methods and Scientific Writing*																				3.49		
48	305D4112	*Alternating Current Transmission Systems*			1.46																			
49	306D4112	*Electric Power System Analysis*			2.00																			
50	307D4112	*Electric Machines Analysis 1 + Laboratory*			3.51														3.51					
51	308D4112	*Electric Power Protection System 1*			3.42																			
52	309D4112	*Electric Power Generation Systems*			3.25																			
53	310D4112	*Power System Control and Stability*			3.38																			
59	311D4113	*Antenna and Propagation + Laboratory*				1.30			1.30											1.30				
69	375D4122	*Control Systems Design*				4.00															4.00			
70	331D4112	*Industrial Robotics*				3.58														3.58				
73	335D4113	*Digital System Design + Laboratory*				1.50															1.50			
74	380D4123	*Embedded Systems Design + Laboratory*				3.37															3.37			3.37
76	379D4123	*Power Electronics + Laboratory*				3.50															3.50			3.50

Number of Courses where Assessment Data (per PI) are collected:	3	5	12	9	5	2	1	0	0	1	1	1	2	1	0	0	4	2	4	3	2	2
Total Assessment Value for each PI:	8.42	16.32	35.11	26.69	15.31	6.29	1.30	0.00	0.00	3.62	3.57	2.00	6.34	3.57	0.00	0.00	12.86	4.88	12.37	9.58	6.36	6.87
Average Measured Assessment Value for each PI:	2.81	3.26	2.93	2.97	3.06	3.15	1.30	2.50	2.50	3.62	3.57	2.00	3.17	3.57	1.14	2.50	3.22	2.44	3.09	3.19	3.18	3.44
Targeted PI Assessment Value:	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Deviation Between Target and Measured PI:	0.19	-0.26	0.07	0.03	-0.06	-0.15	1.70	0.50	0.50	-0.62	-0.57	1.00	-0.17	-0.57	1.86	0.50	-0.22	0.56	-0.09	-0.19	-0.18	-0.44
Number of Students Assessed:	133.00	113.00	612.00	287.00	375.00	94.00	5.00	0.00	0.00	70.00	71.00	2.00	265.00	71.00	0.00	0.00	208.00	31.00	25.00	229.00	83.00	3.00
Performance Indicator Code:	1K	1C	1A	1D	2A	2D	2I	3A	3D	3I	4K	4C	4I	5C	5D	5I	6A	6D	6I	7C	7A	7I
Average Student Outcome Measured Value:	3.00				2.21			3.06			2.90			2.31			2.92			3.31		
Student Outcomes Code:	SO-1				SO-2			SO-3			SO-4			SO-5			SO-6			SO-7		

TABLE 4.18: THE DIRECT ASSESSMENT RESULTS FOR ACADEMIC YEAR 2016/2017, SECOND SEMESTER.

NO	KODE	COURSE	STUDENT OUTCOMES																					
			SO-1				SO-2			SO-3			SO-4			SO-5			SO-6			SO-7		
			1K	1C	1A	1D	2A	2D	2I	3A	3D	3I	4K	4C	4I	5C	5D	5I	6A	6D	6I	7C	7A	7I
9	012U0032	*State Ideology: Pancasila*											3.55			3.55								
10	010U0032	*English*								3.73														
11	017U0033	*Calculus 2*			2.45																		2.35	
12	022U0033	*Physics 2*			3.37																		3.37	
13	105D4123	*Electric Circuits 2*			2.85																			
14	106D4122	*Digital Systems*				2.74			2.74															
15	107D4122	*Computer Programming*						3.06																
16	108D4121	*Electric Circuits Laboratory*																		3.21				
17	109D4121	*Digital Systems Laboratory*						3.55												3.55				
28	007U0032	*Social Science of Maritime Culture*												3.74										
29	210D4123	*Advanced Mathematics 2*			2.54																		2.54	
30	211D4122	*Linear Systems*			2.23																		2.23	
31	212D4122	*Electric Machines*		2.72			2.72																	
32	213D4122	*Basic Multimedia*		3.17			3.17																	
33	214D4122	*Integrated Electronics*				1.89			1.89															
34	215D4122	*Microprocessor Systems and Interfaces*			2.49				2.49															
35	216D4122	*Basic Control Systems*			2.09			2.09																
37	218D4121	*Integrated Electronics Laboratory*																2.62		2.62				
38	219D4121	*Microprocessor Systems and Interfaces Laboratory*				2.92															2.92			
43	342D4122	*Numerical Methods*						2.51														2.51		
45	344D4122	*Environmental Science*	1.57											1.51										
46	345D4122	*Management and Entrepreneurship*													2.71		2.71							
47	402D4112	*Research Methods and Scientific Writing*																				x		
55	349D4122	*Electric Power Protection System 2 + Laboratory*			2.88														2.88					
56	350D4122	*Electric Machines Analysis 2 + Laboratory*			3.05														3.05					
57	351D4122	*Power Systems Operations*			3.05																			
58	352D4122	*High Voltage Engineering + Laboratory*			3.07														3.07					
67	373D4122	*Optimal Control Systems*			3.15														3.15					
68	372D4123	*Digital Control Systems + Laboratory*																		3.75				3.75
69	375D4122	*Control Systems Design*				2.85															2.85			

Number of Courses where Assessment Data (per PI) are collected:	**1**	**2**	**12**	**4**	**2**	**4**	**3**	**1**	**0**	**0**	**1**	**2**	**1**	**1**	**1**	**1**	**4**	**4**	**2**	**1**	**4**	**1**
Total Assessment Value for each PI:	**1.57**	**5.89**	**33.22**	**10.40**	**5.89**	**11.21**	**7.12**	**3.73**	**0.00**	**0.00**	**3.55**	**5.25**	**2.71**	**3.55**	**2.71**	**2.62**	**12.15**	**13.13**	**5.77**	**2.51**	**10.49**	**3.75**
Average Measured Assessment Value for each PI:	**1.57**	**2.95**	**2.77**	**2.60**	**2.95**	**2.80**	**2.37**	**3.73**	**2.50**	**3.62**	**3.57**	**2.63**	**2.71**	**3.55**	**2.71**	**2.62**	**3.04**	**3.28**	**2.89**	**2.51**	**2.62**	**3.75**
Targeted PI Assessment Value:	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**
Deviation Between Target and Measured PI:	**1.43**	**0.05**	**0.23**	**0.40**	**0.05**	**0.20**	**0.63**	**-0.73**	**0.50**	**- 0.62**	**-0.57**	**0.38**	**0.29**	**-0.55**	**0.29**	**0.38**	**-0.04**	**-0.28**	**0.12**	**0.49**	**0.38**	**- 0.75**
Number of Students Assessed:	**10.00**	**214.00**	**895.00**	**342.00**	**214.00**	**378.00**	**351.00**	**65.00**	**0.00**	**0.00**	**65.00**	**77.00**	**103.00**	**65.00**	**103.00**	**133.00**	**155.00**	**370.00**	**140.00**	**76.00**	**329.00**	**4.00**
Performance Indicator Code:	**1K**	**1C**	**1A**	**1D**	**2A**	**2D**	**2I**	**3A**	**3D**	**3I**	**4K**	**4C**	**4I**	**5C**	**5D**	**5I**	**6A**	**6D**	**6I**	**7C**	**7A**	**7I**
Average Student Outcome Measured Value:	**2.62**				**2.62**			**3.31**			**2.86**			**2.83**			**3.03**			**3.16**		
Student Outcomes Code:	**SO-1**				**SO-2**			**SO-3**			**SO-4**			**SO-5**			**SO-6**			**SO-7**		

Table 4.19: The Direct Assessment Results for Academic Year 2017/2018, First Semester.

NO	KODE	COURSE	STUDENT OUTCOMES																					
			SO-1				SO-2			SO-3			SO-4			SO-5			SO-6			SO-7		
			1K	1C	1A	1D	2A	2D	2I	3A	3D	3I	4K	4C	4I	5C	5D	5I	6A	6D	6I	7C	7A	7I
1	011U0032	*Civic Education*											3.46			3.46								
2	009U0032	*Bahasa Indonesia*										3.49												
3	016U0033	*Calculus 1*			2.55																			
4	020U0033	*Physics 1*			2.89																			
5	101D4113	*Electrical Circuits 1*			2.81																			
6	102D4112	*Logic Circuits*				2.48																		
7	103D4112	*Engineering Drawing*				3.14																		
18	008U0032	*Concept of Science and Technology*													3.52									
19	201D4113	*Advanced Mathematics 1*			2.65																		2.65	
20	202D4112	*Basic Electric Power (Systems)*		3.81																				
21	203D4112	*Basic Telecommunication (Systems)*		2.71																				
22	204D4112	*Basic Electronics*			2.69																			
23	205D4112	*Electric Material Physics*	3.33																					
24	206D4112	*Advanced Physics*			3.56																		3.56	
25	207D4111	*Basic Electric Power Laboratory*																	3.72					
26	208D4111	*Basic Telecommunication Laboratory*																	3.50					
27	209D4111	*Basic Electronics Laboratory*																	2.73					
39	301D4112	*Engineering Economics*					2.17								2.17									
40	302D4112	*Probability and Statistics*					2.86	2.86																
41	303D4112	*Electric Measurement*				3.04	3.04																	
42	304D4112	*Electromagnetics*		2.76																		2.76		
47	402D4112	*Research Methods and Scientific Writing*																				2.84		
48	305D4112	*Alternating Current Transmission Systems*			2.17																			
49	306D4112	*Electric Power System Analysis*			2.32																			
50	307D4112	*Electric Machines Analysis 1 + Laboratory*			3.28														3.28					
52	309D4112	*Electric Power Generation Systems*			3.43																			
53	310D4112	*Power System Control and Stability*			2.75																			
70	331D4112	*Industrial Robotics*				3.22														3.22				

Number of Courses where Assessment Data (per PI) are collected:	2	3	11	4	3	1	0	0	0	1	1	0	2	1	0	0	4	1	0	2	2	0
Total Assessment Value for each PI:	6.03	9.28	31.10	11.88	8.07	2.86	0.00	0.00	0.00	3.49	3.46	0.00	5.69	3.46	0.00	0.00	13.23	3.22	0.00	5.60	6.21	0.00
Average Measured Assessment Value for each PI:	3.02	3.09	2.83	2.97	2.69	2.86	2.37	3.73	2.50	3.49	3.46	2.63	2.85	3.46	2.71	2.62	3.31	3.22	2.89	2.80	3.11	3.75
Targeted PI Assessment Value:	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Deviation Between Target and Measured PI:	-0.02	-0.09	0.17	0.03	0.31	0.14	0.63	-0.73	0.50	-0.49	-0.46	0.38	0.16	-0.46	0.29	0.38	-0.31	-0.22	0.12	0.20	-0.11	-0.75
Number of Students Assessed:	161.00	183.00	673.00	266.00	171.00	74.00	0.00	0.00	0.00	83.00	83.00	0.00	105.00	83.00	0.00	0.00	251.00	16.00	0.00	121.00	126.00	0.00
Performance Indicator Code:	1K	1C	1A	1D	2A	2D	2I	3A	3D	3I	4K	4C	4I	5C	5D	5I	6A	6D	6I	7C	7A	7I
Average Student Outcome Measured Value:	2.96				2.58			3.24			2.90			2.82			3.07			3.37		
Student Outcomes Code:	SO-1				SO-2			SO-3			SO-4			SO-5			SO-6			SO-7		

TABLE 4.20: THE DIRECT ASSESSMENT RESULTS FOR ACADEMIC YEAR 2017/2018, SECOND SEMESTER.

NO	KODE	COURSE	STUDENT OUTCOMES																					
			SO-1				SO-2			SO-3			SO-4			SO-5			SO-6			SO-7		
			1K	1C	1A	1D	2A	2D	2I	3A	3D	3I	4K	4C	4I	5C	5D	5I	6A	6D	6I	7C	7A	7I
9	012U0032	*State Ideology: Pancasila*											3.69			3.69								
10	010U0032	*English*								3.76														
11	017U0033	*Calculus 2*			3.02																		3.02	
12	022U0033	*Physics 2*			3.31																		3.31	
13	105D4123	*Electric Circuits 2*			2.97																			
14	106D4122	*Digital Systems*				2.75			2.75															
15	107D4122	*Computer Programming*						2.62																
16	108D4121	*Electric Circuits Laboratory*																		2.97				
17	109D4121	*Digital Systems Laboratory*						3.56												3.56				
28	007U0032	*Social Science of Maritime Culture*												3.33										
29	210D4123	*Advanced Mathematics 2*			2.49																		2.49	
30	211D4122	*Linear Systems*			2.30																		2.30	
31	212D4122	*Electric Machines*		2.07			2.07																	
32	213D4122	*Basic Multimedia*		3.26			3.26																	
33	214D4122	*Integrated Electronics*				2.06			2.06															
34	215D4122	*Microprocessor Systems and Interfaces*			2.66				2.66															
35	216D4122	*Basic Control Systems*			2.38			2.38																
36	217D4122	*Electric Installation + Laboratory*				2.98															2.98			
37	218D4121	*Integrated Electronics Laboratory*																2.86		2.86				
38	219D4121	*Microprocessor Systems and Interfaces Laboratory*				3.26															3.26			
43	342D4122	*Numerical Methods*						2.86														2.86		
44	343D4122	*Energy Conversion*		2.87																		2.87		
45	344D4122	*Environmental Science*	2.76											2.76										
46	345D4122	*Management and Entrepreneurship*													2.42		2.42							
54	348D4122	*Electric Power Distribution Systems + Laboratory*			3.02														3.02					
56	350D4122	*Electric Machines Analysis 2 + Laboratory*			3.45														3.45					
57	351D4122	*Power Systems Operations*			1.70																			
58	352D4122	*High Voltage Engineering + Laboratory*			3.71														3.71					
61	353D4122	*Cellular Communication*				2.38		2.38																
62	354D4122	*Wireless Technology*		3.88			3.88																	
67	373D4122	*Optimal Control Systems*			3.22														3.22					
68	372D4123	*Digital Control Systems + Laboratory*																		2.48				2.48
69	375D4122	*Control Systems Design*				3.30															3.30			

Number of Courses where Assessment Data (per PI) are collected:	**1**	**4**	**12**	**6**	**3**	**5**	**3**	**1**	**0**	**0**	**1**	**2**	**1**	**1**	**1**	**1**	**4**	**4**	**3**	**2**	**4**	**1**
Total Assessment Value for each PI:	**2.76**	**12.08**	**34.23**	**16.73**	**9.21**	**13.80**	**7.47**	**3.76**	**0.00**	**0.00**	**3.69**	**6.09**	**2.42**	**3.69**	**2.42**	**2.86**	**13.40**	**11.87**	**9.54**	**5.73**	**11.12**	**2.48**
Average Measured Assessment Value for each PI:	**2.76**	**3.02**	**2.85**	**2.79**	**3.07**	**2.76**	**2.49**	**3.76**	**2.50**	**3.49**	**3.46**	**3.05**	**2.42**	**3.69**	**2.42**	**2.86**	**3.35**	**2.97**	**3.18**	**2.87**	**2.78**	**2.48**
Targeted PI Assessment Value:	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**
Deviation Between Target and Measured PI:	**0.24**	**-0.02**	**0.15**	**0.21**	**-0.07**	**0.24**	**0.51**	**-0.76**	**0.50**	**-0.49**	**-0.46**	**-0.04**	**0.58**	**-0.69**	**0.58**	**0.14**	**-0.35**	**0.03**	**-0.18**	**0.14**	**0.22**	**0.52**
Number of Students Assessed:	**71.00**	**210.00**	**855.00**	**431.00**	**147.00**	**335.00**	**277.00**	**192.00**	**0.00**	**0.00**	**76.00**	**77.00**	**76.00**	**76.00**	**76.00**	**84.00**	**214.00**	**298.00**	**236.00**	**139.00**	**338.00**	**15.00**
Performance Indicator Code:	**1K**	**1C**	**1A**	**1D**	**2A**	**2D**	**2I**	**3A**	**3D**	**3I**	**4K**	**4C**	**4I**	**5C**	**5D**	**5I**	**6A**	**6D**	**6I**	**7C**	**7A**	**7I**
Average Student Outcome Measured Value:	**2.85**				**2.69**			**3.25**			**2.82**			**2.89**			**3.15**			**2.65**		
Student Outcomes Code:	**SO-1**				**SO-2**			**SO-3**			**SO-4**			**SO-5**			**SO-6**			**SO-7**		

Table 4.21: The Direct Assessment Results for Academic Year 2018/2019, First Semester.

NO	KODE	COURSE	STUDENT OUTCOMES																				
			SO-1				SO-2			SO-3			SO-4			SO-5			SO-6			SO-7		
			1K	1C	1A	1D	2A	2D	2I	3A	3D	3I	4K	4C	4I	5C	5D	5I	6A	6D	6I	7C	7A	7I
1	011U0032	*Civic Education*											3.42			3.42								
2	009U0032	*Bahasa Indonesia*										3.53												
3	016U0033	*Calculus 1*			2.35																			
4	020U0033	*Physics 1*			3.16																			
5	101D4113	*Electrical Circuits 1*			2.61																			
6	102D4112	*Logic Circuits*				2.27																		
7	103D4112	*Engineering Drawing*				3.39																		
8	104D4112	*Advanced Chemistry*	2.57																					
19	201D4113	*Advanced Mathematics 1*			2.12																		2.12	
20	202D4112	*Basic Electric Power (Systems)*		3.28																				
21	203D4112	*Basic Telecommunication (Systems)*		3.13																				
22	204D4112	*Basic Electronics*			2.28																			
23	205D4112	*Electric Material Physics*	3.20																					
24	206D4112	*Advanced Physics*			3.36																		3.36	
25	207D4111	*Basic Electric Power Laboratory*																	3.55					
26	208D4111	*Basic Telecommunication Laboratory*																	2.64					
27	209D4111	*Basic Electronics Laboratory*																	3.08					
39	301D4112	*Engineering Economics*					2.51								2.51									
40	302D4112	*Probability and Statistics*					2.98	2.98																
41	303D4112	*Electric Measurement*				2.38	2.38																	
42	304D4112	*Electromagnetics*		2.93																		2.93		
47	402D4112	*Research Methods and Scientific Writing*																				3.18		
48	305D4112	*Alternating Current Transmission Systems*			2.83																			
49	306D4112	*Electric Power System Analysis*			2.53																			
50	307D4112	*Electric Machines Analysis 1 + Laboratory*			3.90														3.90					
51	308D4112	*Electric Power Protection System 1*			3.31																			
53	310D4112	*Power System Control and Stability*			4.00																			
60	312D4112	*Telecommunication Transmission Systems*			3.66																			
63	322D4113	*Access Network Technology*		3.00																				
64	321D4112	*Data Communications*		2.96			2.96																	
65	329D4113	*Control Systems + Laboratory*			3.56														3.56					
66	330D4112	*Process Control Technology*			3.33														3.33			3.33		
70	331D4112	*Industrial Robotics*				3.57														3.57				
71	333D4113	*Electronic Instrumentation Systems + Laboratory*				3.70														3.70				
72	319D4113	*Microprocessor-based Systems + Laboratory*				3.33														3.33				
73	335D4113	*Digital System Design + Laboratory*				3.08															3.08			
77	334D4112	*Computer Network-based SCADA*				3.58														3.58			3.58	
78	337D4112	*Industrial Automation + Laboratory (PLC)*				3.13														3.13		3.13		

Number of Courses where Assessment Data (per PI) are collected:	**2**	**5**	**14**	**9**	**4**	**1**	**0**	**0**	**0**	**1**	**1**	**0**	**1**	**1**	**0**	**0**	**6**	**5**	**1**	**4**	**3**	**0**
Total Assessment Value for each PI:	**5.77**	**15.30**	**43.00**	**28.43**	**10.83**	**2.98**	**0.00**	**0.00**	**0.00**	**3.53**	**3.42**	**0.00**	**2.51**	**3.42**	**0.00**	**0.00**	**20.06**	**17.31**	**3.08**	**12.57**	**9.06**	**0.00**
Average Measured Assessment Value for each PI:	**2.89**	**3.06**	**3.07**	**3.16**	**2.71**	**2.98**	**2.49**	**3.76**	**2.50**	**3.53**	**3.42**	**3.05**	**2.51**	**3.42**	**2.42**	**2.86**	**3.34**	**3.46**	**3.08**	**3.14**	**3.02**	**2.48**
Targeted PI Assessment Value:	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**
Deviation Between Target and Measured PI:	**0.12**	**-0.06**	**-0.07**	**-0.16**	**0.29**	**0.02**	**0.51**	**-0.76**	**0.50**	**-0.53**	**-0.42**	**-0.04**	**0.49**	**-0.42**	**0.58**	**0.14**	**-0.34**	**-0.46**	**-0.08**	**-0.14**	**-0.02**	**0.52**
Number of Students Assessed:	**187.00**	**231.00**	**915.00**	**337.00**	**201.00**	**51.00**	**2.00**	**0.00**	**0.00**	**108.00**	**108.00**	**0.00**	**64.00**	**108.00**	**0.00**	**0.00**	**365.00**	**57.00**	**12.00**	**132.00**	**190.00**	**0.00**
Performance Indicator Code:	1K	1C	1A	1D	2A	2D	2I	3A	3D	3I	4K	4C	4I	5C	5D	5I	6A	6D	6I	7C	7A	7I
Average Student Outcome Measured Value:	**3.09**				**2.68**			**3.27**			**2.85**			**2.84**			**3.25**			**2.77**		
Student Outcomes Code:	SO-1				SO-2			SO-3			SO-4			SO-5			SO-6			SO-7		

TABLE 4.22: THE DIRECT ASSESSMENT RESULTS FOR ACADEMIC YEAR 2018/2019, SECOND SEMESTER.

NO	KODE	COURSE	STUDENT OUTCOMES																					
			SO-1				SO-2			SO-3			SO-4			SO-5			SO-6			SO-7		
			1K	1C	1A	1D	2A	2D	2I	3A	3D	3I	4K	4C	4I	5C	5D	5I	6A	6D	6I	7C	7A	7I
1	011U0032	*Civic Education*											3.46			x								
9	012U0032	*State Ideology: Pancasila*											x			3.46								
10	010U0032	*English*								3.59														
11	017U0033	*Calculus 2*			2.80																		2.80	
12	022U0033	*Physics 2*			3.28																		3.28	
13	105D4123	*Electric Circuits 2*			2.60																			
14	106D4122	*Digital Systems*				2.04			2.75															
15	107D4122	*Computer Programming*						2.65																
16	108D4121	*Electric Circuits Laboratory*																		3.21				
17	109D4121	*Digital Systems Laboratory*						3.33												3.33				
28	007U0032	*Social Science of Maritime Culture*												3.87										
29	210D4123	*Advanced Mathematics 2*			2.76																		2.76	
30	211D4122	*Linear Systems*			2.10																		2.10	
31	212D4122	*Electric Machines*		3.15			3.15																	
32	213D4122	*Basic Multimedia*		2.93			2.93																	
33	214D4122	*Integrated Electronics*				2.09			2.09															
34	215D4122	*Microprocessor Systems and Interfaces*			2.70				2.70															
35	216D4122	*Basic Control Systems*			2.33			2.33																
36	217D4122	*Electric Installation + Laboratory*				2.36															2.36			
37	218D4121	*Integrated Electronics Laboratory*																3.05		3.05				
38	219D4121	*Microprocessor Systems and Interfaces Laboratory*				2.97															2.97			
43	342D4122	*Numerical Methods*						3.04														3.31		
44	343D4122	*Energy Conversion*		3.04																		3.04		
45	344D4122	*Environmental Science*	3.40											3.40										
46	345D4122	*Management and Entrepreneurship*													3.07		3.07							
54	348D4122	*Electric Power Distribution Systems + Laboratory*			3.63														3.63					
56	350D4122	*Electric Machines Analysis 2 + Laboratory*			3.55														3.55					
57	351D4122	*Power Systems Operations*			2.85																			
58	352D4122	*High Voltage Engineering + Laboratory*			3.32														3.32					
61	353D4122	*Cellular Communication*				2.51		2.50																
62	354D4122	*Wireless Technology*		3.01			3.01																	
67	373D4122	*Optimal Control Systems*			3.67														3.67					
68	372D4123	*Digital Control Systems + Laboratory*																		3.28				3.28
69	375D4122	*Control Systems Design*				3.89															3.89			

Number of Courses where Assessment Data (per PI) are collected:	**1**	**4**	**12**	**6**	**3**	**5**	**3**	**1**	**0**	**0**	**1**	**2**	**1**	**1**	**1**	**1**	**4**	**4**	**3**	**2**	**4**	**1**
Total Assessment Value for each PI:	**3.40**	**12.13**	**35.59**	**15.86**	**9.09**	**13.85**	**7.54**	**3.59**	**0.00**	**0.00**	**3.46**	**7.27**	**3.07**	**3.46**	**3.07**	**3.05**	**14.17**	**12.87**	**9.22**	**6.35**	**10.94**	**3.28**
Average Measured Assessment Value for each PI:	**3.40**	**3.03**	**2.97**	**2.64**	**3.03**	**2.77**	**2.51**	**3.59**	**2.50**	**3.49**	**3.46**	**3.64**	**3.07**	**3.46**	**3.07**	**3.05**	**3.54**	**3.22**	**3.07**	**3.18**	**2.74**	**3.28**
Targeted PI Assessment Value:	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**
Deviation Between Target and Measured PI:	**-0.40**	**-0.03**	**0.03**	**0.36**	**-0.03**	**0.23**	**0.49**	**-0.59**	**0.50**	**- 0.49**	**-0.46**	**-0.64**	**-0.07**	**-0.46**	**-0.07**	**-0.05**	**-0.54**	**-0.22**	**-0.07**	**-0.18**	**0.27**	**-0.28**
Number of Students Assessed:	**66.00**	**270.00**	**1051.00**	**390.00**	**219.00**	**378.00**	**293.00**	**101.00**	**0.00**	**0.00**	**102.00**	**136.00**	**75.00**	**102.00**	**75.00**	**79.00**	**131.00**	**313.00**	**183.00**	**138.00**	**390.00**	**16.00**
Performance Indicator Code:	**1K**	**1C**	**1A**	**1D**	**2A**	**2D**	**2I**	**3A**	**3D**	**3I**	**4K**	**4C**	**4I**	**5C**	**5D**	**5I**	**6A**	**6D**	**6I**	**7C**	**7A**	**7I**
Average Student Outcome Measured Value:	**2.89**				**2.69**			**3.21**			**3.32**			**3.14**			**3.21**			**3.10**		
Student Outcomes Code:	**SO-1**				**SO-2**			**SO-3**			**SO-4**			**SO-5**			**SO-6**			**SO-7**		

4.2.2 Indirect Assessment

In the indirect assessment process, five surveys are introduced, i.e. Senior/Student Exit Survey (SES), Alumni Survey (AS) and Employer Survey (ES). In each survey, several questions are given to the surveyed personal, i.e. recently graduates, alumnae and employers. The capability level is categorized into 5 levels as follows:

Table 4.23: Metric used for the direct assessment method.

Capacity Level	Grade Point	Definition
Very Low	0.00	The capability of capacity of the surveyed personal (alumni, graduate, employer) is in very low level
Low	1.00	The capability of capacity of the surveyed personal (alumni, graduate, employer) is in low level
Medium	2.00	The capability of capacity of the surveyed personal (alumni, graduate, employer) is in medium level
High	3.00	The capability of capacity of the surveyed personal (alumni, graduate, employer) is in high level
Very High	4.00	The capability of capacity of the surveyed personal (alumni, graduate, employer) is in very high level

The List of Survey Questionnaires for PI and SO Measurement is presented in Table 4.24 and Table 4.25, and documented in a sheet. In the table, we can see that there are 22 Senior/Student Exit Survey Questions (labeled with SES followed by the numeric number), 11 Alumni Survey Questions (labeled with AS followed by the numeric number), and Employer Survey Questions. All indirect assessment data are stored in the aforementioned sheet.

Table 4.26 and Table 4.27 present the indirect assessment results from the three kinds of survey. In the bottom part of the Table 4.27 the performance indicator (PI) and student outcome (SO) values are presented. The performance indicator targets for all PIs are set to 3.00. The deviations between the measured and targeted performance indicator are also shown in the table.

Table 4.2 shows the statistics of the employer surveys. The table shows 8 pie charts, which present the survey results from the online Alumni tracing. Table 4.2(a) shows the Alumni survey to ask our Alumni about the relationship of their current job with electrical engineering (EE) field. It seem that 69% of our Alumni's jobs are related to the EE field, and 23% of them have strong relationship. The other survey results can be seen in Figure 4.2.

Table 4.24: List of Survey Questionnaires for PI and SO Measurement.

NO	KODE	COURSE	STUDENT OUTCOMES																					
			SO-1				SO-2			SO-3			SO-4			SO-5			SO-6			SO-7		
			1K	1C	1A	1D	2A	2D	2I	3A	3D	3I	4K	4C	4I	5C	5D	5I	6A	6D	6I	7C	7A	7I
1	INDIRECT ASSESS-MENT	***Student Exit Survey***	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
2		***Alumni Survey***	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
3		***Employer Survey***	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Q	**SES**	**STUDENT EXIT SURVEY QUESTIONNAIRE**																						
1	SES-1	*Ability to define and recognize learned electrical engineering subjects*	x																					
2	SES-2	*Ability to understand and grasp the meaning of the electrical engineering knowledge and problems*		x																				
3	SES-3	*Ability to analyze electrical engineering systems and problems*			x																			
4	SES-4	*Ability to design components and systems to solve electrical engineering problems*				x																		
5	SES-5	*Ability to analyze possible solutions to engineering problems*					x																	
6	SES-6	*Ability to design solution to solve engineering problems*						x																
7	SES-7	*Ability to apply or implement engineering skills to actual conditions*							x															
8	SES-8	*Ability to analyze effective speech structure to communicate idea*								x														
9	SES-9	*Ability to arrange speech concept and structure*									x													
10	SES-10	*Ability to present idea in real situation (in front of audience)*										x												
11	SES-11	*Ability to know and recognize professional code of ethics*											x											
12	SES-12	*Ability to comprehend professional code of ethics*												x										
13	SES-13	*Ability to apply engineering ethics in real engineering design problems*													x									
14	SES-14	*Ability to comprehend leadership skills in a project-based education*														x								
15	SES-15	*Ability to design project plan in a simulated engineering project*															x							
16	SES-16	*Ability to lead a team in real engineering projects*																x						
17	SES-17	*Ability to analyze practically and interpret data to draw conclusions*																	x					
18	SES-18	*Ability to design practical module and conduct experiment independently*																		x				
19	SES-19	*Ability to apply or implement engineering knowledge in laboratory scales*																			x			
20	SES-20	*Ability to identify new issues in electrical engineering fields of study*																				x		
21	SES-21	*Ability to analyze possible alternative solutions to solve a trending problem*																					x	
22	SES-22	*Ability to give novel scientific contribution to solve electrical engineering problems*																						x

Table 4.25: List of Survey Questionnaires for PI and SO Measurement (Continued).

NO	KODE	COURSE	STUDENT OUTCOMES																				
			SO-1				SO-2			SO-3			SO-4			SO-5			SO-6			SO-7		
			1K	1C	1A	1D	2A	2D	2I	3A	3D	3I	4K	4C	4I	5C	5D	5I	6A	6D	6I	7C	7A	7I
Q	**AS**	**ALUMNI SURVEY QUESTIONNAIRE**																						
1	AS-1	*The relationship between your working place with electrical engineering field of study*	x	x	x	x																		
2	AS-2	*Capability to identify, formulate and solve problem in your working place by applying electrical engineering skills and knowledge*	x	x	x	x																		
3	AS-3	*Capability to apply your engineering/technical skills to solve engineering problems in your workplace*					x	x	x															
4	AS-4	*Capacity to communicate*								x	x	x												
5	AS-5	*Capability to recognize ethics and professional responsibilities the impacts on your work place performance*											x	x	x									
6	AS-6	*Capacity to collaborate in a team work*														x	x	x						
7	AS-7	*Capacity to lead a team work*														x	x	x						
8	AS-8	*Capability to develop and conduct project works in practice*																	x	x	x			
9	AS-9	*Capability to interprete or analyse data to draw conclusions*																	x	x	x			
10	AS-10	*Willingness or Capacity (estimated) to pursue graduate/post-graduate study (MSc/PhD)*																				x	x	x
11	AS-11	*Capability to give scientific contributions (writing scientific article) related to engineering problem solving*																				x	x	x
Q	**ES**	**EMPLOYER SURVEY QUESTIONNAIRE**																						
1	ES-1	*Level of Technical Contribution*	x	x	x	x	x	x	x															
2	ES-2	*Level of Communication Skills*								x	x	x												
3	ES-3	*Demonstrated ability to work well on a team*														x	x	x						
4	ES-4	*Level of Ethical and Social Responsibility*											x	x	x									
5	ES-5	*Level of Contribution and Active Role (Leadership)*														x	x	x						
6	ES-6	*Level of Success in Learning New Areas*																	x	x	x	x	x	x
7	ES-7	*Level of Achievement in attending workshop, training, short course or conference*																	x	x	x	x	x	x
Number of Questions where Assessment Data (per PI) are collected:			4	4	4	4	3	3	3	3	3	3	3	3	3	5	5	5	5	5	5	5	5	5
Performance Indicator Code:			1K	1C	1A	1D	2A	2D	2I	3A	3D	3I	4K	4C	4I	5C	5D	5I	6A	6D	6I	7C	7A	7I
Number of Questions for Student Outcome Measurement:			4				3			3			3			5			5			5		
Student Outcomes Label:			SO-1				SO-2			SO-3			SO-4			SO-5			SO-6			SO-7		

Table 4.26: Assessment Result from Survey Questionnaires.

NO	KODE	COURSE	STUDENT OUTCOMES																					
			SO-1				SO-2			SO-3			SO-4			SO-5			SO-6			SO-7		
			1K	1C	1A	1D	2A	2D	2I	3A	3D	3I	4K	4C	4I	5C	5D	5I	6A	6D	6I	7C	7A	7I
1	INDIRECT ASSESS-MENT	***Student Exit Survey***	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
2		***Alumni Survey***	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
3		***Employer Survey***	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Q	SES	**Student Exit Survey Questionnaire**																						
1	SES-1	*Ability to define and recognize learned electrical engineering subjects*	2.71																					
2	SES-2	*Ability to understand and grasp the meaning of the electrical engineering knowledge and problems*		2.71																				
3	SES-3	*Ability to analyze electrical engineering systems and problems*			2.29																			
4	SES-4	*Ability to design components and systems to solve electrical engineering problems*				1.43																		
5	SES-5	*Ability to analyze possible solutions to engineering problems*					2.57																	
6	SES-6	*Ability to design solution to solve engineering problems*						2.29																
7	SES-7	*Ability to apply or implement engineering skills to actual conditions*							2.00															
8	SES-8	*Ability to analyze effective speech structure to communicate idea*								2.57														
9	SES-9	*Ability to arrange speech concept and structure*									2.43													
10	SES-10	*Ability to present idea in real situation (in front of audience)*										2.57												
11	SES-11	*Ability to know and recognize professional code of ethics*											2.57											
12	SES-12	*Ability to comprehend professional code of ethics*												2.43										
13	SES-13	*Ability to apply engineering ethics in real engineering design problems*													2.14									
14	SES-14	*Ability to comprehend leadership skills in a project-based education*														2.71								
15	SES-15	*Ability to design project plan in a simulated engineering project*															2.00							
16	SES-16	*Ability to lead a team in real engineering projects*																2.14						
17	SES-17	*Ability to analyze practically and interpret data to draw conclusions*																	2.43					
18	SES-18	*Ability to design practical module and conduct experiment independently*																		2.29				
19	SES-19	*Ability to apply or implement engineering knowledge in laboratory scales*																			2.71			
20	SES-20	*Ability to identify new issues in electrical engineering fields of study*																				2.43		
21	SES-21	*Ability to analyze possible alternative solutions to solve a trending problem*																					2.43	
22	SES-22	*Ability to give novel scientific contribution to solve electrical engineering problems*																						2.00

TABLE 4.27: ASSESSMENT RESULT FROM SURVEY QUESTIONNAIRES (CONTINUED).

NO	KODE	COURSE	STUDENT OUTCOMES																				
			SO-1				SO-2			SO-3			SO-4			SO-5			SO-6			SO-7		
			1K	1C	1A	1D	2A	2D	2I	3A	3D	3I	4K	4C	4I	5C	5D	5I	6A	6D	6I	7C	7A	7I
Q	AS	**Alumni Survey Questionnaire**																						
1	AS-1	*The relationship between your working place with electrical engineering field of study*	2.78	2.78	2.78	2.78																		
2	AS-2	*Capability to identify, formulate and solve problem in your working place by applying electrical engineering skills and knowledge*	2.85	2.85	2.85	2.85																		
3	AS-3	*Capability to apply your engineering/technical skills to solve engineering problems in your workplace*					2.79	2.79	2.79															
4	AS-4	*Capacity to communicate*								3.11	3.11	3.11												
5	AS-5	*Capability to recognize ethics and professional responsibilities the impacts on your work place performance*											3.26	3.26	3.26									
6	AS-6	*Capacity to collaborate in a team work*														3.39	3.39	3.39						
7	AS-7	*Capacity to lead a team work*														3.22	3.22	3.22						
8	AS-8	*Capability to develop and conduct project works in practice*																	3.25	3.25	3.25			
9	AS-9	*Capability to interprete or analyse data to draw conclusions*																	3.24	3.24	3.24			
10	AS-10	*Willingness or Capacity (estimated) to pursue graduate/post-graduate study (MSc/PhD)*																				2.48	2.48	2.48
11	AS-11	*Capability to give scientific contributions (writing scientific article) related to engineering problem solving*																				2.20	2.20	2.20
Q	ES	**Employer Survey Questionnaire**																						
1	ES-1	*Level of Technical Contribution*	3.23	3.23	3.23	3.23	3.23	3.23	3.23															
2	ES-2	*Level of Communication Skills*								3.14	3.14	3.14												
3	ES-3	*Demonstrated ability to work well on a team*														3.32	3.32	3.32						
4	ES-4	*Level of Ethical and Social Responsibility*											3.32	3.32	3.32									
5	ES-5	*Level of Contribution and Active Role (Leadership)*														3.41	3.41	3.41						
6	ES-6	*Level of Success in Learning New Areas*																	3.23	3.23	3.23			
7	ES-7	*Level of Achievement in attending workshop, training, short course or conference*																	3.09	3.09	3.09			

Number of Questions where Assessment Data (per PI) are collected:	**4**	**4**	**4**	**4**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**5**	**5**	**5**	**5**	**5**	**5**	**3**	**3**	**3**
Total Assessment Value for each PI:	**11.57**	**11.57**	**11.15**	**10.29**	**8.59**	**8.31**	**8.02**	**8.82**	**8.68**	**8.82**	**9.15**	**9.01**	**8.72**	**16.05**	**15.34**	**15.48**	**15.24**	**15.10**	**15.52**	**7.11**	**7.11**	**6.68**
Average Measured Assessment Value for each PI:	**2.89**	**2.89**	**2.79**	**2.57**	**2.86**	**2.77**	**2.67**	**2.94**	**2.89**	**2.94**	**3.05**	**3.00**	**2.91**	**3.21**	**3.07**	**3.10**	**3.05**	**3.02**	**3.10**	**2.37**	**2.37**	**2.23**
Targeted PI Assessment Value:	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**
Deviation Between Target and Measured PI:	**0.11**	**0.11**	**0.21**	**0.43**	**0.14**	**0.23**	**0.33**	**0.06**	**0.11**	**0.06**	**-0.05**	**0.00**	**0.09**	**-0.21**	**-0.07**	**-0.10**	**-0.05**	**-0.02**	**-0.10**	**0.63**	**0.63**	**0.77**
Performance Indicator Code:	**1K**	**1C**	**1A**	**1D**	**2A**	**2D**	**2I**	**3A**	**3D**	**3I**	**4K**	**4C**	**4I**	**5C**	**5D**	**5I**	**6A**	**6D**	**6I**	**7C**	**7A**	**7I**
Average Weighted Student Outcome Measured Value:	**2.73**				**2.74**			**2.93**			**2.96**			**3.11**			**3.07**			**2.30**		
Student Outcomes Code:	**SO-1**				**SO-2**			**SO-3**			**SO-4**			**SO-5**			**SO-6**			**SO-7**		

4.3 Assessment Schedule and Frequency

The rubric-based direct assessment data are collected from several courses in every semester. In the current EESP Self-Study Report, the direct assessment data are measured every semester from the previous 4 academic years, i.e. Academic Year 2015/2016, 2016/2017, 2017/2018 and 2018/2019. The indirect assessment data are collected from 3 kind of surveys in every four or five years, or about a year before the curriculum evaluation.

4.4 Evaluation

The EESP assesses regularly and evaluate the extent to which the program educational objectives (PEOs) and student outcomes (SOs) have been attained in every 5 years. The evaluation is made based on the assessment results of the student outcomes and based on surveys of recently graduates (senior exit survey), alumnae and employers, who employ the EESP graduates. During the evaluation, the curriculum structure, the teaching methods, faculty professional development will be improved to continuously improve the quality and performance of the EESP student output.

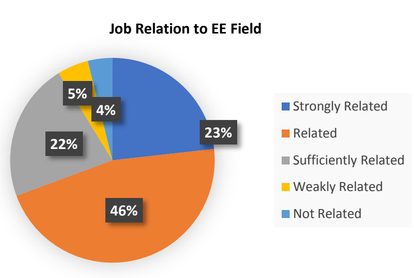
To measure the student outcome (SO), a few performance indicators for each SO are introduced and are measured. The PI data/values should attain the expected PI threshold value. When the PI measurement data is below the expected value, then attention or improvement is required for that particular performance indicator.

4.4.1 Student Outcome Evaluation

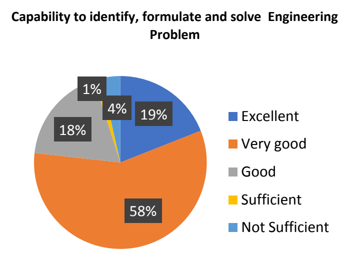
The overview of performance indicator of student outcomes in two semesters per year between 2015 and 2018 is shown Figure FIGURE 4.3. The year and semester are indicated as year (semester). For example 2015(1) means the measurement was conducted in Academic Year 2015/2016 the first semester. Therefore, the achievement of student outcomes can be viewed in terms of year and the completed semester.

The student outcomes, which are related to the Basic Science Skills, the SO-1 and SO-2 show the steady improvement in every semesters. In the first semester, the SO-1 reached the target in 2016 and remained steady about the target in 2017, while the constant value between 2015 and 2016, then increase little below the target in 2017. In comparison, the SO-2 shown continued increase of both semesters performance indicator from 2015 to 2017. The trend has given the optimistic results to reach beyond the target value to improve the capability of students to understand the basic principle in electrical engineering studies and to implement the theory in engineering practice and design.

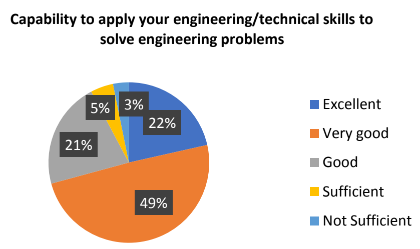
Meanwhile, the professional skills as parts of SO-3 and SO-4 yield different results. The SO-3 reaches the beyond the target value and shows constant increase of both semesters performance indicator between 2015 and 2017. In this case, our students have good and confident capability in speaking and discussing different subjects and topics. A little different results is shown in SO-4 which related to professional and ethical responsibility in engineering practice. Although the data trend rises steadily, the performance index achievement is still lower than the target value.



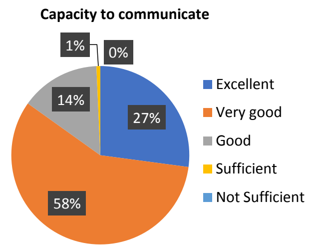
(a) Question Labeled AS-1



(b) Question Labeled AS-2

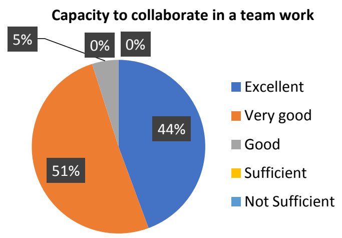


(c) Question Labeled AS-3

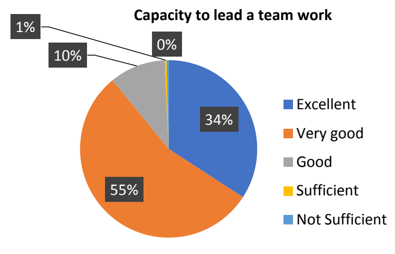


(d) Question Labeled AS-4

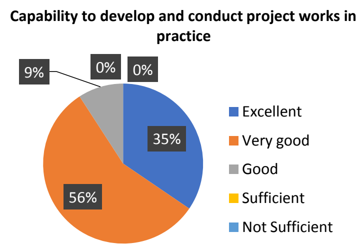
(e) Question Labeled AS-5



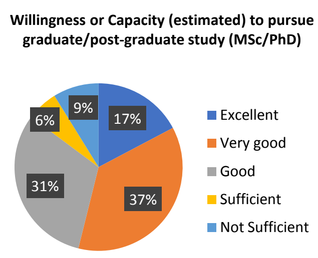
(f) Question Labeled AS-6



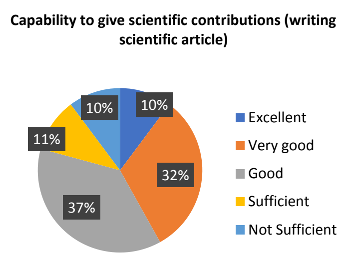
(g) Question Labeled AS-7



(h) Question Labeled AS-8



(i) Question Labeled AS-10



(j) Question Labeled AS-11

FIGURE 4.2: STATISTICS OF THE ALUMNI SURVEY.

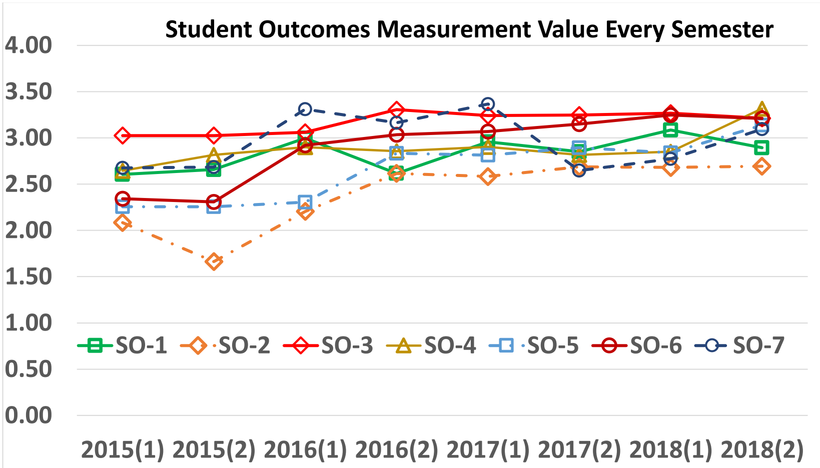


Figure 4.3: SO Assessment every semester in the last 4 years.

Much efforts are totally needed to bring the students more closely to understand the engineering practice responsibility in any technical projects or in the field project implementation. In comparison, the entrepreneurship skills in SO-5 has shown the constant rise of performance indicator to almost reach or little below the target value. It indicates our students in the right track to have the capability of leadership and teamwork in specific environment.

The student outcomes SO-6 and SO-7 yield interesting results with different trend. The capability of students to develop research, to analyze and interpret data, to proceed engineering method and to draw conclusion in SO-6 might reach beyond the target value. It is expected that the trend can be continuously maintained in future to make our students have high creativity in conducting the research activities. However, there is significant decreases of performance indicator of SO-7 in both semesters after 2017. It seems that the level of SO-7 is quite low for undergraduate students. They might have less confident when dealing with advanced learning strategy with new learning and knowledge approaches. Nevertheless, much efforts are needed to return the low achievement values on the target track by provision the much opportunity for students to have on-sit training in research institutes.

The evaluation results in terms of performance indicator of student outcomes (SO) are shown in Figure 4.4. For each student outcomes, there are four types of measurement called rubric, survey, average and target, which are presented in the figure. Except for Student Outcome SO-3, much attention goes to the student outcomes SO-1, SO-2, SO-4, SO-5, SO-6 and SO-7. In these cases, the SO measurements is below the target value. The rubric data is obtained from the performance indicator measurement of selected courses in EESP. Meanwhile, the survey data is taken from questionnaires spread to senior students and alumni regarding the student outcomes performance indicator. Another average data indicates the mean value between the rubric and average data. The last type of measurement is the target that considers the rubric grade point in direct assessment method. In our EESP, the target is uniformly set to 3.00 (“good performance”) for all criteria of student outcomes.

- **Student Outcome SO-1**
  Measured outcome: 2.78

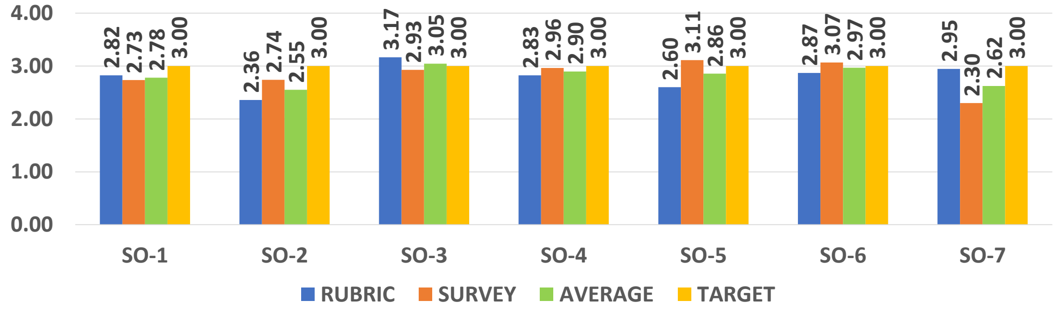


FIGURE 4.4: SO ASSESSMENT RESULT.

Target Outcome: 3.00
Analysis and Action: The average value of SO-1 is lower than the target. The students are encouraged to more intensive learn mathematics and natural sciences. Teaching methods should also be improved, which provides the important of mathematics and natural sciences in solving engineering problems. The EESP will also extend some important components in the mathematics and natural sciences courses to be independent courses such as Discrete Mathematics, Linear Algebra and Electrochemistry.

- **Student Outcome SO-2**
  Measured outcome: 2.55
  Target Outcome: 3.00
  Analysis and Action: The assessment data value of SO-2 is lower than the target. It is necessary to improve the problem solving capability of students in order to match with the analyze capability in engineering design. The strengthening of understanding the fundamental subjects in electrical engineering including the applications of these subjects and topics are totally needed. The EESP will also establish capstone design courses. In the capstone design courses, the student will learn to work in team by using their accumulative experiences obtained from a few supporting courses.

- **Student Outcome SO-3**
  Measured outcome: 3.00
  Target Outcome: 3.00
  Analysis and Action: In recent condition, the average value of SO-3 approach the target. This type of student outcome is related to the professional skills where the students are capable and confident to speak and discuss different topics and subjects with a range of audiences. The result indicates the high potential of the EESP students to develop and establish their carriers after the graduation. Later, it can be seen that the EESP alumni successfully work in different fields. The EESP will try to maintain this achievement.

- **Student Outcome SO-4**
  Measured outcome: 2.90
  Target Outcome: 3.00
  Analysis and Action: The professional skills as a part of SO-4 is still slightly less

than the target. In this respect, the improvement is needed to increase the ability to recognize ethical and professional responsibilities in engineering situations including understanding the impacts in any contexts. The students can be sent to participate in company training or pre-on job training in engineering company. We plan to propose a special professional ethic course to the University's and Faculty's Senate.

- **Student Outcome SO-5**
  Measured outcome: 2.86
  Target Outcome: 3.00
  Analysis and Action: The student outcome of SO-5 which related to leadership and entrepreneurship skills is still lower than the target. In this regard, our students should be motivated to improve their confidence in leadership, to establish own start-up company, to work in team in new environment to design goals, plan tasks, and meet objectives. The result indicates that our students still have capacity to work not only in the field related to electrical engineering subjects, but also in other and different types of business.

- **Student Outcome SO-6**
  Measured outcome: 2.97
  Target Outcome: 3.00
  Analysis and Action: The student outcome of SO-6, which is related to practical engineering skills is slightly lower than the target. It indicates that the EESP students are still suggested to be involved and participate well in the electrical engineering projects and conduct appropriate experimental tasks. The ESSP should organize better the practical courses and upgrade the practicum's guides following the newly installed equipment in each Laboratory.

- **Student Outcome SO-7**
  Measured outcome: 2.62
  Target Outcome: 3.00
  Analysis and Action: The average performance indicator of SO-7 is below the target. Much efforts are needed to enhance the confidence of students to utilize new knowledge for special problem-solving tasks and to increase the creativity in learning strategies. The efforts can be performed by sending the students intensively to research centers in order to undertake special tasks in electrical engineering subjects. A workshop to give student hands-on training for scientific writing and a seminar (national/international), in which students participating in the seminar, can be proposed.

4.4.2 Program Educational Objective Evaluation

The student outcomes are the reflection of four program educational objectives (PEO) of the EESP, presented in Criterion 2, Section 2.2. The program educational objectives are termed as Competency Skills, Professional Skills, Entrepreneur Skills and Research Skills. The evaluation of the program is given below.

The evaluation result of the the EESP PEOs is presented in Table 4.28. The table presents the student outcome values and their weighted contribution to the PEOs.

Beside the SO values, there are also additional factors, i.e. Entrepreneurship Factor (EF) and Research Factor (RF), that contribute to the PEO-3 and PEO-4, respectively.

The EF is the entrepreneurship factor, where the outcome is affected by the number of EESP alumnae, who established their own company for a certain number of surveyed alumnae. The EESP has a target that 10% of the EESP Alumnae should establish their our company. For the 2019 Alumni Survey, this EF value is 55.00%.

The RF is the research outcome factor, where the outcome is affected by the measured and target number of papers, as part of bachelor thesis, that are published in national/international seminars and/or in national/international journals, over the number of finished bachelor thesis in a certain assessment period. For the assessment period of 2013 until 2019, this RF value is calculated as 73.33%. FIGURE 4.5 presents the EESP student publication papers as part of their bachelor theses. From the figure, we can see that the number of student's publication fluctuates every year. The highest number of student's publication is presented in the year 2019. The trend tends to increase from 2017 until 2019.

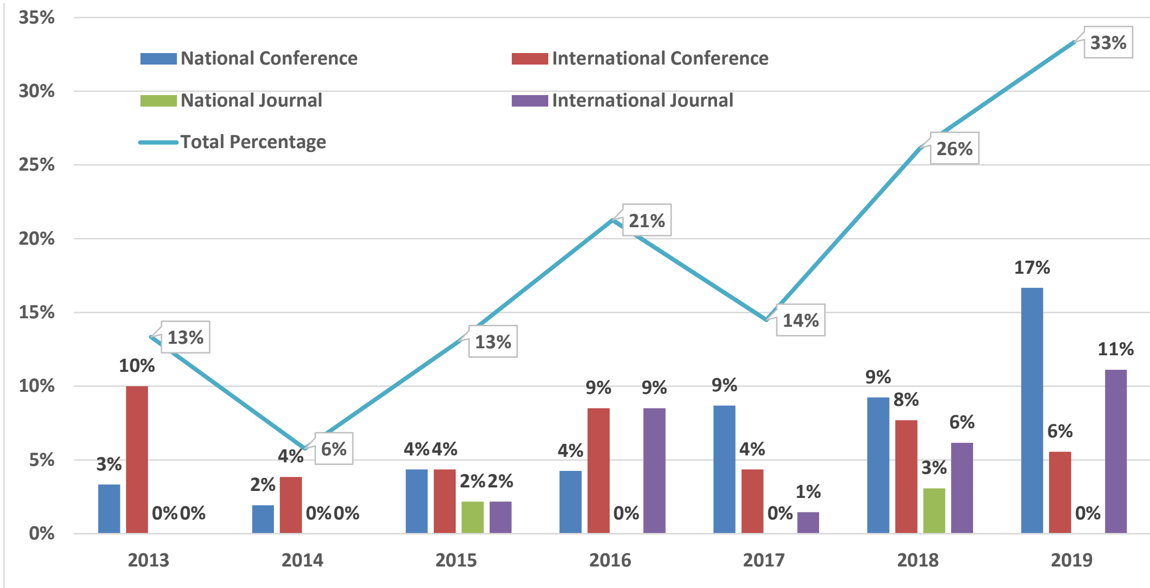


FIGURE 4.5: THE NUMBER OF PUBLICATIONS AS PART OF THE EESP STUDENT BACHELOR DEGREE.

Both factors, EF and RF, contribute to the final PEO-3 and PEO-4 assessment values. The contributing weights of the EF and RF are higher than the values obtained from the weighted student outcome values. The assessment values for all PEOs are shown in TABLE 4.28. In general, the EESP still need to improve the PEO outcomes of PEO-3 and PEO-4. With only 59.88% outcome value for the PEO-3, the EESP should provide more special programs to encourage students to establish start-up companies.

Table 4.28: The evaluation result of the EESP program education objective (PEO).

Student Outcome (SO)		Program Educational Objectives (PEO)											
		PEO-1			PEO-2			PEO-3			PEO-4		
LABEL	VALUE	RELATION	WEIGHT	VALUE	RELATION	WEIGHT	VALUE	RELATION	WEIGHT	VALUE	RELATION	WEIGHT	VALUE
SO-1	2.78	H	6.00	16.68%	M	3.50	9.73%	L	2.00	5.56%	H	4.00	11.12%
SO-2	2.55	H	6.00	15.30%	M	3.50	8.93%	M	3.50	8.93%	H	4.00	10.20%
SO-3	3.05	L	2.00	6.10%	L	2.00	6.10%	H	6.00	18.30%	L	3.00	9.15%
SO-4	2.90	L	2.00	5.80%	H	6.00	17.40%	M	3.50	10.15%	L	3.00	8.70%
SO-5	2.86	L	2.00	5.72%	L	2.00	5.72%	H	6.00	17.16%	M	3.50	10.01%
SO-6	2.97	M	3.50	10.40%	H	6.00	17.82%	L	2.00	5.94%	M	3.50	10.40%
SO-7	2.62	M	3.50	9.17%	L	2.00	5.24%	L	2.00	5.24%	H	4.00	10.48%
EF										55.00%			
RF													73.33%
TOTAL:			25.00	**69.17%**		25.00	**70.94%**		25.00	**59.88%**		25.00	**72.35%**
BASE VALUE:				**2.77**			**2.84**			**2.40**			**2.89**

CRITERION 5

CURRICULUM

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5.1 Program Curriculum

Universitas Hasanuddin's academic system is based on the semester system. An academic year usually begins in the last week of August in a particular year and ends in the last week of May in the following year. The first semester is called the "odd" semester, held from the last week of August until mid December, for 16 weeks of classes, including midterm and final examinations. The second semester, called the "even" semester, starts in the first week of February and ends in the last week of May, also for 16 weeks. The undergraduate program in this university is normally a four-year (or an eight-semester) program. The new students enrol directly into the study program from the first semester. TABLE 5.2 shows the details of the EESP curriculum, and FIGURE 5.1 shows the structure overview of the curriculum detailed in FIGURE 5.2. Out of minimum 147 credit hours required to graduate, 30 credit-hours are delivered as Non-Lecture Courses, and minimum 117 credit-hours are Regular Lecture Courses.

The EESP curriculum is designed to align with the Program Educational Objectives (PEO) described previously (see CRITERION 2). There are four objectives, namely (1) PEO-1 *Basic Science Skills*, (2) PEO-2 *Professional Skills*, (3) PEO-3 *Entrepreneur Skills* and (4) PEO-4 *Research Skills*. The alignment of the curriculum and the PEO is summarized in TABLE 5.1.

TABLE 5.1: THE CURRICULUM ALIGNMENT WITH THE PROGRAM EDUCATIONAL OBJECTIVES

Program Educational Objectives		Courses	Credit Hours
PEO-1	*Basic Science Skills*	Mathematics and Natural Sciences	34
PEO-2	*Professional Skills*	Electrical Engineering Cores + Breadth + Depth	69(min)
PEO-3	*Entrepreneur Skills*	General Education	14
PEO-4	*Research Skills*	Non-Lecture Courses	30
		TOTAL (minimum)	147

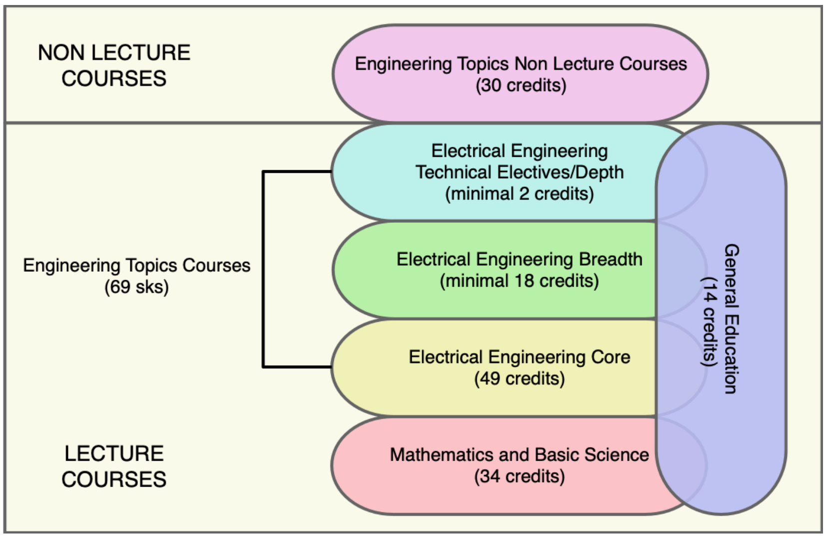


FIGURE 5.1: OVERVIEW OF EESP CURRICULUM.

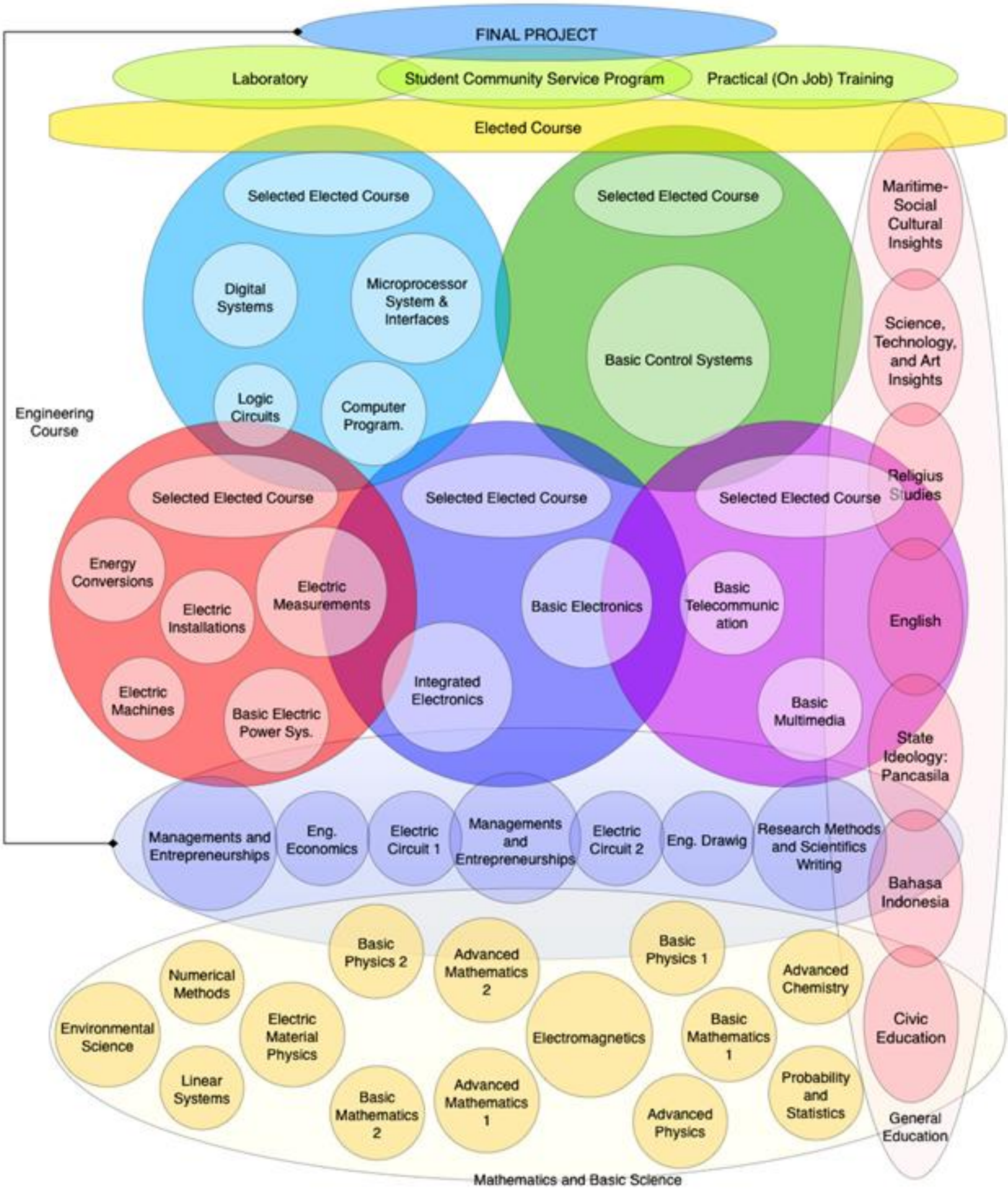


FIGURE 5.2: DETAIL STRUCTURE OF THE EESP CURRICULUM

Table 5.2: The EESP Curriculum.

Course Electrical Engineering	Required, Elective, or a Selected Elective	Subject Area (Credit Hours)				Last Two Terms the Course was Offered: Year and Semester or Quarter	Maximum Section Enrollment for The Last Two Terms the Course was Offered
		Math & Basic Sciences	Engineerin g Topics Check If Contains Significant Design ()	General Education	Other		
Lecture Courses							
011U0032 Civic Education	R			2		I; 1	84
009U0032 Bahasa Indonesia	R			2		I; 1	84
016U0033 Calculus 1	R	3				I; 1	100
020U0033 Physics 1	R	3				I; 1	100
101D4113 Electrical Circuits 1	R		3			I; 1	100
102D4112 Logic Circuits	R		2			I; 1	100
103D4112 Engineering Drawing	R		2			I; 1	100
104D4112 Advanced Chemistry	R	2				I; 1	100
001U0032 Religious Studies (Islam, Catholic, etc)	R			2		I; 2	84
012U0032 State Ideology: Pancasila	R			2		I; 2	84
010U0032 English	R			2		I; 2	84
017U0033 Calculus 2	R	3				I; 2	100
022U0033 Physics 2	R	3				I; 2	90
105D4123 Electric Circuits 2	R		3			I; 2	90
106D4122 Digital Systems	R		2			I; 2	100
107D4122 Computer Programming	R		2			I; 2	95

Table 5.3: The EESP Curriculum (Continued).

Course Electrical Engineering	Required, Elective, or a Selected Elective	Subject Area (Credit Hours)				Last Two Terms the Course was Offered: Year and Semester or Quarter	Maximum Section Enrollment for The Last Two Terms the Course was Offered
		Math & Basic Sciences	Engineering Topics Check If Contains Significant Design ()	General Education	Other		
108D4121 Electric Circuits Laboratory	R		1			I; 2	100
109D4121 Digital Systems Laboratory	R		1			I; 2	95
008U0032 Principle of Science, Technology, and Art	R			2		II;3	70
201D4113 Advanced Mathematics 1	R	3				II;3	85
202D4112 Basic Electric Power (Systems)	R		2			II;3	70
203D4112 Basic Telecommunication (Systems)	R		2			II;3	85
204D4112 Basic Electronics	R		2			II;3	85
205D4112 Electric Material Physics	R	2				II;3	70
206D4112 Advanced Physics	R	2				II;3	85
207D4111 Basic Electric Power laboratory	R		1			II;3	85
208D4111 Basic Telecommunication Laboratory	R		1			II;3	85
209D4111 Basic Electronics Laboratory	R		1			II;3	85
007U0032 Principle of Maritime Science	R			2		II;4	70
210D4123 Advanced Mathematics 2	R	3				II;4	85
211D4122 Linear Systems	R	2				II;4	85
212D4122 Electric Machines	R		2			II;4	70
213D4122 Basic Multimedia	R		2			II;4	70
214D4122 Integrated Electronics	R		2			II;4	85
215D4122 Microprocessor Systems and Interfaces	R		2			II;4	85
216D4122 Basic Control Systems	R		2			II;4	70
217D4122 Electric Installation and Laboratory	R		2			II;4	85

Table 5.4: The EESP Curriculum (Continued).

Course Electrical Engineering	Required, Elective, or a Selected Elective	Subject Area (Credit Hours)				Last Two Terms the Course was Offered: Year and Semester or Quarter	Maximum Section Enrollment for The Last Two Terms the Course was Offered
		Math & Basic Sciences	Engineering Topics Check If Contains Significant Design ()	General Education	Other		
218D4121 Integrated Electronics Laboratory	R		1			II;4	85
219D4121 Microprocessor Systems and Interfaces Laboratory	R		1			II;4	85
301D4112 Engineering Economics	R		2			III;5	
302D4112 Probability and Statistics	R	2				III;5	
303D4112 Electric Measurement	R		2			III;5	
304D4112 Electromagnetics	R	2				III;5	
*Selected Elective Course (1 Package)**	SE		9			III;5	
342D4122 Numerical Methods	R	2				III;6	
343D4122 Energy Conversion	R		2			III;6	
344D4122 Environmental Science	R	2				III;6	
345D4122 Management and Entrepreneurship	R		2			III;6	
*Selected Elective Course (1 Package)**	SE		9			III;6	
402D4112 Research Methods and Scientific Writing	R		2			IV;7	
*Elective Course***	E		2			IV;7	
Total Required Minimum Lecture Courses		34	69	14	0		
Total-ABET Basic Level Requirements							
Total Credit Hours for Lecture Courses	117						
Percent of Total		29,1%	59,0%	12,0%	0,0%		
Total Must Satisfy Either Credit Hours of Percentage	Minimum Semester Credit Hours	32 Hours	48 Hours				

TABLE 5.5: THE EESP CURRICULUM (CONTINUED).

Course **Electrical Engineering**	**Required, Elective, or a Selected Elective**	***Subject Area (Credit Hours)***				**Last Two Terms the Course was Offered: Year and Semester or Quarter**	**Maximum Section Enrollment for The Last Two Terms the Course was Offered**
		Math & Basic Sciences	**Engineering Topics Check If Contains Significant Design ()**	**General Education**	**Other**		
	Minimum Percentage	25,0%	37,5%				
Non-Lecture Courses							
401D4112 Practical (On Job) Training	R		2			IV;7	
403D4112 Final Project Proposal	R		2			IV;7	
Laboratory 1	R		8			IV;7	
491D4124 Student Community Service Programs	R		4			IV;8	
492D4122 Final Project Results	R		2			IV;8	
Laboratory 2	R		8			IV;8	
493D4124 Final Project Report	R		4			IV;8	
Total Credit Hours for Non-Lecture Courses	30						
Overall Minimum Total Credit Hours For Completion of The Program	147						

Table 5.6: The EESP Curriculum (Continued).

Course Electrical Engineering	Required, Elective, or a Selected Elective	Subject Area (Credit Hours)				Last Two Terms the Course was Offered: Year and Semester or Quarter	Maximum Section Enrollment for The Last Two Terms the Course was Offered
		Math & Basic Sciences	Engineerin g Topics Check If Contains Significant Design ()	General Education	Other		
Lecture Courses							
011U0032 Civic Education	R			2		I; 1	84
009U0032 Bahasa Indonesia	R			2		I; 1	84
016U0033 Calculus 1	R	3				I; 1	100
020U0033 Physics 1	R	3				I; 1	100
101D4113 Electrical Circuits 1	R		3			I; 1	100
102D4112 Logic Circuits	R		2			I; 1	100
103D4112 Engineering Drawing	R		2			I; 1	100
104D4112 Advanced Chemistry	R	2				I; 1	100
001U0032 Religious Studies (Islam, Catholic, etc)	R			2		I; 2	84
012U0032 State Ideology: Pancasila	R			2		I; 2	84
010U0032 English	R			2		I; 2	84
017U0033 Calculus 2	R	3				I; 2	100
022U0033 Physics 2	R	3				I; 2	90
105D4123 Electric Circuits 2	R		3			I; 2	90
106D4122 Digital Systems	R		2			I; 2	100
107D4122 Computer Programming	R		2			I; 2	95

There are 7 (seven) Student Outcomes (SO) attainable by EESP's students as described previously in CRITERION 3. The concise version of those 7 outcomes can be listed as the following students abilities:

- SO-1 to apply principles of engineering, science and mathematics
- SO-2 to apply engineering design
- SO-3 to communicate with a range of audiences
- SO-4 to recognize ethical and professional responsibilities
- SO-5 to work in a team
- SO-6 to develop and conduct experiments
- SO-7 to acquire and apply new knowledge and make a contribution

TABLE 5.7 reveals the relationship between the courses in the curriculum and the Student Outcomes, categorized as H (highly related), M (medium) and L (low).

TABLE 5.7: THE CURRICULUM RELATION WITH THE STUDENT OUTCOMES

Courses	Credit Hours	SO-1	SO-2	SO-3	SO-4	SO-5	SO-6	SO-7
Mathematics and Natural Sciences	34	H	M	L	L	L	H	M
Electrical Engineering Cores + Breadth + Depth	69(min)	H	H	M	M	L	H	M
General Education	14	L	L	H	H	M	L	L
Non-Lecture Courses	30	H	H	H	M	H	M	H
TOTAL (minimum)	147	H=Highly Related, M=Medium, L=Low						

Non-Lecture Courses are highly related with most outcomes, while General Education Courses are only highly related with SO-3 and SO-4. All outcomes are highly related with at least one category of courses. It is clear that by taking all required and elective courses offered by the curriculum, all Student Outcomes (SO) will surely be attainable. Especially those design courses such as 335D4113– Digital System Design + Laboratory, 375D4122– Control System Design, and 380D4123– Embedded Systems Design, mostly are delivered as "project courses" where students are grouped in teams to collectively solve problem-based relevant cases.

There are no courses with pre-requisite, however, the structure of the curriculum is designed to guide the students through the stages of their study program. In the first and second semesters, all freshman year students are required to take all the same courses that consisting of Mathematics and Natural Sciences, several General Education Courses, and Basic Engineering Courses, including general engineering as well as basic electrical engineering courses. In the third and fourth semesters, all sophomores are also required to take the same compulsory courses.

At the fifth and sixth semesters, juniors take the selected elective courses (grouped in "packages") according to their favourable option, which is one of five available options, namely: (1) Electrical Power Engineering and Electricity, (2) Telecommunication Engineering and Information Systems, (3) Computer Engineering and Robotics, (4) Control Systems and Instrumentation and (5) Electronic Engineering. Those packages consist of 3 to 4 courses for 9 to 10 credit hours. The students are also urged to take several elective courses to broaden their knowledge and perspective.

Almost no restriction on what courses should be taken by an EESP student in a particular semester, except that the upper limit of credit hours is set to be 24 credit hours per semester. This upper limit used to be set based on the student's IP (*Indeks Prestasi*, similar to the GPA in the US) in the previous semester. But the university academic senate, in the new regulation, cancelled this limitation in recent years.

In the final year, seniors almost take no more lecture-courses. They apply for a position in one of the EESP laboratories and working groups. An annual contract is signed by a senior with the head of laboratory (or the chairman of research group) he or she chooses to apply for a position. There are 24 credit hours of Non-Lecture Courses taken in the laboratory, namely:

1. 8 credit hours of Laboratory 1
2. 8 credit hours of Laboratory 2
3. 2 credit hours Undergraduate Final Project Proposal Seminar
4. 2 credit hours Undergraduate Final Project Results Seminar
5. 4 credit hours of Final Undergraduate Project Report, Presentation and Examination called *Skripsi*

Two other Non-Lecture Courses are delivered off campus, namely: (1) 4 credit hours of Community Services called "Kuliah Kerja Nyata" or KKN and (2) 2 credit hours of Practical (Industrial or "On Job") Training.

Table 5.8 shows how the minimum of 117 credit hours of lecture courses are distributed in the area of Mathematics and Natural Sciences, Engineering Topics and General Education. The proportion of Mathematics and Natural Sciences is only 23% of the total 147 credit hours minimum requirement for graduation. However, 30 credit hours out of those 147 credit hours are Non-Lecture Courses, such as Final Undergraduate Projects (Final Project, Seminars, and Laboratories) and Student Community Services, which may have Mathematics and Natural Sciences contents and are not comparable ("*apple to apple*") to the Regular Lecture Courses. Based on the argument above, the Non-Lecture Courses may be excluded so that the proportion of Mathematics and Science is now **29%** of the total of **117 credit hours** of Regular Lecture Courses.

Table 5.8: The Proportion of Each Component of Lecture Course

Courses	Credit Hours	%	Credit Hours	%
Non-Lecture Courses	(excluded)	N/A	30	20%
Mathematics and Natural Sciences	34	29%	34	23%
Electric Engineering Cores + Breadth + Depth	69(min)	59%	69(min)	47%
General Education	14	12%	14	10%
TOTAL (minimum)	117	100%	147	100%

General Education

The general education consists of 7 courses (total 14 credit hours) as shown in Table 5.9 These 7 courses satisfy the university's requirements for general education curriculum, designed to accomplish the goals of *Universitas Hasanuddin* as defined by its mission statements.

Table 5.9: The General Education List of Courses

Code	General Education	Credit Hours
011U0032	Civic Education	2
009U0032	Bahasa Indonesia (Indonesian Language)	2
001U0032	Religion	2
012U0032	State Ideology: Pancasila	2
008U0032	Concept of Science and Technology	2
010U0032	English	2
007U0032	Social Science of Maritime Culture	2

From Table 5.7 it is clearly shown that General Education Courses are highly related with SO-3 and SO-4 student outcomes, which are the ability to communicate with a range of audiences and the ability to recognize ethical and professional responsibilities. Language courses, 009U0032– Bahasa Indonesia (Indonesian Language) and 010U0032– English, are designed to enhance the students' communication skills in both languages, actively (speaking and writing) and passively (listening and reading).

Three General Education Courses, i.e. 011U0032– Civic Education, 001U0032– Religion, and 012U0032– State Ideology: Pancasila, are declared (by law) to be nationally obligatory for all Indonesian students. These courses are to educate the students about their responsibilities, right and obligation, both as the citizens of the country and the people who embrace a religion, both ethical and professional. Indonesia is a nation with diverse ethnic groups and religions, so the state ideology Pancasila (Five Principles) is supposed to become the common platform in uniting all the people. The national slogan "*Bhinneka Tunggal Ika*" has a very deep meaning: Unity in Diversity, teaches the Indonesian students to respect the diversity. The courses on the citizenship and religion are delivered to urge the students to attain a deep conciousness on the law-obedience, and its importance in continuously improving the nation's quality of life.

The other two General Education Courses, 008U0032–Concept of Science and Technology and 007U0032–Social Science of Maritime Culture, are presented mainly to motivate the students to share their best contribution to the *Universitas Hasanuddin*'s vision to become "*a center of excellence for the Indonesian maritime-based development of humanity, sciences, technology, arts, and cultures*" and the Faculty of Engineering's vision to become "*a leading institution in the field of engineering for the global sustainability with the spirit of maritime culture*". Both courses also introduce the students to the general aspects of technology such as the engineering and industrial standards and codes, and awareness to the local and global changes and their impacts to the environment, both physical and social impacts, such as the controversy related to the climate changes and global warming effects.

Table 5.10: The List of Courses on Mathematics

Code	General Education	Credit Hours	Classroom Lecture	Tutorial
016U0033	Calculus 1	3	3	0
017U0033	Calculus 2	3	3	0
201D4113	Advanced Mathematics 1	3	3	0
210D4123	Advanced Mathematics 2	3	3	0
241D4102	Linear Systems	2	2	0
302D4112	Probability and Statistics	2	2	0
342D4122	Numerical Methods	2	2	0

Table 5.11: The List of Basic Science

Code	General Education	Credit Hours	Classroom Lecture	Laboratory
020U0033	Physics 1	3	2	1
022U0033	Physics 2	3	2	1
206D4112	Advanced Physics	2	2	0
104D4112	Advanced Chemistry	2	2	0
205D4112	Electrical Engineering Materials	2	2	0
304D4112	Electromagnetics	2	2	0
344D4122	Environmental Science	2	2	0

Mathematics and Basic Science

It is a well-known fact that the field of Electrical Engineering is strongly based on Mathematics and Natural Sciences, especially Physics and Chemistry. Early in their study in EESP, the students should enhance their skills and knowledge in applying mathematics and basic science fundamental concepts to solve engineering problems, to attain the SO-1 and SO-6, which are the ability to apply principles of engineering, science and mathematics and the ability to develop and conduct experiments. The mathematics and basic science consist of 34 credit hours, as shown in Table 5.10 for mathematics (18 credit hours) and Table 5.11 for sciences (16 credit hours).

Prior to their admittance to the university, Indonesia students learn scholastic Mathematics and Natural Sciences up to 12th grade level. The EESP first and second semesters mathematics, physics and chemistry are intended to provide the new students familiarities with college level of those subjects, and how they are different from (or similar to) the scholastic level. To give a simple example, at schools the students learn to solve problems with embedded assumptions that the solutions always exist. In college level, they learn that a problem may have a solution or not, or even many possible solutions, and also there are a lot of methods to approach the problem with.

One of the courses on basic sciences,344D4122– Environmental Science, is intended to present to the EESP students important issues regarding environmental impacts of

TABLE 5.12: THE COMPULSORY LECTURE COURSES ON ENGINEERING TOPICS

Code	Courses of Engineering Topics	Credit Hours	Classroom Lecture	Laboratory
101D4113	Electric Circuit 1	3	3	0
102D4112	Logic Circuits	2	2	0
103D4112	Engineering Drawing	2	2	0
121D4123	Electric Circuit 2	3	3	0
106D4122	Digital Systems	2	2	0
107D4122	Computer Programming	2	1	1
101D4121	Electric Circuit Laboratory	1	0	1
109D4121	Digital Systems Laboratory	1	0	1
202D4112	Basic Electrical Power	2	2	0
203D4112	Basic Telecommunication	2	2	0
233D4102	Basic Electronics	2	2	0
207D4111	Basic Electric Power Laboratory	1	0	1
208D4111	Basic Telecommunication Laboratory	1	0	1
209D4112	Basic Electronics Laboratory	1	0	1
212D4122	Electric Machines	2	2	0
213D4122	Basic Multimedia	2	2	0
214D4122	Integrated Electronics	2	2	0
205D4121	Microprocessor Systems and Interfaces	2	2	0
246D4102	Basic Control Systems	2	2	0
217D4122	Electrical Installation Laboratory	2	1	1
218D4121	Integrated Electronics Laboratory	1	0	1
205D4121	Microprocessor Systems and Interface Laboratory	1	0	1
301D4112	Engineering Economics	2	2	0
303D4112	Electric Measurements	2	2	0
343D4122	Energy Conversion	2	2	0
345D4122	Management and Entrepreneurship	2	2	0
402D4112	Research Methods and Scientific Writing	2	2	0
	Selected Elective Courses (2 packages) minimum	18	0	0

engineering solutions to the society and humanity, such as public health and safety issues, etc.

Two courses in physics, 020U0033– Physics 1 , and 022U0033– Physics 2, require students to do laboratory coursework for 1 credit-hour each. This is a part of the efforts to attain the SO-6, the ability to develop and conduct experiments, in the laboratory environment, to provide the students familiarities with data collecting, measurement, analysis and presentation, and also safety issues.

Engineering Topics

TABLE 5.12 and TABLE 5.13 are the lists of engineering courses offered by EESP. There are two categories, i.e. the Lecture Courses listed in TABLE 5.12 and Non-Lecture Courses listed in TABLE 5.13. There are also two categories of lecture courses: (1) Electrical Engineering courses and (2) General Engineering courses. The General Engineering courses are for example 103D4112– Engineering Drawing, 301D4112– Engineering Economics, 345D4122– Management and Entrepreneurship, and 402D4112– Research Methods and Scientific Writing.

Table 5.13: The Non-Lecture Courses

Code	Non-Lecture Courses	Credit Hours	Classroom Lecture	Laboratory	Off Campus
401D4112	Practical (On Job) Training	2	N/A	0	2
491D4124	Student Community Service Programs	4	N/A	0	4
446D4138	Laboratory 1	8	N/A	8	0
447D4138	Laboratory 2	8	N/A	8	0
403D4112	Final Project Proposal	2	N/A	2	0
492D4122	Final Project Result	2	N/A	2	0
493D4122	Final Project Report	4	N/A	4	0

All engineering courses are either compulsory, selected elective or elective courses. Selective elective courses should be taken in packages of 3 to 4 courses with minimum 9 credit hours, while elective courses are offered independently from other courses. Electrical Engineering courses can be delivered in classrooms and/or laboratories, they are derived from 4 (four) very fundamental courses, namely: (1) 304D4112–Electromagnetics (2) 101D4113–Electric Circuit 1, 121D4123–Electric Circuit 2, and 101D4121–Electric Circuit Laboratory (3) 102D4112–Logic Circuits, 106D4122–Digital Systems, and 109D4121–Digital Systems Laboratory (4) 233D4102–Basic Electronics, and 209D4112–Basic Electronics Laboratory.

All compulsory and selected elective courses have their course profiles. A course profile is a collection of documents related to that course, including its syllabus, textbooks and other learning materials, problem sets of previous midterm and final examination, examples of graded student's papers, midterm and final examination, exercises, and other student works. This collection of course-related materials will be contained in a special room, to make it easy for the visiting evaluators to see them.

As an example, a course profile of 246D4102–Basic Control Systems is presented here. The course is fully a classroom lecture course of 2 credit hours. There are 5 (five) instructors who are usually assigned to teach this course. They share classes, two instructors teach one class for a half of a semester (8 weeks) each. At the end of the semester they come up with their grades and based on these grades the final grades of all students are determined.

The important part of the documents in the course profile is what so-called semester course plan. In this course plan the learning attainment is stated. For 246D4102–Basic Control Systems, for instance, there are 3 (three) learning attainments, (at the end of semester, students should be able) namely:

1. CP-1: to describe examples of automatic and manual control systems, to simply a block diagram using block diagram algebra, and to build mathematical model of control systems using the transfer function model and Laplace transform

2. CP-2: to explain control systems terminologies such as: feedback control systems, compensator, closed loop transfer function, open-loop transfer function, characteristic equation, pole and zero.

3. CP-3: to describe the system time and frequency response, stability, Routh criteria, the roots of characteristic equation in the complex plane, and Root Locus techniques.

All those learning attainments are related to the CRITERION 3, in this case this course is strongly related to SO-1 to apply principles of engineering, science and mathematics, and is also related to SO-7 to acquire and apply new knowledge and make a contribution, eventhough not as strong as its relation with SO-1. This kind of information is available in each of the course profile, and will be made available to the visiting program evaluators.

Capstone Design

The undergraduate final project is the culminating learning experience of an EESP student. He or she is expected to show his or her competency in the area of electrical engineering by a contribution. Currently, the EESP student works individually, not in a team, to complete his or her final project. The project is not always a design project, either. Therefore, this curriculum has not accomplished a capstone because the student only works individually on a relatively small and simple project, and his or her project is not always a design project. However, there are design-based courses such as 335D4113 Digital Systems Design, 375D4122 Control Systems Design, and 380D4123–Embedded Systems Design. These courses are basically “project courses”. Students work in groups to create a design, but again, it is only a course exercise, not a capstone.

Beginning next semester, we are planning to maximize the two laboratory courses Laboratory 1 and 2 (total 16 credit hours) so the students could accomplish a culminating learning experience by working in a team on a relatively large design project.

5.2 Course Syllabi

The course syllabi can be found in Appendix A of this Self-Study Report. The information in a course syllabus includes (but not limited to): (1) course number (code) and title, (2) credit hours and contact hours, (3) instructors, (4) references (for textbooks: title, authors, publisher and year), (5) specific course information, (6) the course’s specific goals and (7) brief list of topics. The instructors announce this course syllabus in the beginning of the classes, along with other information such as the grading system, exams, quizzes, exercises, etc.

5.3 Advisory Committee

Universitas Hasanuddin has an internal unit in its organization to assist the study programs in curriculum development and the quality assurance. The unit is the *LPMPP – Lembaga Penjaminan Mutu dan Pengembangan Pembelajaran* or the Institute for Quality Assurance and Learning Development, whose main function is to advise study programs to solve problems and obstacles in the curriculum development and learning process.

The EESP made curriculum revisions every 5 (five) years (see TABLE 1 in CRITERION). The most recent curriculum revision was made in 2015 and fully implemented a year later in 2016, delayed due to the relocation to the new campus. The development process of this Curriculum 2015 started in 2012 by establishing a team of Focus Group

Discussion (FGD) on Curriculum 2015, consisting of a chairman, a secretary, and 3 members. All of them were senior EESP faculty members. The first thing that the FGD on Curriculum 2015 did was developing the awareness among the faculty members, administrative staff and EESP students that there would be a major revision of curriculum in 2015. A tracer study was made a year later in 2013. Based on this tracer study, the main structure of the new curriculum was started to be developed.

There are at least 2 (two) major revisions in Curriculum 2015. Firstly, the three sub-study programs or concentrations were discontinued and merged back to a single EESP with five options. Secondly, the introduction of new courses, namely Laboratory 1 (8 credit hours) and Laboratory 2 (8 credit hours).

The final draft of the new EESP's Curriculum 2015 was presented before the Faculty of Engineering Academic Senate to get an endorsement. Then, after some minor revisions, the final draft was submitted to the Education Commission of *Universitas Hasanuddin* Academic Senate to get a final approval to be implemented in 2016.

CRITERION 6

FACULTY

6.1 Faculty Qualifications

The EESP faculty core member consists of 29 members (23 Doctoral degree and 6 Master degree), which 6 of them are Full Professors and 17 associate professors. They finished their studies (Doctoral and Master program) in the area of electrical engineering from various leading universities in Indonesia and overseas such as from University of Wisconsin in the U.S.A, Kyushu University, Kumamoto University, Ehime University, and Nara Institute of Science and Technology in Japan, Technische Universit́at Darmstadt in Germany, the University of Queensland and University of Technology Sydney in Australia. Besides educational completion, all members obtained Lecturer Certification from Indonesian government which confirmed their competence nationally as (professional) educators. Some of them have also Professional Engineers Certification from Indonesian Institution of Engineers, namely, 1 member is the holder for IPU certificate (highest) and 2 members have IPM certificate (medium). Their competence and expertise support highly the achievement level of learning in the EESP.

Faculty members expertise can be categorized into three main areas, namely, Telecommunications and Information Engineering; Electric Power Engineering; and Computer, Control and Electronic Engineering. The name of Faculty Members is presented in Table 6.3 until Table 6.7.

In the area of Telecommunication and Information Engineering, the EESP has 9 main faculty core members. They have many years of experience in design and planning of telecommunication system related to wireless, satellite, fiber optic, antenna, traffic engineering, and switching. For Electric Power Engineering, the EESP has 15 faculty core members. They have expertise in Stability, Control and Power System Protection, Power Electronics, High Voltage and Isolation, Distribution of Power Systems and Electrical Installations, Power Systems and Electricity, Electricity Infrastructure. For Computer, Control and Electronic Engineering area, the EESP has 5 faculty core members. In addition, there is also one visiting lecturer from Germany, who help teaching in the Computer, Control and Electronic Engineering area.

The name of Faculty Core Members are presented in Table 6.1. Most of the faculty members conduct research intensively and manage academic activities of research groups where they attached (based on the field of expertise). As an output, they are active in writing paper for publication in conferences and reputed international journals. In addition to the 29 Faculty Core Members, the EESP engages also 3 Emeritus Professors, 1 Guest Lecturer, 1 Visiting Lecturer from Germany and 7 Faculty Staff from Department of Informatic. Table 6.2 presents the supporting teaching/faculty staff.

Table 6.1: Faculty Core Member

No.	Faculty Name	Field of Study
1	Salama Manjang (Head of Department)	Electric Power Engineering
2	Ansar Suyuti	Electric Power Engineering
3	Syafaruddin	Electric Power Engineering
4	Sri Mawar Said	Electric Power Engineering
5	Zaenab Muslimin	Electric Power Engineering
6	Tajuddin Waris	Electric Power Engineering
7	Gassing	Electric Power Engineering
8	Indar Chaerah Gunadin	Electric Power Engineering
9	Yusran	Electric Power Engineering
10	Muhammad Bachtiar Nappu	Electric Power Engineering
11	Ikhlas Kitta	Electric Power Engineering
12	Yusri Syam Akil	Electric Power Engineering
13	Hasniaty A.	Electric Power Engineering
14	Fitriyanti Mayasari	Electric Power Engineering
15	Ardiaty Arief	Electric Power Engineering
16	Syafruddin Syarif	Telecommunication Engineering
17	Andani Achmad	Telecommunication Engineering
18	Zulfajri Basri Hasanuddin	Telecommunication Engineering
19	Elyas Palantei	Telecommunication Engineering
20	Dewiani Djamaluddin	Telecommunication Engineering
21	Wardi Djuaeni	Telecommunication Engineering
22	Intan Sari Areni	Telecommunication Engineering
23	Merna Baharuddin	Telecommunication Engineering
24	Andini Dani Achmad	Telecommunication Engineering
25	Rhiza Samsoe'oed Sadjad	Control Engineering
26	A. Ejah Umraeni Salam	Control Engineering
27	Faizal Arya Samman	Electronic Engineering
28	Muhammad Anshar	Electronic Engineering
29	Ida Rachmaniar Sahali	Computer Engineering

Table 6.2: Supporting faculty staff.

No.	Faculty Name	Field of Study (Supporting Role)
1	Muhammad Arief	Electric Power Eng. (Emeritus Professor)
2	Muhammad Tola	Power Electronics (Emeritus Professor)
3	Nadjamuddin Harun	Electric Power Eng. (Emeritus Professor)
4	Sonny Taniadji	Electric Power Eng. (Guest Lecturer)
5	Andreas Vogel	Electronic Eng. (Visiting Lecturer from Germany)
6	Adnan	Information Techn. (Support. Lect. from Dept. of Informatic)
7	Amil Achmad Ilham	Information Techn. (Support. Lect. from Dept. of Informatic)
8	Christoforus Yohannes	Computer Eng. (Support. Lect. from Dept. of Informatic)
9	Indrabayu	Information Techn. (Support. Lect. from Dept. of Informatic)
10	Ingrid Nurtanio	Information Techn. (Support. Lect. from Dept. of Informatic)
11	Muhammad Niswar	Information Techn. (Support. Lect. from Dept. of Informatic)
12	Zahir Zainuddin	Computer Eng. (Support. Lect. from Dept. of Informatic)

Table 6.3: Faculty Qualification Summary

No	Faculty Name	Highest Degree Earned- Field and Year				Rank [1]	Type of Academic Appointment[2] T, TT, NTT	FT or PT[3]	Years of Experience			Professional Registration/ Certification[5]	Level of Activity[4] H, M, or L		
		Highest Degree	Year	Field of Study	Institution, where degree is earned				Govt./Ind. Practice	Teaching	This Institution		Professional Organizations	Professional Development	Consulting/summer work in industry
1	Adnan	Dr	2013	Information Technology	Tsukuba Univ., Japan	SL		FT	0	11	14	LC	L	M	L
2	Amil Ahmad Ilham	Dr	2011	Information Technology	Kyushu University, Japan	AP		FT	2	15	20	LC, PE	M	M	L
3	Andani Achmad	Dr	2010	Telecomm. Eng.	Universitas Hasanuddin, Makassar	P		FT	0	31	31	PE, LC	M	H	L
4	Andini Dani Achmad	MS	2013	Telecomm. Eng.	Universitas Hasanuddin, Makassar	SL		FT	1	4	4	LC	L	L	L
5	Andi Ejah Umraeni Salam	Dr	2015	Control Eng.	Universitas Hasanuddin, Makassar	SL		FT	0	18	21	PE, LC	L	M	L
6	Andreas Vogel	MS	1995	Electronic Eng.	Univ. of Dortmund, Germany	L		PT	0	9	12	NA	L	M	L
7	Ansar Suyuti	Dr	2013	Electric Power Eng.	Universitas Hasanuddin, Makassar	P		FT	22	26	26	PE, LC, APEI, LPJK, IPU, PII	H	H	H
8	Ardiaty Arief	Dr	2012	Electric Power Eng.	University of Queensland, Australia	SL		FT	1	12	17	LC	L	M	L

Table 6.4: Faculty Qualification Summary (Continued)

No	Faculty Name	Highest Degree Earned- Field and Year				Rank [1]	Type of Academic Appointment[2] T, TT, NTT	FT or PT[3]	Years of Experience			Professional Registration/ Certification[5]	Level of Activity[4] H, M, or L		
		Highest Degree	Year	Field of Study	Institution, where degree is earned				Govt./Ind. Practice	Teaching	This Institution		Professional Organizations	Professional Development	Consulting/summer work in industry
9	Christoforus Yohannes	MS	2002	Computer Eng.	Universitas Hasanuddin, Makassar	SL		FT	6	22	22	PE,	M	M	M
10	Dewiani	Dr	2013	Telecomm. Eng.	Kumamoto University, Japan	AP		FT	0	18	24	LC, PE, IEEE, PII	M	H	L
11	Elyas Palantei	Dr	2012	Telecomm. Eng.	Griffith University	AP		FT	3	18	24	LC, IEEE	M	H	L
12	Faizal Arya Samman	Dr	2010	Electronic Eng.	Technische Univ. Darmstadt, Germany	P		FT	2.8	11	16	LC, PE,	M	H	M
13	Fitriyanti Mayasari	MS	2012	Electric Power Eng.	PhD in progress at Universitas Indonesia (UI)	SL		FT	0	4	12	-	L	L	L
14	Gassing	MS	1995	Electric Power Eng.	Institut Teknologi Bandung (ITB)	AP		FT	0	30	32	PE, LC	M	M	H
15	Hasniaty A.	MS	2002	Electric Power Eng.	PhD in progress at Univ. Kebangsaan Malaysia	SL		FT	0	6	18	-	L	L	L
16	Ida Rachmaniar Sahali	MS	2012	Computer Eng.	Institut Teknologi Bandung (ITB)	L		FT	2	7	7	LC	L	L	L
17	Ikhlas Kitta	Dr	2016	Electric Power Eng.	Universitas Hasanuddin, Makassar	SL		FT	8	11	11	LC, PE	M	M	M

TABLE 6.5: FACULTY QUALIFICATION SUMMARY (CONTINUED)

No	Faculty Name	Highest Degree Earned- Field and Year				Rank [1]	Type of Academic Appointment[2] T, TT, NTT	FT or PT[3]	Years of Experience			Professional Registration/ Certification[5]	Level of Activity[4] H, M, or L		
		Highest Degree	Year	Field of Study	Institution, where degree is earned				Govt./Ind. Practice	Teaching	This Institution		Professional Organizations	Professional Development	Consulting/summer work in industry
18	Indar Chaerah Gunadin	Dr	2013	Electric Power Eng.	Institut Teknologi Sepuluh Nopember, Surabaya (ITS)	AP		FT	1	15	21	LC, IAEEE	M	H	L
19	Indrabayu	Dr	2013	Information Technology	Universitas Hasanuddin, Makassar	AP		FT	3	13	17	LC, PE	H	H	H
20	Inggrid Nurtanio	Dr	2013	Information Technology	Universitas Hasanuddin, Makassar	SL		FT	6	27	31	LC, PE	M	H	L
21	Intan Sari Areni	Dr	2013	Telecomm. Eng.	Ehime University, Japan	AP		FT	0	14	19	LC, RRS	M	H	L
22	Merna Baharuddin	Dr	2010	Telecomm. Eng.	Chiba University, Japan	SL		FT	1	10	13	LC	M	M	L
23	Muhammad Anshar	Dr	2017	Electronic Eng.	University of Technology Sydney	SL		FT	2	7	14	LC	L	L	L
24	Muhammad Arief	Dr	1985	Electric Power Eng.	l'Institute National Polytechnique de Toulouse, France	Em		PT	0	37	49	PE	H	H	H
25	Muh. Bachtiar Nappu	Dr	2013	Electric Power Eng.	University of Queensland	AP		FT	0	10	16	LC	L	L	L
26	Muhammad Niswar	Dr	2010	Information Technology	Information Science Nara Institute of Science and Technology	SL		FT	9	14	20	LC, CCNA, CDCP	M	H	H

Table 6.6: Faculty Qualification Summary (Continued)

No	Faculty Name	Highest Degree Earned- Field and Year				Rank [1]	Type of Academic Appointment[2] T, TT, NTT	FT or PT[3]	Years of Experience			Professional Registration/ Certification[5]	Level of Activity[4] H, M, or L		
		Highest Degree	Year	Field of Study	Institution, where degree is earned				Govt./Ind. Practice	Teaching	This Institution		Professional Organizations	Professional Development	Consulting/summer work in industry
27	Muhammad Tola	Dr	1985	Power Electronics	Kobe University, Japan	Em		PT	0	35	41	NA	L	L	L
28	Nadjamuddin Harun	Dr	1999	Electric Power Eng.	Universitas Hasanuddin, Makassar & TU Berlin, Germany	Em		PT	0	44	50	NA	L	L	L
29	Rhiza Samsoe'oed Sadjad	Dr	1994	Control Eng.	Univ. of Wisconsin-Madison, USA	AP		FT	2.5	28	37	LC, IEEE	M	H	L
30	Salama Manjang	Dr	2001	Electric Power Eng.	Institut Teknologi Bandung & TU Braunschweigh, Germany	P		FT	2	29	29	PE	M	H	H
31	Sonny Taniadji	Ir	1976	Electric Power Eng.	Universitas Hasanuddin, Makassar	SL		PT	50	43	43	NA	M	M	H
32	Sri Mawar Said	Dr	2014	Electric Power Eng.	Universitas Hasanuddin, Makassar	AP		FT	0	33	33	LC, PE, TIEI	L	H	L
33	Syafaruddin	Dr	2009	Electric Power Eng.	Kumamoto Univ., Japan	P		FT	2	15	20	LC, CSD,	H	H	L
34	Syafruddin Syarif	MS	2013	Telecomm. Eng.	Universitas Hasanuddin, Makassar	P		FT	0	27	31	LC, PE, IEEE	M	H	L

TABLE 6.7: FACULTY QUALIFICATION SUMMARY (CONTINUED)

No	Faculty Name	Highest Degree Earned- Field and Year				Rank [1]	Type of Academic Appointment[2] T, TT, NTT	FT or PT[3]	Years of Experience			Professional Registration/ Certification[5]	Level of Activity[4] H, M, or L		
		Highest Degree	Year	Field of Study	Institution, where degree is earned				Govt./Ind. Practice	Teaching	This Institution		Professional Organizations	Professional Development	Consulting/summer work in industry
35	Tajuddin Waris	MS	2001	Electric Power Eng.	PhD in progress in Toyohashi Univ. of Technology, Japan	SL		FT	0	19	27	LC, PE	L	M	L
36	Wardi	Dr	2012	Telecomm. Eng.	Ehime Univ. Japan	SL		FT	2	15	20	LC, MTCNA	M	M	M
37	Yusran	Dr	2013	Electric Power Eng.	Universitas Gadjah Mada, Yogyakarta (UGM)	AP		FT	2	13	19	LC	M	M	L
38	Yusri Syam Akil	Dr	2013	Electric Power Eng.	Kumamoto Univ., Japan	SL		FT	0	11	14	LC	M	H	L
39	Zaenab Muslimin	MS	2004	Electric Power Eng.	Universitas Hasanuddin, Makassar	AP		FT	26	26	26	LC, PE	M	H	H
40	Zahir Zainuddin	Dr	2005	Computer Eng.	Institut Teknologi Bandung (ITB)	AP		FT	0	24	30	LC, PE, IEEE	M	H	L
41	Zulfajri Basri Hasanuddin	Dr	2003	Telecomm. Eng.	Kyushu University, Japan	AP		FT	0	21	26	LC, PE,	H	H	L

Dr = Doctor degree
MS = Master degree
Ir = Engineer degree (Abbrev. *Insinyur*)
PE = Professional Engineer
LC = Professional Lecture Certificate

P = Professor
EP = Emeritus Professor
AP = Associate Professor
SL = Senior Lecturer
L = Lecturer

FT = Full-Time
PT = Part-Time

6.2 Faculty Workload

The EESP full-time faculty members require to fulfill 12-16 credits hours in each semester which covering the area of teaching, research, community service, and others. Teaching and research typically accounts for minimum 9 credits hours of workload, where teaching for minimum 6 credit hours. The teaching activities include thesis supervisor, examiner for proposal seminar and final year report, and academic advisor. The faculty members engage in minimum 3 hours of community service and other activities. TABLE 6.8 until TABLE ?? present the Faculty Workload Summary and describes this information in terms of workload expectations or requirements. Beside the 29 Faculty Core Members, the table presents also the workload for 3 Emeritus Professors, 1 Guest Lecturer, 1 Visiting Lecturer from Germany and 7 Faculty Member from Department of Informatic, who teach also some EESP's courses.

Most of the faculty members conduct highly research activities and manage the research groups in their each field of expertise. They are also very active in writing some articles for some conferences and reputable international journals.

Interactions with students: Several ways are conducted to interact closely between faculty and students, such as face-to-face meeting in classroom or meeting in the faculty room. Interaction can also be done through online media including e-mail, Learning Management System (LMS), social media, and special social media application. The interactions are usually done in relation to the assignment of the course, faculty as academic adviser, as a supervisor: undergraduate research and field study, student activities i.e. robotic contest.

University service activities: The service activities carried out by the faculty are extensive, both on campus and off campus. Some faculty memcobers become members of the university division. Also some faculty members participate in various committees for university or faculty activities, participate in coaching student activities such as robot contests, student creativity programs, and others. In addition, participation is also conducted outside the campus to serve the community such as Procurement and counseling on how to obtain clean water for people in areas that are difficult to get clean water; Engagement in electricity-saving education programs and the use of solar panels for locations that have no electricity services covered by the government.

TABLE 6.8: FACULTY WORKLOAD SUMMARY

No	Faculty Member (name)	PT or FT[1]	Classes Taught (Course No./Credit Hrs.) Term* and Year**	Program Activity Distribution (%)[3]						% of Time Devoted to the to the Program
				Teaching		Research or Scholarship		Other[4]		
				1st	2nd	1st	2nd	1st	2nd	
1	Adnan	FT	1. Logic Circuits (102D4112/27) 1st 2. Computer Programming (107D4122/27) 2nd	48	49	21	19	31	32	100%
2	Amil Ahmad Ilham	FT	1. Web Programming (327D4112/27) 1st 2. Cloud Computing (328D4112/27) 1st 3. Digital Systems (106D4122/27) 2nd 4. Algorithm and Data Structure (366D4122/27) 2nd	43	46	22	22	35	32	100%
3	Andani Achmad	FT	1. Logic Circuits (102D4112/27) 1st 2. Basic Electronics (204D4112/27) 1st 3. Basic Electronics Laboratory (209D4111/13) 1st 4. Probability and Statistics (302D4112/27) 1st 5. Process Control Technology (330D4112/27) 1st 6. Optical Fiber Communication (323D4112/27) 1st 7. Digital Systems (106D4122/27) 2nd 8. Spread Spectrum (354D4122/27) 2nd 9. Control Systems Design (374D4122/27) 2nd	44	42	26	29	30	29	100%
4	Andini Dani Achmad	FT	1. Logic Circuits (102D4112/27) 1st 2. Basic Telecommunication (Systems) (203D4112/27) 1st 3. Basic Telecommunication Laboratory (208D4111/13) 1st 4. Advance Mathematics 1 (201D4113/40) 1st 5. Telecommunication Transmission Systems (312D4112/27) 1st 6. Digital Systems (106D4122/27) 2nd 7. Computer Programming (107D4122/27) 2nd 8. Telecommunication Network Optimization (433D4132/27) 2nd 9. Advance Mathematics 2 (210D4123/27) 2nd 10. Multimedia (Network) Systems (362D4122/27) 2nd	53	59	16	10	31	31	100%

Table 6.9: Faculty Workload Summary (Continued)

No	*Faculty Member (name)*	*PT or FT*[1]	*Classes Taught (Course No./Credit Hrs.) Term* and Year***	*Program Activity Distribution (%)*[3]						*% of Time Devoted to the to the Program*
				Teaching		*Research or Scholarship*		*Other*[4]		
				1st	*2nd*	*1st*	*2nd*	*1st*	*2nd*	
5	Andi Ejah Umraeni Salam	FT	1. Logic Circuits (102D4112/27) 1st 2. Basic Electronics (204D4112/27) 1st 3. Basic Electronics Laboratory (209D4111/13) 1st 4. Control Systems + Laboratory (329D4113/27) 1st 5. Artificial Intelligence Systems (435D4132/27) 1st 6. Integrated Electronics (214D4122/27) 2nd 7. Basic Control Systems (216D4122/27) 2nd 8. Optimal Control Systems (372D4122/27) 2nd 9. Linear Systems (211D4122/27) 2nd 10. Digital Control Systems + Laboratory (371D4123/40) 2nd	44	51	24	17	32	32	100%
6	Andreas Vogel	PT	1. Integrated Electronics (214D4122/27) 2nd 2. Digital Systems Laboratory (109D4121/13) 2nd 3. Integrated Electronics Laboratory (218D4121/13) 2nd 4. Embedded Systems Design + Laboratory (380D4123/40) 2nd	100	100	-	-	-	-	100%
7	Ansar Suyuti	FT	1. Engineering Economics (301D4112/27) 1st 2. Electrical Measurement (303D4112/27) 1st 3. Electric Motor Application (406D4132/27) 1st 4. Electric Installations Laboratory (217D4122/27) 2nd 5. Electric Machines (212D4122/27) 2nd 6. Management and Entrepreneurship (345D4122/27) 2nd 7. Algorithm and Data Structure (366D4122/27) 2nd	48	53	22	14	30	33	100%
8	Ardiaty Arief	FT	1. Control and Stability of Electric Power System (310D4112/27) 1st 2. Alternating Current Transmission Systems (305D4112/27) 1st 3. Electric Power System Analysis (306D4112/27) 1st 4. Energy Conversion (343D4122/27) 2nd 5. Power Systems Operations (351D4122/27) 2nd	44	47	26	23	30	30	100%
9	Christoforus Yohannes	FT	1. Advance Chemistry (104D4112/27) 1st 2. Industrial Robotics (331D4112/27) 1st 3. Industrial Automation + Laboratory (PLC) (337D4112/27) 1st 4. Integrated Electronics (214D4122/27) 2nd 5. Microprocessor Systems and Interfaces (215D4122/27) 2nd 6. Microprocessor Systems and Interfaces Lab. (219D4121/13) 2nd	47	60	21	8	32	32	100%

TABLE 6.10: FACULTY WORKLOAD SUMMARY (CONTINUED)

No	Faculty Member (name)	PT or FT[1]	Classes Taught (Course No./Credit Hrs.) Term* and Year**	Program Activity Distribution (%)[3]						% of Time Devoted to the to the Program
				Teaching		Research or Scholarship		Other[4]		
				1st	2nd	1st	2nd	1st	2nd	
10	Dewiani	FT	1. Basic Telecommunication (Systems) (203D4112/27) 1st 2. Basic Telecommunication Laboratory (208D4111/13) 1st 3. Advance Mathematics 1 (201D4113/40) 1st 4. Probability and Statistics (302D4112/27) 1st 5. Optical Fiber Communication (323D4112/27) 1st 6. Telecommunication Network Optimization (433D4132/27) 2nd 7. Advance Mathematics 2 (210D4123/27) 2nd 8. Linear Systems (211D4122/27) 2nd	55	46	13	20	32	34	100%
11	Elyas Palantei	FT	1. Electromagnetics (304D4112/27) 1st 2. Basic Multimedia (213D4122/27) 2nd 3. Telecomm. Management and Regulations (353D4122/27) 2nd 4. Multimedia Signal Processing + Laboratory (360D4123/40) 2nd	44	43	22	23	34	34	100%
12	Faizal Arya Samman	FT	1. Basic Electronics (204D4112/27) 1st 2. Basic Electronics Laboratory (209D4111/13) 1st 3. Digital Systems (106D4122/27) 2nd 4. Digital Systems Laboratory (109D4121/13) 2nd 5. Integrated Electronics (214D4122/27) 2nd 6. Integrated Electronics Laboratory (218D4121/13) 2nd 7. Basic Control Systems (216D4122/27) 2nd 8. Digital System Design + Laboratory (335D4113/40) 1st 9. Integrated Circuits Technology (339D4112/27) 1st 10. Embedded Systems Design + Laboratory (380D4123/40) 2nd	41	47	29	20	30	33	100%
13	Fitriyanti Mayasari	FT	N/A (pursuing PhD degree)	0	0.0	100	100	0	0	N/A
14	Gassing	FT	1. Advance Chemistry (104D4112/27) 1st 2. Basic Electric Power (Systems) (202D4112//27) 1st 3. Advance Physics (206D4112/27) 1st 4. Basic Electric Power laboratory (207D4111/13) 1st 5. Electric Power Generation Systems (309D4112/27) 1st 6. Electric Machines Analysis 2 + Laboratory (350D4122/40) 1st 7. Electric Installations Laboratory (217D4122/27) 2nd 8. Electric Machines (212D4122/27) 2nd 9. Numerical Methods (342D4122/27) 2nd	46	48	19	23	35	29	100%

TABLE 6.11: FACULTY WORKLOAD SUMMARY (CONTINUED)

No	Faculty Member (name)	PT or FT[1]	Classes Taught (Course No./Credit Hrs.) Term* and Year**	Program Activity Distribution (%)[3] Teaching		Research or Scholarship		Other[4]		% of Time Devoted to the to the Program
				1st	2nd	1st	2nd	1st	2nd	
15	Hasniaty A.	FT	1. Electrical Circuits 1 (101D4113/40) 1st 2. Advance Chemistry (104D4112/27) 1st 3. Advance Physics (206D4112/27) 1st 4. Electric Circuits 2 (105D4123/40) 2nd 5. Advance Mathematics 2 (210D4123/27) 2nd 6. Electric Circuits Laboratory (108D4121/13) 2nd 7. Electric Power System Analysis (306D4112/27) 2nd 8. Electric Machines Analysis 2 + Laboratory (350D4122/27) 2nd	61	58	0	4	39	38	100%
16	Ida Rachmaniar Sahali	FT	1. Computer Network + Laboratory (325D4112/27) 1st 2. Data Communication (321D4112/27) 1st 3. Industrial Automation + Laboratory (PLC) (337D4112/27) 1st 4. Digital Systems (106D4122/27) 2nd 5. Computer Programming (107D4122/27) 2nd	50	74	17	5	33	21	100%
17	Ikhlas Kitta	FT	1. Basic Electric Power (Systems) (202D4112/27) 1st 2. Electrical Engineering Materials (205D4112/27) 1st 3. Basic Electric Power laboratory (207D4111/13) 1st 4. Alternating Current Transmission Systems (305D4112/27) 1st 5. Electric Installations Laboratory (217D4122/27) 2nd 6. Electric Power Distribution Systems + Lab. (348D4122/27) 2nd	40	62	33	7	27	31	100%
18	Indar Chaerah Gunadin	FT	1. Advance Physics (206D4112/27) 1st 2. Basic Electric Power (Systems) (202D4112//27) 1st 3. Basic Electric Power laboratory (207D4111/13) 1st 4. Electrical Measurement (303D4112/27) 1st 5. Control and Stability of Electric Power System (310D4112/27) 1st 6. Intelligent Electric Power Systems (411D4132/27) 1st 7. Environmental Science (344D4122/27) 2nd 8. Basic Control Systems (216D4122/27) 2nd	41	42	30	25	29	33	100%
19	Indrabayu	FT	1. Engineering Economics (301D4112/27) 1st 2. Artificial Intelligence Systems (435D4132/27) 1st 3. Basic Multimedia (213D4122/27) 2nd	46	48	19	21	35	31	100%

TABLE 6.12: FACULTY WORKLOAD SUMMARY (CONTINUED)

No	*Faculty Member (name)*	*PT or FT*[1]	*Classes Taught (Course No./Credit Hrs.) Term* and Year***	*Program Activity Distribution (%)*[3]						*% of Time Devoted to the to the Program*
				Teaching		*Research or Scholarship*		*Other*[4]		
				1st	*2nd*	*1st*	*2nd*	*1st*	*2nd*	
20	Ingrid Nurtanio	FT	1. Advance Mathematics 1 (201D4113/40) 1st 2. Advance Mathematics 2 (210D4123/27) 2nd 3. Intelligent Control Systems (373D4122/27) 2nd	45	49	18	19	37	32	100%
21	Intan Sari Areni	FT	1. Advance Mathematics 1 (201D4113/40) 1st 2. Basic Telecommunication (Systems) (203D4112/27) 1st 3. Advance Mathematics 1 (201D4113/40) 1st 4. Basic Telecommunication Laboratory (208D4111/13) 1st 5. Digital Communication (324D4112/27) 1st 6. Linear Systems (211D4122/27) 2nd 7. Multimedia Signal Processing + Laboratory (360D4123/40) 2nd 8. Analog and Digital Filters (359D4122/27) 2nd	47	45	22	23	31	32	100%
22	Merna Baharuddin	FT	1. Basic Telecommunication (Systems) (203D4112/27) 1st 2. Basic Telecommunication Laboratory (208D4111/13) 1st 3. Special Topics in Telecommunication Network (425D4132/27) 1st 4. Telecommunication Transmission Systems (312D4112/27) 1st 5. Basic Multimedia (213D4122/27) 2nd 6. Spread Spectrum (354D4122/27) 2nd 7. Analog and Digital Filters (359D4122/27) 2nd	55	64	17	11	28	25	100%
23	Muhammad Anshar	FT	1. Engineering Drawing (103D4112/27) 1st 2. Basic Electronics (204D4112/27) 1st 3. Basic Electronics Laboratory (209D4111/13) 1st 4. Industrial Robotics (331D4112/27) 1st 5. Integrated Electronics (214D4122/27) 2nd 6. Microprocessor Systems and Interfaces (215D4122/27) 2nd 7. Intelligent Control Systems (373D4122/27) 2nd 8. Microprocessor Systems and Interfaces Lab. (219D4121/13) 2nd 9. Embedded Systems Design + Laboratory (380D4123/40) 2nd	44	46	25	23	31	31	100%
24	Muhammad Arief	PT	1. High Voltage Engineering + Laboratory (352D4122/27) 2nd	100	100	-	-	-	-	100%
25	Muhammad Bachtiar Nappu	FT	1. Advance Physics (206D4112/27) 1st 2. Electricity Market (413D4132/27) 1st 3. Numerical Methods (342D4122/27) 2nd 4. Power Systems Operations (351D4122/27) 2nd	45	48	24	22	31	30	100%

Table 6.13: Faculty Workload Summary (Continued)

No	*Faculty Member (name)*	*PT or FT*[1]	*Classes Taught (Course No./Credit Hrs.) Term* and Year***	*Program Activity Distribution (%)*[3]						*% of Time Devoted to the to the Program*
				Teaching		*Research or Scholarship*		*Other*[4]		
				1st	*2nd*	*1st*	*2nd*	*1st*	*2nd*	
26	Muhammad Niswar	FT	1. Logic Circuits (102D4112/27) 1st 2. Computer Network + Laboratory (325D4112/27) 1st 3. Web Programming (327D4112/27) 1st 4. Digital System Design + Laboratory (335D4113/40) 1st 5. Digital Systems (106D4122/27) 2nd 6. Computer Programming (107D4122/27) 2nd	47	42	21	26	32	32	100%
27	Muhammad Tola	PT	1. Advance Physics (206D4112/27) 1st 2. Optoelectronics (404D4132/27) 1st 3. Power Electronics + Laboratory ()	100	100	-	-	-	-	100%
28	Nadjamuddin Harun	PT	1. Electric Power Generation Systems (309D4112/27) 1st 2. Environmental Science (344D4122/27) 2nd 3. Basic Control Systems (216D4122/27) 2nd	100	100	-	-	-	-	100%
29	Rhiza S. Sadjad	FT	1. Process Control Technology (330D4112/27) 1st 2. Control Systems + Laboratory (329D4113/27) 1st 3, Basic Control Systems (216D4122/27) 2nd 4. Control Systems Design (374D4122/27) 2nd 5. Optimal Control Systems (372D4122/27) 2nd 6. Digital Control Systems + Laboratory (371D4123/40) 2nd	57	60	11	9	32	31	100%
30	Salama Manjang	FT	1. Electrical Engineering Materials (205D4112/27) 1st 2. Electromagnetics (304D4112/27) 1st 3. Electric Power Distribution Systems + Lab. (348D4122/27) 2nd 4. High Voltage Engineering + Laboratory (352D4122/27) 2nd 5. Electric Power Distribution Systems + Lab. (348D4122/27) 2nd	45	48	24	19	31	33	100%
31	Sonny Taniadji	PT	1. Electric Power Protection System 1 (308D4112/27) 1st 2. Electric Power Protection System 2 + Laboratory (349D4122/27) 2nd	100	100	-	-	-	-	100%

Table 6.14: Faculty Workload Summary (Continued)

No	Faculty Member (name)	PT or FT[1]	Classes Taught (Course No./Credit Hrs.) Term* and Year**	Program Activity Distribution (%)[3] Teaching		Research or Scholarship		Other[4]		% of Time Devoted to the to the Program
				1st	2nd	1st	2nd	1st	2nd	
32	Sri Mawar Said	FT	1. Electrical Circuits 1 (101D4113/40) 1st 2. Basic Electric Power (Systems) (202D4112/27) 1st 3. Basic Electric Power laboratory (207D4111/13) 1st 4. Electric Power Protection System 1 (308D4112/27) 1st 5. Electric Circuits 2 (105D4123/40) 2nd 6. Electric Circuits Laboratory (108D4121/13) 2nd 7. Electric Power Protection System 2 + Lab. (349D4122/27) 2nd 8. Electric Machines Analysis 2 + Laboratory (350D4122/27) 2nd	46	66	23	5	31	29	100%
33	Syafaruddin	FT	1. Electric Power System Analysis (306D4112/27) 1st 2. Energy Conversion (343D4122/27) 2nd 3. Numerical Methods (342D4122/27) 2nd	45	46	24	23	31	31	100%
34	Syafruddin Syarif	FT	1. Digital Communication (324D4112/27) 1st 2. Terrestrial Network Design (320D4112/27) 1st 3. Information Theory and Coding (355D4122/27) 2nd 4. Telecommunication Systems Performance (364D4122/27) 2nd 5. Wireless Technology (354D4122/27) 2nd	43	58	26	12	31	30	100%
35	Tajuddin Waris	FT	N/A (pursuing PhD degree)	0	0.0	100	100	0	0	N/A
36	Wardi	FT	1. Basic Telecommunication (Systems) (203D4112/27) 1st 2. Basic Electronics (204D4112/27) 1st 3. Basic Telecommunication Laboratory (208D4111/13) 1st 4. Basic Electronics Laboratory (209D4111/13) 1st 5. Special Topics in Telecommunication Network (425D4132/27) 1st 6. Data Communication (321D4112/27) 1st 7. Basic Multimedia (213D4122/27) 2nd 8. Multimedia (Network) Systems (362D4122/27) 2nd	50	52	19	21	31	27	100%

TABLE 6.15: FACULTY WORKLOAD SUMMARY (CONTINUED)

No	Faculty Member (name)	PT or FT[1]	Classes Taught (Course No./Credit Hrs.) Term* and Year**	Program Activity Distribution (%)[3]						% of Time Devoted to the to the Program
				Teaching		Research or Scholarship		Other[4]		
				1st	2nd	1st	2nd	1st	2nd	
37	Yusran	FT	1. Advance Chemistry (104D4112/27) 1st 2. Advance Physics (206D4112/27) 1st 3. Electrical Measurement (303D4112/27) 1st 4. Electric Power Generation Systems (309D4112/27) 1st 5. Electromagnetics (304D4112/27) 1st 6. Intelligent Electric Power Systems (411D4132/27) 1st 7. Environmental Science (344D4122/27) 2nd 8. Electric Machines (212D4122/27) 2nd 9. Advance Mathematics 2 (210D4123/27) 2nd	53	50	16	18	31	32	100%
38	Yusri Syam Akil	FT	1. Basic Electric Power (Systems) (202D4112/27) 1st 2. Basic Electric Power laboratory (207D4111/13) 1st 3. Electrical Measurement (303D4112/27) 1st 4. Electric Motor Application (406D4132/27) 1st 5. Energy Conversion (343D4122/27) 2nd 5. Electric Power System Analysis (306D4112/27) 2nd	45	45	23	23	32	32	100%
39	Zaenab Muslimin	FT	1. Electrical Circuits 1 (101D4113/40) 1st 2. Probability and Statistics (302D4112/27) 1st 3. Electric Circuits 2 (105D4123/40) 2nd 4. Electric Circuits Laboratory (108D4121/13) 2nd 5. Linear Systems (211D4122/27) 2nd	50	60	20	8	30	32	100%
40	Zahir Zainuddin	FT	1. Logic Circuits (102D4112/27) 1st 2. Engineering Drawing (103D4112/27) 1st 3. Microprocessor Systems and Interfaces (215D4122/27) 2nd 4. Microprocessor Systems and Interfaces Lab. (219D4121/13) 2nd 5. Artificial Intelligence Systems (435D4132/27) 2nd	44	50	26	24	30	26	100%
41	Zulfajri B. Hasanuddin	FT	1. Probability and Statistics (302D4112/27) 1st 2. Satellite Communication Systems (314D4112/27) 1st 3. Terrestrial Network Design (320D4112/27) 1st 4. Telecomm. Management and Regulations (353D4122/27) 2nd 5. Telecommunication Systems Performance (364D4122/27) 2nd 6. Radar and Navigation (365D4122/27) 2nd 7. Wireless Technology (354D4122/27) 2nd	51	60	24	9	25	31	100%

6.3 Faculty Size

The EESP employs 41 faculty members to conduct the courses in the EESP. The qualifications of each faculty member is presented in Table 6.3 until Table 6.7. The faculty members are sufficient to cover all of the courses both required engineering courses and elective courses, with at least two faculty members competent of teaching the courses. All of the courses are presented at once a year, and some of the elective courses are offered for every semester.

6.4 Faculty's Professional Development

Professional development: Professional development for faculty core members is regularly carried out. A faculty is required to take apart in the course design and pedagogical techniques training such as Instructional Technique for Basic Skills Improvement Training and Applied Approach Training. Some of the training are also attended by faculty members such as training on: the research proposal preparation, the strategy to penetrate international scientific journal publications, and the research output utilization with potential for patents.

In addition to professional developments, the faculty members also build effective network with other lecturer in both domestic and abroad through post graduated program in foreign universities, national and international conferences, the visiting scholar program such as "Scheme for Academic Mobility and Exchange (SAME) Program" in foreign universities.

Interactions with industrial and professional practitioners including employers of students: Some of the faculty members are actively involved in solving industrial problems, and conducting collaborative research such as with electric utility and cement companies. The EESP is regularly invited representatives from industry as guest lecturers in undergraduate classes to give public lectures to broaden the students understanding of current industrial context.

The summary of professional development activities for each faculty core member, including 10 faculty member from Department of Informatic, is presented in Table 6.16.

Table 6.16: Summary of Professional Development Activities for Faculty Members, including faculty member from Department of Informatic.

No	Faculty Name	Conference		Workshop		Instructional Training
		Presenter	Attendance	Presenter	Attendance	
1	Adnan	1	1	0	2	3
2	Amil Ahmad Ilham	4	3	0	2	2
3	Andani Achmad	6	7	0	5	3
4	Andini Dani Achmad	3	5	0	2	1
5	Andi Ejah Umraeni Salam	5	10	0	3	2
6	Andreas Vogel	NA	NA	NA	NA	NA
7	Ansar Suyuti	9	9	0	3	4
8	Ardiaty Arief	14	0	3	0	2
9	Christoforus Yohannes	3	5	2	1	4
10	Dewiani	4	0	0	2	3
11	Elyas Palantei	1	1	1	1	1
12	Faizal Arya Samman	36	0	12	0	2
13	Fitriyanti Mayasari	4	8	0	5	2
14	Gassing	1	2	2	1	4
15	Hasniaty A.	5	4	0	6	2
16	Ida Rachmaniar Sahali	1	2	0	2	4
17	Ikhlas Kitta	2	4	1	1	1
18	Indar Chaerah Gunadin	5	3	3	2	4
19	Indrabayu	12	8	4	4	8
20	Inggrid Nurtanio	6	8	0	2	3
21	Intan Sari Areni	7	4	1	3	3
22	Merna Baharuddin	10	5	0	2	2
23	Muhammad Anshar	9	0	2	0	0
24	Muhammad Arief	NA	NA	NA	NA	NA
25	Muhammad Bachtiar Nappu	28	0	3	0	3
26	Muhammad Niswar	6	0	1	0	2
27	Muhammad Tola	NA	NA	NA	NA	NA
28	Nadjamuddin Harun	NA	NA	NA	NA	NA
29	Rhiza Samsoe'oed Sadjad	0	0	0	0	1
30	Salama Manjang	10	3	1	3	5

Table 6.17: Summary of Professional Development Activities for Faculty Members (Continued).

No	***Faculty Name***	***Conference***		***Workshop***		***Instructional Training***
		Presenter	***Attendance***	***Presenter***	***Attendance***	
31	Sri Mawar Said	1	1	0	1	2
32	Syafaruddin	26	3	0	1	2
33	Syafruddin Syarif	9	30	6	13	5
34	Sonny Taniadji	NA	NA	NA	NA	NA
35	Tajuddin Waris	2	5	0	10	3
36	Wardi	5	3	2	2	2
37	Yusran	4	2	1	2	2
38	Yusri Syam Akil	10	3	0	2	2
39	Zaenab Muslimin	1	0	0	1	3
40	Zahir Zainuddin	5	5	2	2	2
41	Zulfajri Basri Hasanuddin	6	6	4	7	2

6.5 Institute's Hiring, Retention, Attrition and Promotion

In our institution, tenure-track is not recognized. All faculty members are civil servant or government employed staff. The lowest rank of the faculty grade is Lecturer (*Asisten Ahli*), following the higher rank is Senior Lecturer (*Lektor*) or Assistant Professor, then Associate Professor (*Lektor Kepala*). The highest rank is Full Professor (*Guru Besar*). In order to be promoted to higher rank, each faculty member must collect an amount of credit points. The credit points can be obtained from teaching records, writing books, student supervising, publishing scientific articles and patents, etc.

Table 6.18: The number of credit points collected by a faculty to attain his/her rank.

Faculty Rank	Number of required credit points
Lecturer (*Asisten Ahli*)	150
Senior Lecturer (*Lektor*)	200
Associate Professor (*Lektor Kepala*)	400
Full Professor (*Guru Besar*)	850

Table 6.19 presents the changes of the number of the faculty core member at EESP.

Table 6.19: The number of core faculty members in the last 5 years, 2014–2019.

Year	Number of Faculty Core Members				
	Total	P	AP	SL	L
2019	32	5	13	9	5
2018	29	4	12	9	4
2017	30	5	12	9	4
2016	32	3	16	9	4
2015	32	4	15	9	4
2014	33	5	15	10	3

P = (Full) Professor, AP = Associte Professor, SL = Senior Lecturer, L = Lecturer

6.6 Authority and Responsibility of Faculty

Faculty members at the EESP have responsibility related to academic program in electrical engineering which is approved by faculty. Besides semester evaluation, every five years, faculty members evaluate/ review the implementation of academic program as a whole including such as program goals, curriculum, student ratings, and equipment resources. The review is intended to know the implementation level of the academic program so it can be used as a reference in designing the next academic program. If there are big changes such as deleting or adding a new course, then it is proposed to department and forwarded to faculty for final approval. Faculty members have authority for course modifications.

CRITERION 7

FACILITIES

7.1 Offices, Classrooms, and Laboratories

7.1.1 Administrative Office

In the administrative office of the Electrical Engineering (EE) Department there is rooms for the EE Department Chair, also in charge of the EESP Chair, and Secretary, as well as rooms for EE Master Program Chair, EE PhD Program Chair, and a department meeting room. The EESP Chair's and Secretary offices have a conference table and chairs, phones, printers, bookshelf or cabinet and computer with internet access.

In the front side of the administrative staff, there are administrative staff rooms and head of administration staff (See FIGURE 7.1). The EESP administrative office is equipped with phones, printers, computers with internet access, and office supplies. In addition, the EE Department has tablet and laptop computers, projectors and wireless audio/speaker amplifier available for use by faculty and students.

(a) Front/Entrance View (b) Indoor administrative staff room

FIGURE 7.1: ADMINISTRATIVE OFFICE

7.1.2 Classrooms

Most of the EESP basic courses are taught in the Classroom Building. The building and its indoor views are shown in Figure 7.2.

All the classrooms are equipped with a white board, chairs and markers. Internet can be accessed in the majority of rooms in the Classroom building. Projectors are also available in a equipment room on the ground floor.

The classroom facilities are divided into two types of classroom according the maximum capacity of students. There are 47 and 22 classrooms which are available for 50 and 100 students, respectively. The classroom divisions in Table 7.1 are as follows:

Table 7.1: Classroom Facilities

Floor	Capacity of 100 students	Capacity of 100 students	Purposes
G	2	9	New Students Only
1	4	14	Students
2	8	12	Students
3	9	12	Students
Total	22	47	

(a) Outdoor side view

(b) Entrance

(c) Indoor View

(d) Classroom Indoor view

Figure 7.2: Classroom Building.

7.1.3 Lecture Theatres

The Faculty of Engineering, *Universitas Hasanuddin* has four lecture s rooms (Lecture Theatres 1, 2, 3, and 4) which are located in the CSA Building, Faculty of Engineering, *Universitas Hasanuddin* in Gowa. These rooms are usually used for seminars or guest lectures and doctoral promotion. Lecture Theatre 1 and 2 are identical rooms with a capacity of 140-150 people each, while Lecture Theatre 3 and 4 are identical rooms with a capacity of 100-110 people each. The facilities that are owned by all the theatre lectures are: main screen, projector, mixer, audio speaker, TV, sofa, and tea table. Especially for lecture theatre 3 has 40 sets of computers prepared for teleconferences.

(a) Lecture Theatres 1

(b) Lecture Theatre 2

(c) Lecture Theatre 3

(d) Lecture Theatre 4

FIGURE 7.3: LECTURE THEATRE

7.1.4 Meeting Room

The Office of the Electrical Engineering Department has two meeting rooms. The first room is used for internal meetings within the Department of Electrical Engineering, such as meeting to determine courses, lecture system evaluation meetings, etc. as shown in the FIGURE 7.4(A). The second room is an IATEL room or Alumni Room that is used if there is a meeting with alumni or fellow guests as shown in the FIGURE 7.4(B).

Likewise in every Laboratory there is a meeting room that is used for internal meetings of Laboratory members and student, bachelor and doctoral student examination exams as shown in the FIGURE 7.4(C).

(a) Internal Meeting Room

(b) IATEL or Alumni Room

(c) Laboratory Meeting Room

FIGURE 7.4: MEETING ROOM

7.1.5 Laboratories

The laboratory facilities and equipment in the EE Department support the EESP to meet its program educational objectives. Rooms are provided in the laboratories for each faculty member. The rooms are equipped with tables, chairs, phones, storage bookshelves and/or cabinets with internet access. Teaching assistants share office spaces in the laboratories, which are also equipped with phones, and internet access. In the EE Department, there are 13 laboratories, where 8 research groups are deployed in the laboratories.

7.1.5.1 Electronics and Devices Laboratory

The Electronics and Devices Laboratory houses equipment, electronic development kits and to support analog and digital circuit design. In the Electronics and Devices Laboratory, there some electronic equipment such as analog, digital and mixed-signal oscilloscopes, function generators, multimeters, power supplies, electronic circuit boards, electronic breadboards, active and passive electronic components as well as PCB manufacture equipment set, which are utilized to complete laboratory assignments. All the facilities in the Electronics and Devices Laboratory are used for the following BE assessment courses.

- 233D4102–Basic Electronics
- 209D4112–Basic Electronics Laboratory
- 106D4122–Digital Systems
- 109D4121–Digital Systems Laboratory
- 214D4122–Integrated Electronics
- 218D4121–Integrated Electronics Laboratory
- 335D4113–Digital System Design + Laboratory
- 380D4123–Embedded Systems Design

In the Electronics and Devices Laboratory, there are also some software tools used to support teaching methodology and to improve student's capabilities to comprehend the teaching materials. The available software tools and development kits in the Electronics and Devices Laboratory, their functionality and related courses that use them are summarized in Table 7.2.

Table 7.2: Software Tools and Development Kits available in the Electronics and Devices Laboratory

No.	Software tools / Development kits	Function	Course Related
1	Altera Quartus II software & Altera FPGA development kits	for rapid prototyping of digital circuits on FPGA devices	106D4122– Digital Systems, 335D4113– Digital System Design + Laboratory, 380D4123– Embedded Systems Design
2	MentorGraphics Modelsim	for digital circuit simulation based on HDL (VHDL/SystemVerilog) circuit modeling	106D4122–Digital Systems, 335D4113–Digital System Design + Laboratory, 380D4123–Embedded Systems Design
3	Altium Designer	for circuit schematic and layout design of PCB manufacture	209D4112–Basic Electronics Laboratory
4	OrCAD PSpice	for electric and electronic circuit simulation	233D4102–Basic Electronics, 209D4112–Basic Electronics Laboratory
5	Microwind and DSch CAD software	for integrated circuit topography design	214D4122–Integrated Electronics, 218D4121–Integrated Electronics Laboratory

Electronic circuit boards, electronic breadboards, active and passive electronic components and devices are used in 209D4112–Basic Electronics Laboratory course. In the course, the students are divided into some groups to analyse some simple electronic circuit in practice. The students in 209D4112 are given a final project to design and implement a simple example of electronic circuit applications such as audio/speaker amplifier, LED driver and/or USB voltage regulator. The students use PSpice Software for circuit modelling and simulation and use Altium Designer to design the printed circuit board (PCB) of the electronic circuit.

Altera FPGA (Field Programmable Gate Array) Kits together with the Altera Quartus II IDE (Integrated Development Environment) software are used in 106D4122–Digital Systems, 335D4113–Digital System Design + Laboratory, 380D4123–Embedded Systems Design courses. The students use Modelsim software for circuit design and simulation of digital circuits in the 335D4113–Digital System Design + Laboratory and 380D4123–Embedded Systems Design courses. The analog/digital/mixed-signal oscilloscopes are used to test the circuit performance or circuit behaviors of the designed digital circuit.

The Microwind and DSch CAD software are used in the 214D4122–Integrated Electronics, 218D4121–Integrated Electronics Laboratory courses. The students design integrated circuit topology and do physical-level simulation of the integrated circuit using Microwind CAD, and do gate-level simulation of digital integrated circuits using DSch CAD.

7.1.5.2 Electric Machines Laboratory

In the Electric Machines Laboratory, there are various equipments which use for practical courses. Besides that, the existing equipments are also used to support several

Table 7.3: Software Tools and Development Kits available in the Electric Machines Laboratory

No.	Software tool / Development kits	Function	Course Related
1	DC Generator	To generate direct current electricity	202D4112– Basic Electrical Power
2	DC Motor	To produce mechanical energy from direct current electricity	207D4111– Basic Electric Power Laboratory
3	Transformer (single and three phase)	To increase or decrease electrical voltage value	307D4112– Electric Machine Analysis 1 + Laboratory
4	Synchronous Generator	To generate AC electric power	349D4122– Electric Machine Analysis 2 + Laboratory
5	Power Supply	To provide electric power for equipment	202D4112– Basic Electrical Power307D4112– Electric Machine Analysis 1 + Laboratory349D4122– Electric Machine Analysis 2 + Laboratory
6	Tachometer	To measure rotation speed of machine	202D4112– Basic Electrical Power307D4112– Electric Machine Analysis 1 + Laboratory349D4122– Electric Machine Analysis 2 + Laboratory
7	Electric meter	To measure electric parameters such as voltage, current, resistance	202D4112– Basic Electrical Power307D4112– Electric Machine Analysis 1 + Laboratory349D4122– Electric Machine Analysis 2 + Laboratory

courses (such as assignment for students) and final project of students. Some of the laboratory equipments including their functions are shown in Table 7.3. There are many equipment in the Electric Machines Laboratory including DC generator, DC Motor, single-phase transformer, three-phase transformer, synchronous generator, induction generator, instruments set (such as mechanical power digital measurement unit, and torque measurement unit), load set (resistive load, inductive load, and capacitive load), tachometer, electric meter, controller (such as starting and synchronization unit for three phase synchronous machines, and excitation rheostat), power supply and solar PV system. The equipment are mainly used to complete or to support several courses as below:

- 202D4112–Basic Electrical Power
- 207D4111–Basic Electric Power Laboratory
- 307D4112–Electric Machine Analysis 1 + Laboratory
- 349D4122–Electric Machine Analysis 2 + Laboratory

7.1.5.3 Control Systems and Instrumentation Laboratory

The Control Systems and Instrumentation Laboratorymain hall is divided into 4 (four) laboratory sections, namely: (1) Laboratory Section for Instrumentation Systems, (2) Laboratory Section for Process Control Systems, (3) Laboratory Section for Robotics and (4) Workspace for Laboratory Courses. One corner of the main hall is assigned as a room for undergraduate students who take research and development courses for their final projects. At the other corner across the hall are small rooms for professors' and technician's offices, a meeting room, a room for graduate students and a storage room for laboratory equipment.

For the undergraduate teaching and learning process, our laboratory provides supporting facilities for the research and development activities related to the students' undergraduate final projects and also - more importantly - supports the delivery of the following courses:

- 333D4113–Electronic Instrumentation System + Laboratory
- 330D4112–Process Control Technology
- 329D4113–Control Systems + Laboratory
- 375D4122–Control System Design
- 372D4123–Digital Control Systems + Laboratory
- 331D4112–Industrial Robotics
- 319D4113–Microprocessor Based System + Laboratory
- 337D4112–Industrial Automation + Laboratory (PLC)

The laboratory's main purpose is to facilitate students to learn how to build mathematical and physical models of several types of control systems. The models help the students to understand, define and formulate the control problems usually found in the real industrial world. A miniaturized boiler drum plant is available to give insights on a process control system and technology in the real industrial plants with liquid materials, while another miniaturized plant is built as a physical model of industrial processes involving solid materials.

To emphasize the importance of understanding the models of control system's plants, modular sets of a standard servo motor training system and a miniaturized room temperature control system's plants are also available.

Sensors and transducers are essential to enable feedback in automatic control systems. Modular instrumentation training sets are available to give the students hands-on experience with real sensors and transducers and know-how to converts physical quantities into electrical signals, both analog and digital.

The ultimate engineering work in the area of control system studies is to design the controller part. A microcontroller-based universal digital controller module is provided for students to practice with programming control algorithms for control systems.

Table 7.4: Software Tools and Development Kits available in the Control Systems and Instrumentation Laboratory

No.	Software tool / Development kits	Function	Course Related
1	Instrumentation System Module Experiment	Used for Experimenting Instrumentation System	333D4113– Electronic Instrumentation System + Laboratory
2	Room Temperature Regulatory Module	To find out the working principle of a room heating system	375D4122– Control System Design329D4113– Control Systems + Laboratory
3	Microcontroller-based Universal Digital Controllers	To find out the working principle of a digital control	372D4123– Digital Control Systems + Laboratory
4	ED-4400B Servo Motor Experimental Modules	To find out the working principle of a DC motor control system	329D4113– Control Systems + Laboratory
5	Solid Material Process Control Mini-Plant	To find out the working principle of process systems manufacturing for solid materials in the industry by studying their miniatures	330D4112– Process Control Technology
6	Boiler Drum	To find out the working principle of boiler processes in the industry by studying the miniatures	330D4112– Process Control Technology
7	48 KVA 3-phase Silent Type AC Diesel Generator	For back-up power source	All courses
8	40 Mhz 2-channel Digital Storage Oscilloscopes	To see the display of voltage and electric current flowing on a system	319D4113– Microprocessor Based System + Laboratory331D4112– Industrial Robotics
9	3D Printer Creality CR 20 and CNC Mashibe 3018	To make the casing of an assembled tool	333D4113– Electronic Instrumentation System + Laboratory331D4112– Industrial Robotics

7.1.5.4 High Voltage Laboratory

Saving energy is becoming more and more important. Saving energy can be done by reducing losses. An important factor to reduce losses is to transfer energy through High Voltage Transmission lines.But High Voltage is also difficult to handle properly, and there is a lot of technical problems to overcome to make handling of High Voltage even more efficient. With High Voltage Laboratory Modular Training Set most of these problems can be studied.

High Voltage Construction Kit HV 9000 is based on a system of components made with the highest precision and can be used to build systems both for teaching and research as well as for industrial routine and type tests. The assembly of a required Test Set Up is easily done and requires no special tooling. The system gives values with high accuracy and can even be used for calibration purpose.

General specifications:

Modular design make it easy and quick to set up different test circuits, allowing maximum time for experiments. Easy to handle due to low weight. All components with exception for the test transformer can be handled by one person. Special deigned joints facilitates the connection between components. Specially designed to minimize partial discharge. All oil filled components are leak proof.

Easy to follow equipment manuals and experiment manuals. All the facilities in the High Voltage Laboratory are used for the following assessment courses.

- Generation and Measurement of Alternating Voltage.
- Generation and Measurement of Direct Voltages.
- Generation and Measurement of Direct Voltages II.
- Generation of Impulse Voltages.
- Measurement of Impulse Voltages.
- Power Frequency and Impulse Voltage Tests on Power Transformer.
- Experiment on Insulating Liquids.
- Experiment on Solid and Insulating Liquids.
- Experiment on Partial Discharge and Corona.
- Experiment on PD and Gliding Discharges.
- Break down of Gases.

Each type of equipment requires different types of High Voltage Tests depending on their operational requirements. TABLE 7.5 shows a list of equipment and function of each equipment.

Table 7.5: Software Tools and Development Kits available in the High Voltage Laboratory

No.	Software tools / Development kits	Function	Course Related
1	Control Desk	The Control Desk is used to control and operate high voltage AC/DC Impulse test equipment	351D4122–High Voltage Engineering + Laboratory 405D4132–Electromagnetic Compatibility
2	Test Transformator 100 kV	Test transformer with coupling winding for cascade connection to produce AC high voltage	351D4122–High Voltage Engineering + Laboratory 405D4132–Electromagnetic Compatibility
3	Control Desk	For connection of multi-stage AC voltage test equipment with the test transformer	351D4122–High Voltage Engineering + Laboratory 405D4132–Electromagnetic Compatibility
4	Cascade Connection Set	To be used to couple 3 pcs HV9105 Transformers in a cascade position including base plate with four wheels	351D4122–High Voltage Engineering + Laboratory 405D4132–Electromagnetic Compatibility
5	Discharge Rod	For Manual discharging of equipment components	351D4122–High Voltage Engineering + Laboratory 405D4132–Electromagnetic Compatibility
6	Connecting Rod	Connecting Rod	351D4122–High Voltage Engineering + Laboratory 405D4132–Electromagnetic Compatibility
7	Connecting Cup	Conductive Element: four elements can be inserted in horizontal position and two in vertical position	351D4122–High Voltage Engineering + Laboratory 405D4132–Electromagnetic Compatibility
8	Floor Pedestal	Conductive Element: for mounting up to four Spacer bars horizontally and supporting one Component vertically	351D4122–High Voltage Engineering + Laboratory 405D4132–Electromagnetic Compatibility
9	HV Rectifier	For use in impulse voltage and DC voltage generation	351D4122–High Voltage Engineering + Laboratory 405D4132–Electromagnetic Compatibility
10	Smoothing Capacitor/Impulse Capacitor	Impulse capacitor for generation of impulse voltages. It can also be used as smoothing capacitor in DC voltage generation	351D4122–High Voltage Engineering + Laboratory 405D4132–Electromagnetic Compatibility
11	Measuring Resistor	High voltage resistor for measurement of DC voltages	351D4122–High Voltage Engineering + Laboratory 405D4132–Electromagnetic Compatibility
12	Load Resistor	Can be used as charging resistor in impulse generators or loading resistors in HVDC	351D4122–High Voltage Engineering + Laboratory 405D4132–Electromagnetic Compatibility
13	Earthing Switch	For grounding the high voltage construction kit when de-energized	351D4122–High Voltage Engineering + Laboratory 405D4132–Electromagnetic Compatibility
14	Spacer Tube	Connecting Rod	351D4122–High Voltage Engineering + Laboratory 405D4132–Electromagnetic Compatibility
15	Connecting Rod	Mechanical and electrical connection on ground level when inserted into floor pedestal	351D4122–High Voltage Engineering + Laboratory 405D4132–Electromagnetic Compatibility

No.	Software tools / Development kits	Function	Course Related
16	Charging Resistor	For multistage impulse voltage test equipment and current limiting resistor in DC voltage generation	351D4122–High Voltage Engineering + Laboratory 405D4132–Electromagnetic Compatibility
17	Wave Front Resistor	For generation of impulse voltages. The resistors determine the rise time of the impulse voltage in lightning and switching impulse voltage generation	351D4122–High Voltage Engineering + Laboratory 405D4132–Electromagnetic Compatibility
18	Wave Tail Resistor	For generation of impulse voltages. The resistors determine the time to half value of the impulse voltage in lightning and switching impulse voltage generation	351D4122–High Voltage Engineering + Laboratory 405D4132–Electromagnetic Compatibility
19	Insulating Rod	Insulating component	351D4122–High Voltage Engineering + Laboratory 405D4132–Electromagnetic Compatibility
20	Sphere Gap	For impulse voltage generation, for pre-settings of Impulse voltage peak	351D4122–High Voltage Engineering + Laboratory 405D4132–Electromagnetic Compatibility
21	Drive for Sphere Gap	Remote control of Shere Gap size. Mounted underneath the Sphere Gap and connected by drive shaft	351D4122–High Voltage Engineering + Laboratory 405D4132–Electromagnetic Compatibility
22	Top Electrode	Serves as termination in conjunction with Grounding switch for safety grounding. Also serves as corona free electrode	351D4122–High Voltage Engineering + Laboratory 405D4132–Electromagnetic Compatibility
23	Electrode 200	Top electrode to be placed on the top transformer in 3-stage AC-Set-up. Manufactured in polished aluminium	351D4122–High Voltage Engineering + Laboratory 405D4132–Electromagnetic Compatibility
24	Electrode 300	Top electrode to be placed on the top transformer in 3-stage AC-Set-up. Manufactured in polished aluminium	351D4122–High Voltage Engineering + Laboratory 405D4132–Electromagnetic Compatibility
25	Measuring Capacitor/100	High voltage divider capacitor for measurement of AC voltages	351D4122–High Voltage Engineering + Laboratory 405D4132–Electromagnetic Compatibility
26	Measuring Capacitor/200	High voltage divider capacitor for measurement of AC voltages	351D4122–High Voltage Engineering + Laboratory 405D4132–Electromagnetic Compatibility
27	Measuring Capacitor/300	High voltage divider capacitor for measurement of AC voltages	351D4122–High Voltage Engineering + Laboratory 405D4132–Electromagnetic Compatibility
28	Low Voltage Divider	Socket of the load capacitor and connection to the Impulse Voltage meter by means of co-axial cable	351D4122–High Voltage Engineering + Laboratory 405D4132–Electromagnetic Compatibility
29	Triggering Device	For Triggering the impulse voltage generator impulse voltage oscilloscope and chopping spark gap	351D4122–High Voltage Engineering + Laboratory 405D4132–Electromagnetic Compatibility

No.	Software tools / Development kits	Function	Course Related
30	Electronic Trigger Sphere	Suitable for use with the sphere gaps and measuring spark gaps. In conjunction with the triggering device	351D4122–High Voltage Engineering + Laboratory 405D4132–Electromagnetic Compatibility
31	AC Peak Voltmeter	Measurement of AC voltage Peak. For connection to the measuring capacitor, the compressed gas capacitor or the Coupling capacitor	351D4122–High Voltage Engineering + Laboratory 405D4132–Electromagnetic Compatibility
32	DC Voltmeter	Measurement of the DC Voltage. For Connection to the Measuring Resistor	351D4122–High Voltage Engineering + Laboratory 405D4132–Electromagnetic Compatibility
33	Impulse Volt Meter	Measurement of the Impulse Voltage peak. For Connection to the load capacitor	351D4122–High Voltage Engineering + Laboratory 405D4132–Electromagnetic Compatibility
34	Space Bar (for HV9133)	For Measuring Spark Gap	351D4122–High Voltage Engineering + Laboratory 405D4132–Electromagnetic Compatibility
35	Measuring Spark Gap	Standard measuring device for flash over voltage using various electrode arrangements	351D4122–High Voltage Engineering + Laboratory 405D4132–Electromagnetic Compatibility
36	Vessel for Vacuum/ and Pressure	For Vacuum and Pressure for the determination of the flashover voltage of electrode arrangements as a function of vacuum and pressure	351D4122–High Voltage Engineering + Laboratory 405D4132–Electromagnetic Compatibility
37	Vacuum Pump	For pumping of inert gases in the range of rough vacuum, between atmospheric pressure and ultimate pressure of the pump	351D4122–High Voltage Engineering + Laboratory 405D4132–Electromagnetic Compatibility
38	Compressor	A piston type oil-lubricated compressor driven by a single phase electric motor and of fully automatic design	351D4122–High Voltage Engineering + Laboratory 405D4132–Electromagnetic Compatibility
39	Corona Cage	Inserted into the VVP (Vessel for Vacuum and Pressure) for determination of the partial discharge intensity as a function of the wire diameter and the voltage	351D4122–High Voltage Engineering + Laboratory 405D4132–Electromagnetic Compatibility
40	Oil Testing Cup	Used to measure breakdown of insulating oils	351D4122–High Voltage Engineering + Laboratory 405D4132–Electromagnetic Compatibility
41	Capacitor Coupling	To be used mainly for partial discharge measurements in HV testing	351D4122–High Voltage Engineering + Laboratory 405D4132–Electromagnetic Compatibility
42	High Voltage safety Cage/safety Net	To protect high voltage hazards from human touch	351D4122–High Voltage Engineering + Laboratory 405D4132–Electromagnetic Compatibility
43	Partial discharge meter (DTM) (to Computer & Oscilloscope)	To measure the level of aging of insulation material	351D4122–High Voltage Engineering + Laboratory 405D4132–Electromagnetic Compatibility

7.1.5.5 Electrical Installation Laboratory

The Electrical Installation Laboratory teach the practical aspects of Electrical Installation Engineering to students. At present it conducts parts of the following laboratory classes for the students, Electrical Engineering of all fields and Electrical Installations. TheElectrical Installation Laboratory is also used in carrying out research, consultancy and testing work.

The curriculum is designed to prepare students with entry level knowledge and manipulative skills for employment in the electrical industry. The program combines theory with laboratory activities as an effective means of developing the skills essential to the electrical trade.

The equipment are mainly used to complete or to support several courses as below:

- 217D4122–Electrical Installation Laboratory
- 406D4132–Electric Motors Application

The student begins with the fundamentals of electricity and wiring of simple circuits, then progresses to residential interior wiring, three phase alternating current power, and wiring of more complex circuits and equipment. Safety is stressed as an integral part of each shop task. Emphasis is placed on wiring in accordance with the provisions contained in the PUIL (SNI).

Table 7.6: Software Tools and Development Kits available in the Electrical Installation Laboratory

No.	Software tools/ Development kits	Function	Course Related
1	De Lorenzo Module	to assembly and manufacture of home Installation	217D4122–Electrical Installation Laboratory
2	Electrical drive system Equipment based PLC	to development process control of electrical drive system	406D4132–Electric Motors Application
3	Power Quality Meters	to measure quality of electric	217D4122–Electrical Installation Laboratory
4	Solar Cell Modules	to sources electrical energy	217D4122–Electrical Installation Laboratory
5	Air Conditioner Module	to load of house installation	217D4122–Electrical Installation Laboratory
6	Wye-Delta Motor Starting Modules	to control motor starting	406D4132–Electric Motors Application
7	Induction Motor Modules	to load of house installation	406D4132–Electric Motors Application
8	Stepper Motor Modules	to load of house installation	406D4132–Electric Motors Application
9	DC Motor Modules	to load of house installation	406D4132–Electric Motors Application
10	House Installations Mains	to assembly and manufacture of home Installation	217D4122–Electrical Installation Laboratory
11	Hospital Installation Modules	to assembly and manufacture of hospital installation	217D4122–Electrical Installation Laboratory

7.1.5.6 Basic Electric Laboratory

The Basic Electric Laboratory is one of the most fundamental laboratories in the Department of Electrical Engineering. It could be said that an Electrical Engineering student will not become a competent Bachelor of Electrical Engineering who is able to understand performance and characteristics of electrical circuits, electrical components and equipment if they do not pass with well all practicum are carried out at this Laboratory's Basic Electric Laboratory. All the facilities in the Basic Electric Laboratory are used for the following BE assessment courses.

- 101D4113– Electric Circuit 1
- 102D4112– Logic Circuits
- 121D4123– Electric Circuit 2
- 101D4121– Electric Circuit Laboratory
- 233D4102– Basic Electronics
- 209D4112– Basic Electronics Laboratory
- 303D4112– Electric Measurements

In the Basic Electric Laboratory, there are also some software tools used to support teaching methodology and to improve student's capabilities to comprehend the teaching materials. The available software tools and development kits in the Basic Electric Laboratory, their functionality and related courses that use them are summarized in Table 7.7.

Table 7.7: Software Tools and Development Kits available in the Basic Electric Laboratory

No.	Software tools/ Development kits	Function	Course Related
1	OrCAD PSpice	For electric and electronic circuit simulation	233D4102–Basic Electronics209D4112–Basic Electronics Laboratory101D4113–Electric Circuit 1121D4123–Electric Circuit 2
2	Electro Magnetism	Used for study about principles of the basic electronics and electromagnetism	233D4102–Basic Electronics209D4112–Basic Electronics Laboratory303D4112–Electric Measurements
3	Logic circuit	To know and simulation logic gate function	102D4112–Logic Circuits
4	Function Transfer Analysis	To simulation of function transfer analysis	303D4112–Electric Measurements
5	Wattmeter	To measure electrical power	303D4112–Electric Measurements

7.1.5.7 Relay and Measurement Laboratory

Operation of an electric power system requires better planning including the safety, security and stability of the system in the event of disturbances. These problems in power system will cause high short-circuit current flow and also the possibility of loss-synchronism of system; therefore this unexpected event needs to be isolated quickly, accurately with fast response. In this case, it is important to have the sophisticated power system protection to detect current, voltage and frequency out of the boundary of permitted limits. To isolate the disturbance, the coordination between protection devices should be appropriately regulated so that the healthy system not being affected. Therefore, it is high priority to design the structure of curriculum of this subject.

In addition, it is important for engineers in future to have comprehensive understanding about the protection of power systems in order to ensure the continuous power supply to customers with high efficiency and quality. In future, the engineers might have the practical knowledge beyond the theoretical understanding because the subject of power system protection is the compulsory for the graduate of electrical engineering students where the theoretical and practical approaches are the main component of this subject.

All the facilities in the Basic Electric Laboratory are used for the following BE assessment courses.

- 308D4112–Protection System 1
- 348D4122–Protection System 2 + Laboratory

The purpose of the subject is to provide theoretical and practical knowledge to students regarding the power system protection. Meanwhile, the study and discussion in laboratory are focused on general system protection that might be implemented in power distribution, generation, transmission, transformers, switching devices and their operations. However, it is very risk to involve the students to conduct the laboratory works in field applications. It is due to the power system protection involves large equipment that is connected to power grid. In this respect, most of power system protection laboratories utilize the modeling and simulation to explain the theoretical subjects in classroom. However, it is difficult to evaluate the actual performance of protection devices through the computer simulation and benchmark devices measurement. Therefore, the existence of laboratory in physical is highly important to help better understanding to students in associated with subjects of power system protection including their problem-solving in general.

Table 7.8: Software Tools and Development Kits available in the Relay and Measurement Laboratory

No.	Software tools / Development kits	Function	Course Related
1	Universal Base	As generator and brush-less motor holder	308D4112–Protection System 1348D4122–Protection System 2 + Laboratory
2	DC Power Supply	Power supply for variable DC voltage suitable for supplying DC machine	308D4112–Protection System 1348D4122–Protection System 2 + Laboratory
3	Capacitive Load	As single or three-phase capacitive step-variable load, Suitable for the 1.1 kW UNILAB electric machines laboratory	308D4112–Protection System 1348D4122–Protection System 2 + Laboratory
4	Inductive Load	As single or three-phase inductive step-variable load	308D4112–Protection System 1348D4122–Protection System 2 + Laboratory

7.1.5.8 Power Electronics Laboratory

There are several equipment in the power electronics laboratory. This equipment is used to assist students in practical and research activities. Practical activities carried out in accordance with the theories that have been obtained in the classroom. Whereas, for research activities, it is usually used to analyse the relationship between theory and practice. In Table 7.9 some laboratory equipment and their uses are shown.

In addition to the equipment contained in table Table 7.9 there are also other equipment that are often used to complement practical needs such as VSD (Variable Speed Drive), Microcontroller, Active and Passive Components.

- 379D4123– Power Electronics + Laboratory
- 233D4102– Basic Electronics
- 212D4122– Electric Machines
- 406D4132– Electric Motors Application
- 307D4112– Electric Machine Analysis 1 + Laboratory
- 349D4122– Electric Machine Analysis 2 + Laboratory
- 414D4132– Spread Power Generation System
- 351D4122– High Voltage Engineering + Laboratory

Table 7.9: Software Tools and Development Kits available in the Power Electronics Laboratory

No.	Software tools / Development kits	Function	Course Related
1	Power Electronics Trainer	To analyse the power electronics circuits and applications	379D4123– Power Electronics + Laboratory
2	Electronics Demonstration System	To analyse electronics circuit	233D4102– Basic Electronics
3	Silicon Controlled Rectifier (SCR) Trainer	To analyse circuit using SCR	379D4123– Power Electronics + Laboratory351D4122– High Voltage Engineering + Laboratory
4	Motor-Generator Trainer	To build and analyse circuit using motor/generator	212D4122– Electric Machines406D4132– Electric Motors Application414D4132– Spread Power Generation System
5	PC Oscilloscope, 2 Channels	To measure analog and digital signals	379D4123– Power Electronics + Laboratory307D4112– Electric Machine Analysis 1 + Laboratory349D4122– Electric Machine Analysis 2 + Laboratory
6	Analog Oscilloscope, 2 Channels	To measure analog signal	379D4123– Power Electronics + Laboratory307D4112– Electric Machine Analysis 1 + Laboratory349D4122– Electric Machine Analysis 2 + Laboratory

7.1.5.9 Computer and Networking Laboratory and Software Engineering Laboratory

Computer and Networking Laboratory has some computers and measurement equipment. The equipment are used in some courses and practical courses, and to support design projects from some course assignment including the final bachelor project. There are some electronic equipment such as computer, networking equipment (LAN tester, crimping tool, twisted pair cable), and mixed-signal oscilloscopes, which are utilized to complete laboratory assignments and courses. All the facilities in the Computer Hardware, Networking and Software Engineering Laboratory are used for the following courses.

- 107D4122–Computer Programming
- 371D4122–Advanced Computer Programming
- 334D4112–SCADA Computer Networks Based
- 317D4112–Telecommunication Software
- 370D4122–Object Oriented Programming
- 368D4122–Computer Operating System

In the Computer and Networking Laboratory , there are also some software tools used to support teaching methodology and to improve student's capabilities to comprehend the teaching materials. The available software tools and development kits in the Computer and Networking Laboratory , their functionality and related courses that use them are summarized in Table 7.10

Table 7.10: Software Tools and Development Kits available in the Computer and Networking Laboratory and Software Engineering Laboratory

No.	Software tools/ Development kits	Function	Course Related
1	Code Blocks	Media editor and compiler for C/C++ programming	107D4122–Computer Programming
2	Dev C++	Media editor and compiler for C/C++ programming	107D4122–Computer Programming
3	Borland C++	Media editor and compiler for C/C++ programming	107D4122–Computer Programming
4	Eclipse	Media editor and compiler (Java)	370D4122–Object Oriented Programming
5	PyCharm	Media editor and compiler (Java)	371D4122–Advanced Computer Programming
6	IDLE (Phyton 3.7 32 bit)	Media editor and compiler (Phyton)	371D4122–Advanced Computer Programming

7.1.5.10 Telematics Laboratory

In the Telematics Laboratory, there are some electronic equipment such as Bit error rate tester, Communication technology for Fibre Optics, Raspberry Pi, Nano Station. All the facilities in the Telematics Laboratory are used to support the BE courses and researches.

The available development kits in the Telematics Laboratory, their functionality and related courses and research that use them are summarized in Table 7.11

- 203D4112–Basic Telecommunication

Table 7.11: Software Tools and Development Kits available in the Telematics Laboratory

No.	Software tools / Development kits	Function	Course Related
1	Bit Error Rate Tester	To verify the integrity of the network from end-to-end with a bit error rate test. Leave with a concise report	203D4112–Basic Telecommunication
2	Communication Technology for Fibre Optics Training Course	To know the Characteristics of Optical Transceiver in Fibre Optic	203D4112–Basic Telecommunication
3	Raspberry Pi	Mini computer	Research
4	Nano Stations Antenna	Telecommunication Networking	Research

7.1.5.11 Antenna and Propagation Laboratory

There are various equipments in Antenna and Propagation Laboratory , which use for practical courses. Besides that, the existing equipments are also used to support several courses (such as assignment for students) and final project of students. Some of the laboratory equipments including their functions are shown in Table 7.12. The equipment are mainly used to complete or to support several courses as below.

- 311D4113–Antenna and Propagation + Laboratory
- 313D4113–High Frequency and Transmission System
- 313D4113–High Frequency and Transmission System
- 312D4112– Telecommunication Transmission Line

Table 7.12: Software Tools and Development Kits available in the Antenna and Propagation Laboratory

No.	Software tools/ Development kits	Function	Course Related
1	3D-Electromagnetic Field Simulation Software	To design (modelling) antenna	311D4113–Antenna and Propagation + Laboratory
2	Vector Signal Generator	To measure the response of the network as vector or real and imaginary parameters	313D4113–High Frequency and Transmission System
3	Logic Analyzer-32 Channel	To captures and displays multiple signals from a digital system or digital circuit	311D4113–Antenna and Propagation + Laboratory313D4113–High Frequency and Transmission System
4	RF-anechoic Chamber	To Used for performing measurements like Radiation pattern measurements, RCS measurements, Antenna parameters (gain, efficiency, pattern characteristics, etc.) testing, & Radar cross section measurements	311D4113–Antenna and Propagation + Laboratory313D4113–High Frequency and Transmission System

Beside the equipment presented in Table 7.12 in the Antenna and Propagation Laboratorythere are also multimeters, soldering tools, electronic development kits/boards and active electric/electronic components/devices to complete laboratory assignment.

7.1.5.12 Telecommunication, Radio, and Microwave Laboratory

The Telecommunication, Radio and Microwave Laboratory (preferred to mention later on as TRML) has been equipped by several numbers of both hardware and software tools to support various numbers of regular academic and scientific activities. TRML has roles that are including to carry out of both the teaching and the research activities. A number of TRML research products are readily to deploy in several higher institutions and the local peoples such as RF passive devices (e.g. various antenna types, RF passive splitter/ combiner and some others) and smart campus/ smart city/ smart society applications based on smart card/ smart phone transactions. Couples of R& D products might get ready to utilize in the targeted consumers after few modifications and further testing. Despite the different experiment categories performed in

TRML, i.e. teaching based laboratory experiments and research based laboratory experiments, the types of equipment to optimally utilize by students and faculty members are extremely different to use. Most of the teaching based lab experiments assigned are supported by the basic hardware and software tools such as multimeter/ Voltmeter/ Amperemeter sets, electronics tools kit (both for low and high frequency operation regions), power supply, digital oscilloscopes, power meter, signal generator, digital communication experiments module, optical communication experiments module, RF components and system experiments module, Matlab software, NEC software, PCB design software, CAD design software and so on. However, in order to perform the large number R& D experiments several varieties of an industry based experiments equipment were provided in TRML through several financial budgeting schemes such as R& D grants awarded, respectively, by the Directorate General of National Telecommunication Standardization, Ministry of Communication and Information, Republic of Indonesia; the Ministry of Research, Technology, and Higher Education; and JICE/ JICA Projects on the Engineering Faculty Development of UNHAS located at the new Gowa campus. Through, this various financial budgeting allow the modernized TRML equipment to comply with the required industry standards. This will also guarantee the high quality of R& D activities to be well performed by students and concerned faculty member. The teaching and research activities based tools/ facilities equipped in TRML are optimally utilized to support for the following BE assessment courses.

- 203D4112–Basic Telecommunication
- 208D4111–Basic Telecommunication Laboratory
- 304D4112–Electromagnetics
- 315D4112–Telephone Telecommunication Network
- 352D4122–Cellular Communication
- 353D4122–Wireless Technology
- 359D4122–Digital Signal Processing

In TRML, the equipped hardware and software tools are mutually used to support teaching and research methodology and to improve student's capabilities to comprehend the teaching materials and to boost the research quality. The available hardware and software tools and development kits/ experimental modules in TRML, their functionality and related courses that use them are summarized in TABLE 7.13.

Table 7.13: Software Tools and Development Kits available in the Telecommunication, Radio, and Microwave Laboratory

No.	Software tools / Development kits	Function	Course Related
1	RF Signal Generator (Agilent 100 kHz-8 GHz)	To generate various basic signals (modulated or unmodulated); To perform the local standard transmitter in case of WPT applications or to utilize in the sensor network testing	203D4112–Basic Telecommunication 208D4111–Basic Telecommunication Laboratory
2	R& S Handheld Power Meter/ Spectrum Analyzer/ Network Analyzer	To perform S-parameter measurements; as Mobile Field Testing of Network Quality; To perform radiation pattern testing; and To support RF components parameters such as VSWR, Gain, Axial Ratio and many others	315D4112–Telephone Telecommunication Network 352D4122–Cellular Communication 353D4122–Wireless Technology
3	Vector Network Analyzer (Agilent ENA Series 100 MHz – 8.5 GHz)	To perform S-parameter measurements; To support RF components parameters such as VSWR, Gain, Axial Ratio and many others; and to perform radiation pattern testing	315D4112–Telephone Telecommunication Network 352D4122–Cellular Communication 353D4122–Wireless Technology
4	Oscilloscope	To display measured parameters (amplitude, phase, noises, time period, and delay time) of various electrical quantities such Voltage and Current	203D4112–Basic Telecommunication208D4111–Basic Telecommunication Laboratory359D4122–Digital Signal Processing
5	RF and Electromagnetic Simulation Engines	To perform 3D numerical computing the large varieties numbers of RF components such as antennas, filters, combiners, splitters, and many others. The engines are useful for both teaching and research activities	304D4112–Electromagnetics352D4122–Cellular Communication353D4122–Wireless Technology
6	Universal Radio Communication Test set with GSM	To measure the radiation level of the manufactured RF appliances such as mobile devices and other wearable/implantable prototypes	315D4112–Telephone Telecommunication Network 352D4122–Cellular Communication353D4122–Wireless Technology
7	Upgradeable Oscilloscope	To display measured parameters (amplitude, phase, noises, time period, and delay time) of various electrical quantities such Voltage and Current	203D4112–Basic Telecommunication 208D4111–Basic Telecommunication Laboratory 359D4122–Digital Signal Processing

No.	Software tools / Development kits	Function	Course Related
8	RF-Anechoic Chamber (AtenLab)	The chamber is equipped with a number of facilities including the Electronic Workbench, Fabrication Tools and OTA-500 Testing Facilities. The chamber could be used for testing RF emission/ reception to record pattern characteristics of a numbers of appliances such as communication devices, biomedical devices, and other higher frequency peripherals. The chamber could working from several hundred MHz up to 20 GHz	315D4112–Telephone Telecommunication Network 352D4122–Cellular Communication353D4122–Wireless Technology
9	Outdoor Environment Testing of Designed Communication Devices/ Communication Systems	This outdoor testing facility consists of RF transmission lines, communication towers and transceiver modules. The facilities are located on the 4th Floor (Rooftop) of Electrical Engineering Building. The outdoor testing tools is pretty powerful to use to perform various measurement tasks including signal quality of radiation/ transmission processes a number of LTE systems, Cellular network devices ((3G/ 4G and beyond), radar and navigation systems, SCADA networks for industry applications, and various other related applications	315D4112–Telephone Telecommunication Network 352D4122–Cellular Communication353D4122–Wireless Technology

7.2 Computing Resources

Internet facilities in Faculty of Engineering, *Universitas Hasanuddin* may reach the maximum speed of 500 Mbps. However, it is still very rare to reach this speed due to the internet hardware limitation. Therefore, it is necessary to improve the internet facility through the upgrading and replacement of devices.

(a) CSA's Building

(b) Library

(c) Front View

(d) Back View

FIGURE 7.5: COMPUTING RESOURCES

7.3 Guidance (Policy of Occupational Health and Safety)

The occupational health is the part of public health sectors that is correlated with overall potential factors influencing the health workers including academic staffs students and lecturers. The job risks are similar to the other environmental health problems which are characterized with acute or chronic (temporary and sustainable) and their effects might occur instantaneously. Also, the effects to the health condition might be directly and indirectly as well. The public health of workers need to be highly considered because it causes problems to productivity level and other side effects.

The purpose of occupational health is focused on the workers and work equipment in *Universitas Hasanuddin*. Through the efforts of health concern in working environment, the potential risks and diseases as results of environmental pollution might be reduced from the laboratory product and activity that influence to laboratory people including the surrounded society. According to the policy of occupational health and safety in *Universitas Hasanuddin*, it mentions that every workers including academic staffs students and lecturers have the safe, secure and healthy working environments in their daily activities. Principally, all parties must attempt to take positive actions regarding the safe, secure and healthy working conditions. In general, the policy of occupational health and safety in *Universitas Hasanuddin* includes some points as follows.

1. To increase awareness and provide understanding that the working accidents can be avoided

2. To deliver understanding that the main target of occupational health and safety in *Universitas Hasanuddin* is "zero accident"

3. To prioritize the safety of employees (lecturers, students and academic staffs) in using of equipment and materials in the working environment of *Universitas Hasanuddin*

4. To guarantee that employees have full knowledge in associated with their jobs productively through the safety method with correct guideline, properly working instructions, proper equipment and material usage instructions by the right supervising methods

5. To provide adequate facilities and to guarantee the safety equipment that will be used appropriately

6. To ensure that requirement and recommendation in the policy of occupational health and safety can be fulfilled

7. To improve the protection and preservation of the environment in academic activities and to minimize the damage that might occur due to these activities. All employees must be aware of their respective responsibilities including caring for their health, safety and the environment at work, in connection with the policy

More specifically, the scope policy of occupational health and safety in *Universitas Hasanuddin* working activities includes the lecturer room and laboratory. The guidelines stipulate requirements for management system of occupational health and safety, so that the academic community of *Universitas Hasanuddin* can participate in programs as listed as follows.

1. To control the risk of occupational health and safety and to improve its performance

2. To establish the management system of occupational health and safety program in order to reduce risks for employees as well as other interested parties who may experience the occupational health and safety hazards due to their activities

3. To implement, maintain and carry out the continuous improvement of the management system of occupational health and safety program. The level of implementation will depend on several factors, such as organization policy of occupational health and safety, the nature of activities, risks and complexity of works

Table 7.14: Annual EESP's Share of Budget for Common Equipment and Facilities Maintenance

Fiscal Year	EESP's Share
2016	Rp. 435,272,000,-
2017	Rp. 1,120,106,000,-
2018	Rp. 1,506,479,000,-
2019	

7.4 Maintenance and Upgrading of Facilities

The Faculty of Engineering's new campus in Gowa has been utilized since 2012, and still in its status as a development project managed by the Project Implementation Unit (PIU) until 2019. All equipment and facilities in EESP's Electrical Engineering Building are newly installed, most of them are still in the period of guarantee, so that no maintenance will be required for the next 5 years.

The equipment and other facilities commonly utilized by the whole Faculty of Engineering since 2012 started to be managed by the Faculty of Engineering Division of Operation and Maintenance (O& M) since 2017. The Division of O& M's responsibility for operation and maintenance includes all equipment and facilities in 3 buildings, namely the Classroom Building, Center of Technology (COT) Building and the Center for Student Activity (CSA) Building, that have been fully utilized since 2012. The budget allocation for operating and maintaining these common equipment and facilities is taken from the Faculty of Engineering's Annual Plan of Activities and Budgeting (*Rencana Kegiatan dan Anggaran Tahunan*, **RKAT**), shared by all departments' budgets. The EESP's share for this budget allocation is shown in Table 7.14.

The Electrical Engineering Building facilities are upgraded by spending the investment allocated from the Faculty of Engineering annual budget, for instance in 2018 fiscal year, a total of Rp. 150.000.000 fund has been spent for the EESP's Department administrative office and laboratories to upgrade their computer network and audio-visual equipment. In addition to that, in 2018, the university also allocated a Rp. 350.000.000 fund raised from the new student admission process, called the "non-subsidized admission" (*Jalur Non-Subsidi*, JNS) for the same purpose.

In 2019 fiscal year, a total of Rp. 200.000.000 fund is allocated by the Faculty of Engineering for upgrading the facilities in the Electrical Engineering Building. A department's meeting room has been upgraded with the total of Rp. 50.000.000 fund raised by the alumni association, **IATEL**.

7.5 Library Services

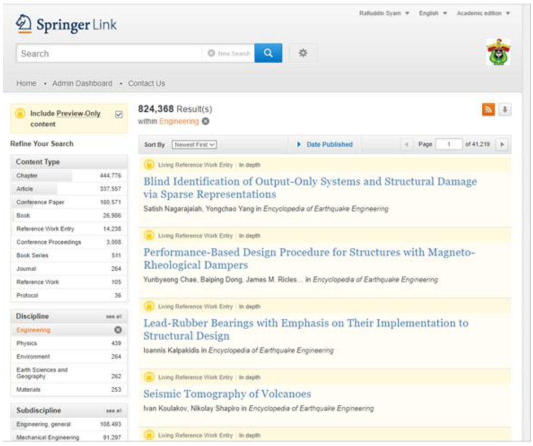
Library facility in Faculty of Engineering, *Universitas Hasanuddin* has about 2450 science and engineering books including essay manuscript of students who have already graduated from faculty. The library has daily visitors with average of 150 students. The journal article in Faculty of Engineering, *Universitas Hasanuddin* can be freely accessed without password through the link: https://cot.unhas.ac.id/library. Especially, the link of popular journal of Nature Springer publisher (Figure 7.6(a)) can be accessed through https://link.springer.com. In addition, this journal can be also accessed from outside of campus by the prior registration in campus.

To ensure the document searching inside the library website, the Faculty of Engineering, *Universitas Hasanuddin* provides internet access with the maximum speed of

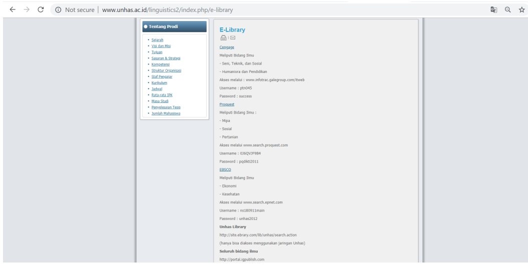
500 Mbps.

In general, the students may access the university library in the main campus of *Universitas Hasanuddin* through e-library which the main page appears in FIGURE 7.6(B) as follows.

If the students have registered as the National library member, they can access some publishers as listed in TABLE 7.15 as follows.



(a) Main Page of Journal Access through Springer Link



(b) Main Page of Journal Accesses through University e-library

FIGURE 7.6: LIBRARY SERVICES

TABLE 7.15: LIST OF PUBLISHERS ACCESSES THROUGH NATIONAL LIBRARY

Alexander Street Press
Alexander Street Video
Balai Pustaka
Brill Online
Britannica Library
Cambridge University Press
Carano Pustaka Universitas Andalas
Cengage Learning
Digital Angkasa
Ebrary
Ebsco Host
IGI Global
IG Publishing
(IG Group also included the collection of American Library Association, American Society for Training & Development, Amsterdam University Press, Business Expert, Columbia University Press, Hawai, ISEAS, Liverpool, University Press, Nias Press, Princeton University Press, RIBA Architecture, and University of California Press)
Indonesia Heritage Digital Library
Lexis Nexis
Myilibrary
[NELITI] Repositori Studi Kebijakan Indonesia
Proquest
Proquest Statistical Abstract International
Sage Knowledge
Science Direct
Taylor & Francis
Westlaw
Wiley Online Library
Springer Nature
McGraw Hill eBook Library
CNKI
CAB Direct
Emerald Insight
Wiley Online
Britannica Ebooks

7.6 Overall Comments on Facilities

In general, most of the facilities, especially, the hardware equipment, are newly installed in the EESP building. Their conditions are still good. The EESP has also some software facilities, which are used as supporting elements in the teaching and research activities.

CRITERION 8

INSTITUTIONAL SUPPORT

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8.1 Leadership

Effective leadership directs and influences the behavior of all elements in the study program, follows mutually agreed norms, ethics, and organizational culture, and is able to make the right and fast decisions. Leadership is defined as the capabilities to:

- predict the future
- formulate and articulate a realistic and credible vision

- communicate the future vision, which emphasizes the harmony of human relations
- stimulate intellectually and wisely for members to realize the vision of the organization
- provide direction, goals, roles, and assignments to all elements in the university.

The leadership pattern in the study program are described as follows.

8.1.1 Operational Leadership

To achieve effective operational leadership as the basis for directing and influencing the behavior of all elements including system of togetherness. This is created by emphasizing the harmony of human relations, namely the involvement of all elements in the organizational structure of the study program and the academic community. It also involves solving problems and establishing policies, agreements to be obeyed together in carrying out respective duties, so that all activities will run normally followed by adequate monitoring and evaluation work records. Some indicators of effective operational leadership are the determination of courses lecturers, the division of supervisors and examiners for final assignments of students through discussions in department meetings involving all lecturers.

8.1.2 Organizational Leadership

To achieve harmony leadership in an organization, the task of each element is contained in a standard operational procedure (SOP). The procedure is given as a series of efforts aiming at stimulating intellectually and wisely all members in carrying out the mission of the EESP so that the realization of the organization's vision can be achieved. All elements in the procedure are clearly defined tasks and responsibilities so that to avoid overlapping tasks. This is followed by consistent and responsible execution by always following the organization's established work procedures. In carrying out the duties, possibilities that the chair of the PS may be absence, there should be an alternative work planning such as delegation of duties and responsibilities to department secretary based on the agreed SOP.

8.1.3 Public Leadership

To managing internal interests, the study program also prioritizes the development patterns with external parties in addition to playing an active role in solving community problems as a manifestation of the character of public leadership. The collaboration can be through under the faculty level, i.e. Center of Technology (CoT) and the Research and Community Service (LP2M) at the university level, as well as those which are carried out under the EESP. In addition, the study program directs the public leadership to achieve its vision of becoming one of the main parts in the global network of science-technology infrastructure and to realize the mission of enhancing study program image through strategic collaboration with government, educational institutions and industry at the local and regional levels. As results, the chair of study program and lecturers are actively involved in various activities which include various components outside the university by opening opportunities for academic community to disseminate various ideas and creativity in carrying out the Three Services of the

Indonesian Higher Education System. As example, the members of study program might be as resource persons in several government agencies such as Ministry of Energy and Mineral Resources, North Kalimantan provincial government, East Kalimantan provincial government and National Electric Company. They might also involve in professional organizations such as IATKI, FORTEI and PII.

8.2 Program Budget and Financial Support

8.2.1 Budget Process and Continuity of Support

8.2.1.1 Source of Funds

As an autonomous state university (PTNBH), the source of EESP funding comes from the state's income and expenditure budget and other sources in the form of:

- The fee of selecting university entrance examination
- Tuition fee (Donations for Education Development ((SPP))
- Collaboration based on the Three Services of the Indonesian Higher Education System
- Donations and grants from individuals, government institutions or non-government institutions (Crowdfunding)
- Management asset of autonomous state university (PTNBH)
- Grant

Other funding sources for the operation and development of the EEPS were obtained from the State Higher Education Operational Assistance (BOPTN) which began in 2013 and a collaborative program with other agencies such as the Ministry of Communication and Information, Local Government, State Company (BUMN), international cooperation and others. The research and community service are funded by Universitas Hasanuddin and the Ministry of Research, Technology and Higher Education. The research grant also from collaborated institutions both from overseas and domestic.

8.2.1.2 Budget Planning

The Universitas Hasanuddin prepared the budget planning system according to the principles of transparency, accountability, objectivity and decentralization. The principles are based on Universitas Hasanuddin Regulation Number 46116/UN4.0.1/OT.10/2016. It is therefore, EESP organised an Annual Work Plan and Budget (RKAT) at every end of year in coordination with the Department of Electrical Engineering. The budget planning process starting with a board discussion attended by all study programs in a faculty meeting. Based on the results of the meeting, past experiences, and the university's maximum budget allocation, the EESP complies the RKAT for the next year budget plan. The Departement of Electrical Engineering discusses the RKAT with other postgraduate programs, i.e. Master and Doctoral Degree Program Study. The discussion results of RKAT in the EE Department are proposed to the vice dean II to finalize the budget allocation for EESP in RKAT. The proposed RKAT is submitted to the university for approval.

Table 8.1: Permanent (recurring) sources of support EESP

Source of Funds	Type of Funds	Allocated Budget ($)					Average ($)
		2013-14	2014-15	2015-16	2016-17	2017-18	
University	Entrance administration fees and tuition fees	114,894.16	228,825.63	80,206.92	80,206.92	300,691.96	160,965.12
State Budget (APBN)	Professional allowance	127.43	127.43	127.43	127.43	26,023.24	5,306.59
	Faculty salary	8,212.25	8,212.25	5,352.21	8,971.27	8,971.27	7,943.85
	Staff salary	10,936.78	10,936.78	18,674.99	11,767.98	81,009.98	26,665.30
	Faculty remuneration	-	-	-	-	-	-
	Staff remuneration	-	-	-	-	-	-
	Operational Cost of State University (BOPTN)	0.02	0.01	14.16	14,159.29	14,159.29	5,666.56
Total		134,170.64	248,102.10	104,375.72	115,232.90	430,855.74	206,547.42

Note: $1 = 14,125 IDR

The Universitas Hasanuddin Mechanisms and Procedures Organization Accounting and Financial Statements are contained in the Assembly Regulations Trustees of Universitas Hasanuddin Number 42943/UN4.0.1/OT.10/2016. The regulation mandates that financial management must be carried out in an orderly manner, comply with laws and regulations and carried out effectively, efficiently, transparently and responsibly by taking into account the principles of propriety and the benefits and principles of financial management. Therefore, financial management in EESP is carried out transparently, accountably, and based on the faculty/university Implementation Operational Standard (SOP). Some faculty SOPs related to financial management are SOPs for Issuance of Official Travel Letters (1.FT.KU.2015), SOPs for Payment of Goods/Services Expenditures from Supply Money Funds (2.FT.KU.2015), SOPs for Requests for Money (3.FT.KU.2015), and SOP for Proposals for Honorarium Shopping Payments (4.FT.KU.2015). The use of the EESP budget is in accordance with the SOPs based on the approved RKAT. The source of permanent EESP funding comes from the university and the state budget (APBN) as shown in Table. 8-1. Funding sources from universities increased in 2017-2018 due to an increase in tuition fees.

EESP activities are based on performance, with initial funds for each activity are given at 75% of the total budget. The remaining 25% of the budget will be paid after collecting accountability reports on the use of the 75% budget with receipts and invoices to the Faculty through the Vice Dean II, and then submitted to the Head of Administration (KTU).

8.2.2 Teaching Assistant, Graders, and Teaching Workshop

Improvement of staff competency is carried out with various trainings, i.e. the improvement trainings, basic skills on instructional techniques (PEKERTI) and Applied Approach (AA). The trainings were held regularly by LPMPP. PEKERTI and AA is important for developing professional of faculty members according to the curriculum set by Higher Education in line with No. 14 of 2005 concerning Teachers faculty members. The PEKERTI and AA programs are training programs designed by the ministry of Research, Technology and Higher Education in order to increase pedagogical competencies for faculty members.

Furthermore, the EESP regularly host seminar and special program to improve the

Table 8.2: Adequacy of Staff Resources

No	Support Staff	Name of Non-academic Staff	Job Area
1	Head of Administrative Staff	Rhisma Hidayani	Department Office
2	Administrative Staff	Salmiati	Department Office
3	Administrative Staff	Hartika	Department Office
4	Administrative Staff	Syamsiah	Department Office
5	Administrative Staff	Aris	Department Office
6	Laborant	Amsal Salim	EESP Laboratory
7	Laborant	Mustakim	EESP Laboratory
8	Laborant	Budi Prayitno	EESP Laboratory
9	Laborant	Nompo	EESP Laboratory
10	Cleaning Service	Ayu	Area of EESP
11	Cleaning Service	Tia	Area of EESP
12	Office Boy	Ikhsan	Area of EESP

capacity of faculty members and students learning skills. The university also supports electrical engineering software usage, such as CST antenna design, 3D-elecromagnetic field simulation software.

8.2.3 Additional Sources of Funds for Acquisition, Maintenance, and Upgrade of Infrastructure, Facilities, and Equipment

The additional source of funds from some alumni and JICA grant i.e. C-BEST Research grants (from 2016 till now) for the development of educational facilities, infrastructure and research in the EESP. The funds have a very significant role in increasing the capacity of faculty members and students. Additionally, supporting financial from research grants and collaboration with government/private institutions play a significant role in increasing the number of scientific publications to be used as sources of funds for acquisition, maintenance and upgrade of infrastructure, facilities and equipment.

8.2.4 Adequacy of Resources

The permanent and non-permanent funding sources shown in the previous section provide adequate funding support and continuity to guarantee the achievement of students for ABET Student Outcomes and for the Indonesian National Qualifications Framework (KKNI) for EESP.

8.2.5 Adequacy of Staff Resources

Empowerment of functional tasks are carried out by study program management system based on regulations, faculty and university policies and SOPs. The duties and responsibilities of each implementing staffing are determined based on their capacities and competencies (Table 8.2). As usual, the study program, which implements the Three Services of the Indonesian Higher Education System has always recommended or sent experts based on their competencies.

The management of adequacy and staff resources of EESP is based on a work program planning that has been made through a lecturer working meeting with reference to the university and faculty strategic plan and the Annual Plan of Activities and

Budgeting at the beginning of each period of leadership in the EESP. The mechanism is compiled accordingly to study program mission in order to achieve the vision. All study program planning processes are always based on SOP from the study program, faculty to university levels. In this respect, the functional and operational management system of study programs have been supported and carried out based on a complete SOP.

The implementation of the staff resources development is directed towards the realization of the established strategic planning including programs needed by the community, such as the increased need for learning process. The problems are identified and anticipated by the laboratory formation of part of organizations such as research laboratories and educational laboratories. All organizations under the EESP work in accordance with the standard operational procedure (SOP). The duty responsibility of each position according to the Universitas Hasanuddin Statute No. 53/2015 concerning the duties and responsibilities of implementing working units in Universitas Hasanuddin as follows:

1. Chair of Department
   - Carrying out the academic policies and educational quality standards set by the faculty
   - Arranging plan activities or department work programs
   - Coordinating the education, research and community service activities in Department
   - Carrying out the development of department in the field of education, research and community service
   - Developing good relations and cooperation with stakeholders
   - Monitoring and evaluating the implementation of teaching and learning process at the department level
   - Submitting activity reports regularly to the Dean of Faculty of Engineering
2. Secretary of Department
   - Carrying out administrative and secretarial activities of Department
   - Coordinating the preparation and development of the department's education curriculum
   - Coordinating the activities of teaching and learning process along with the Expert Lecturer Group
   - Arranging lecture schedules at department level
   - Coordinating laboratory activities within the department
   - Coordinating Field Work Practices and/or Real Student Work Lectures
   - Arranging student academic database in the department
   - Compiling a database of education, research and community service activities in the Department
3. Secretary of Department for Student Affairs
   - Carrying out administrative and secretarial activities of department especially those directly related to student activities

- Providing guidance on student activities
- Providing counseling services to students, consulting services, guidance to students regarding issues of non-academic activities
- Compiling the student database in the department
- Compiling a database of student activities in the department

4. Internal Quality Assurance Team

- Implementing the quality assurance documents at the Department level
- Preparing and socializing Quality Documents at the department level
- Monitoring and evaluating the implementation of quality documents at the Department level

5. Head of Laboratory

- Planning activities for education, research and community services in the laboratory
- Developing operational plans and laboratory development
- Providing services for the academic community to carry out the development of science and technology
- Preparing a schedule of academic activities carried out in the laboratory
- Coordinating all academic activities carried out in the laboratory
- Providing guidance to laboratory members
- Establishing cooperation with outside parties in the context of resource sharing and laboratory empowerment
- Monitoring and evaluating the availability of infrastructure and activities in the laboratory/studio
- Reporting activities at least every semester to the Department Chair

6. Head of Master and Doctoral Degrees Study Program

- Responsible for the overall implementation of activities in the Study Program
- Arranging plans for academic activities in education, research and community service in the Study Program
- Arranging plans and implementation of study program work programs
- Collaborating with related institutions in the framework of developing study programs
- Planning activities for education, research, and community service in the laboratory
- Developing operational plans and laboratory development
- Submitting activity reports regularly to the Department Chair

Table 8.3: Training and planning program in EESP

No	Training Program	Planning Program	Activities
1	Online management system by Management Information System of Universitas Hasanuddin called SIM	Capability of staffs to handle the SIM system in the level of EESP	Training
2	Specific requirement in the EESP level	Capability of staffs to handle the administrative services, laboratory services and maintenance, library operational system, etc.	Training and Benchmarking
3	Improvement of remuneration system of EESP staffs	Capability of staffs to handle faculty remuneration through online system	Training

8.2.6 Training and Retention Staff

Similar to other study program in Universitas Hasanuddin, the EESP has a clear planning for training and development of staffs. The typical training program and planning is clearly depicted in Table 8.3.

To improve the efficiency and effectiveness of training and planning program such as finance, human resources, infrastructure and facilities, the chair of study program is responsible for directing the increase in field collaboration regarding the Three Services of the Indonesian Higher Education System. For a number of activities, the study program appointed the person in charge of the activity to facilitate coordination and to provide an opportunity to manage each of the programs that have been made by PS. Every policy is always discussed through lecturer meetings which are held regularly (once a month), according to needs and are based on SOP.

Continuous monitoring and control of training and planning program are carried out on a weekly, semester and annual basis based on the SOP that applies both at the PS, faculty and university levels. The task of each element in the study program management system has targets that will be evaluated together through lecturer meetings, such as academic activities and monitoring systems carried out by the Internal Quality Assurance Team. Before the semester activities begin, the meeting regarding the institutional tasks (lecture, research and community service) is held as part of the study program task of controlling in the middle of the semester. Then an evaluation of the implementation as the target of employee is carried out by the assessor and approved by the chair of study program and the faculty head.

8.2.7 Hiring of New Faculty

Recruitment system of new faculty members in EESP is conducted by Universitas Hasanuddin according to numbers of candidates determined by the Ministry of Research, Technology and Higher Education. The recruitment process is established based on the principles of credibility, transparency, accountability, responsibility, and fairness following the official letter of Ministry of Empowerment of National Apparatus and Bureaucracy Reform No B/2215/M.PAN-RB/7/2013 about employee system reform for civil servant candidates. As one of the autonomy state university from 2017, Universitas Hasanuddin may recruit new staff members by using the schemes of new faculty permanent non-civil servants and work agreements. The schematic process of recruitment of new faculty members is shown in Figure.

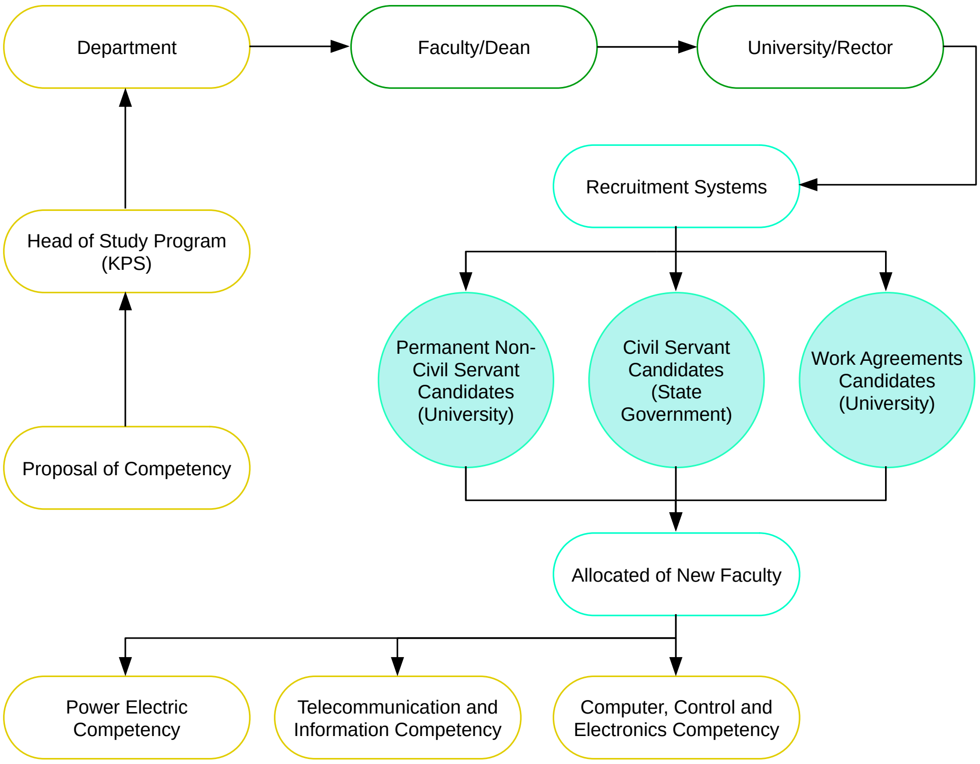

FIGURE 8.1: PROCEDURE FOR RECRUITING NEW FACULTY

The general criteria of new faculty member candidates is to have minimum qualification of Master degree. The recruitment results in EESP is quite slow with each only one lecturer was accepted in 2015 and 2019 (both are holding Master degree). This low number is due to the small quota allotted from the government, high competence test criteria and tight competition of candidates. Of course, the aims of new recruitment are to improve and refresh the quality staff of study program after some lecturers have already or nearly retired. In the recruitment process, the quota number of faculty is determined by the Universitas Hasanuddin after reviewing the proposal of new faculty member needs. The proposal is designed from the EESP meeting agreement, then submitted to the Dean of Faculty of Engineering before lodged to Universitas Hasanuddin.

8.2.8 Retention of Faculty

(a) Efforts to increase the interest of prospective students: Conducting visits to senior high schools and distributing leaflets to introduce EESP. In addition, the university and faculty also provides scholarship funds for outstanding students.

The expected result is that the number of enthusiasts increases so that the high selectivity level can get better input quality.

(b) Efforts to improve management quality: Improving the quality of management of the study program especially implementing the quality assurance system in accordance with the direction of increasing of laboratory based education and student center learning systems. In addition, the human resource competencies were also carried out by including management training. Optimizing the use of information technology in order to produce an efficient and effective management system.

(c) Efforts to improve the quality of graduates: Development of curriculum materials according to the demands of the community, stakeholders, and increasing industrial collaboration for student workplaces and providing additional competencies for students such as the use of computer software, soft skills and English. The expected result is that the number of graduates with a GPA of > 3.00 increases and the waiting time for getting a job is getting shorter. It is expected that the next 2 to 3 years will be shortened by improving soft skills that are related to the field of electrical engineering competence and English language skills.

(d) Efforts for the implementation of partnership collaboration: Strengthening the cooperation network (signing of the MOU) by conducting visits to various universities (local/abroad), especially student and lecturer exchanges. Collaboration with government and private institutions to provide opportunities for students and lecturers to get internships and field lectures. The obtained results are an increasing number of partnerships in the field of the Three Services of the Indonesian Higher Education System. Among them, there are international cooperations with the University of Malaysia, Akita University, Kumamoto University, Ehime University, and Kyushu University of Japan. The collaboration with East Kalimantan Provincial Government (Bontang and Balikpapan Regional Government), North Kalimantan Provincial Government (Tarakan Regional Government), University of Indonesia, ITB, Universitas Telkom (Smart Card Consortium), Ministry of communication and information (research and telecommunications equipment).

(e) Efforts and achievements in obtaining competitive grants: Lecturers are expected to looking for competitive grant information and competitive research grants, such as Foreign Cooperation, MP3EI, Featured Research, Competency of Study Programs, Internal Competition, Postdoctoral Research, C-BEST JICA, and other institutions. The results show that every year at least 10 lecturers get research competitive grants, where the students are being involved in the research activities.

PROGRAM CRITERIA

The official name of this study program is the Electrical Engineering Study Program (EESP). The range of engineering topics implied by this name includes (1) the application of circuit analysis and design, computer programming, associated software for simulation, analog and digital electronics, microcomputers and microcontrollers, electricity systems installation and distribution and (2) the application of natural sciences (physics and chemistry) and mathematics above 12th grade scholastic subjects to the desgn and analysis, operation and maintenance of electrical and electronic systems.

The structure of the EESP curriculum as discussed in Criterion 5 provides both breadth and depth across the range of engineering topics implied by the title of the program above.

The curriculum includes probability and statistics, including applications appropriate to the EESP; mathematics through differential and integral calculus, sciences (physics, chemistry and environmental sciences) and engineering topics (including computer programming, engineering drawing and engineering economics) necessary to analyze and design complex electrical and electronic devices, software, and systems containing hardware and software components.

The EESP curriculum includes advanced mathematics, such as differential equations, linear algebra, complex variables, transforms and phasors in power system analysis and control. The curriculum also includes topics in telecommunication theory and systems, design and operation of telecommunication network and computer network for services such as voice, data, image, and video transport.

APPENDIX A

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A.1 Civic Education

1. Course code: 011U0032
   Course name: Civic Education
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Baharuddin
   (b) Wahyudi
4. Text book, title, author, publisher and year:
   (a) Pokok-Pokok Filsafat Hukum, Darji Darmodiharjo, Publisher: Gramedia Pustaka Utama, 1996.
   (b) Filsafat Pancasila sebagai Filsafat Bangsa Negara Indonesia, Kaelan, Publisher: Departemen Pendidikan Nasional Direktur Jendral Pendidikan Tinggi, 2005.
   (c) Geostrategic Indonesia, Armaidy Armawi, Publisher: Departemen Pendidikan Nasional Direktur Jendral Pendidikan Tinggi, 2005.
   (d) Pengetahuan Politik dan Strategi, Chaidir Basri, Publisher: Departemen Pendidikan Nasional Direktur Jendral Pendidikan Tinggi, 2005.
   (e) Hak dan Kewajiban Warga Negara, AT Soegito, Publisher: Departemen Pendidikan Nasional Direktur Jendral Pendidikan Tinggi, 2005.
   (f) Pancasila sebagai Visi dan Referensi Kritik Sosial, M Sastrapratedja, Publisher: Universitas Sanata Dharma, 2001.
   (g) Pancasila sebagai dasar etika kehidupan bermasyarakat, berbangsa dan bernegara, Koento Wibisono Siswomiharjo, Publisher: Departemen Pendidikan Nasional Direktur Jendral Pendidikan Tinggi, 2005.
   (h) Membangun Kembali Karakter Bangsa, Tim Sosialisasi Penyemaian Jati Diri Bangsa, Publisher: PT. Gramedia, 2003.
   (i) Demokrasi dan Pendidikan Demokrasi, Winaputra Udin S, Publisher: Departemen Pendidikan Nasional Direktur Jendral Pendidikan Tinggi, 2005.
   (j) Panduan Kuliah Pendidikan Pancasila untuk Perguruan Tinggi, Elly M. Setiadi, Publisher: Gramedia Pustaka Utama, 2005.
   (k) Pendidikan Pancasila, Kaelan, Publisher: Pradnya Paramitha, 2003.
   (l) Kajian tentang UUD Negara RI (Hasil Amandemen disahkan tanggal 16 Agustus 2002) (Analisis Filosofis & Yuridis), Kaelan, Publisher: Pradnya Paramitha, 2002.
   (m) Desentralisasi dan Pembangunan Untuk Rakyat Miskin, Abdul Wahab, Publisher: Universitas Brawijaya, 2000.
   (n) Demokrasi, Hak Asasi Manusia dan Masyarakat Madani, Azyumardi Azra, Publisher: Prenada Media, 2003.
   (o) Rencana Pembangunan Jangka Menengah Nasional Tahun 2004-2009, Publisher: Sinar Grafika, 2005.
   (p) Pendidikan Kewarganegaraan, Handan Mansoer, Publisher: Gramedia, 2001.
   (q) Geopolitik Indonesia, Slamet Soeminarno, Publisher: Direktur Jendral Pendidikan Tinggi, 2005.
   (r) Pendidikan Pancasila Perguruan Tinggi, Tim Dosen Pancasila, Publisher: Universitas Hasanuddin, 2003.
   (s) Pendidikan Pancasila Bunga Rampai, Tim Dosen Pancasila, Publisher: STIMIK Dipanegara, 2004.

5. Specific course information:
   (a) This course discusses about understanding of Citizenship Education contextual problems in Indonesian nation and land
   (b) Pre-requisite: N/A
   (c) Course type: Required (R)
6. Specific goals for the course: Student will able to analyse Citizenship Education contextual problems, develop positive attitudes, and behave in a way that supports the nationalism concept and spirit, love the country, democracy, legal awareness, appreciation for diversity and participate in nation build based on Pancasila and UUD RI 1945.
7. Brief list of topics to be covered:
   (a) Citizenship Education as General Course in College/University
   (b) National Identity
   (c) National Integration
   (d) State and Constitution
   (e) Relation Between States and Citizens
   (f) Indonesian Democracy
   (g) State of Law and Human Rights
   (h) Geopolitics/Archipelago Insights
   (i) Indonesian Geostrategy/ National Resilience
   (j) Indonesian Polstranas

A.2 Bahasa Indonesia (Indonesian Language)

1. Course code: 009U0032
   Course title: Bahasa Indonesia (Indonesian Language)

2. Credits: 2
   Contact hours: 27 hours

3. Instructors:

   (a) Nursamsilis

   (b) Raviqa

4. Text book, title, author, publisher and year:

   (a) Pokoknya Menulis, Alwasilah. A.C., Senny Suzanna, Publisher: Bandaung Kiblat, 2005.

   (b) Kajian Bahasa, Abdul Chaer, Publisher: Rineka Cipta, 2007.

   (c) Wacana Pemahaman dan Hubungan Antarunsur, Djajasudarma, T. Fatimah, Publisher: Rafika Aditama, 2006.

   (d) Logic and Conversation, Paul Grice, Publisher: Academic Press, 1975.

   (e) Komposisi: Sebuah Pengantar Kemahoran Bahasa, Keraf Gorys, Publisher: Nusa Indah, 1977.

   (f) Menulis Akademik untuk Mahasiswa, K. Kurniawan, Publisher: Universitas Pendidikan Indonesia, 2004.

   (g) Principle of Pragmatics, Geoffrey Leech, Publisher: Longman, 1983.

   (h) Pragmatics, S. Levinson, Publisher: Cambridge University Press, 1983.

   (i) Analisis Wacana Pragmatik, Lubis, Hamid Hasan, Publisher: Angkasa, 1991.

   (j) Bahasa Indonesia sebagai Alat Pengembangan IPTEKS, Suwarsih Madya, Publisher: Departemen Pendidikan Nasional Direktur Jendral Pendidikan Tinggi, 2006.

   (k) Metode Penelitian Bahasa, Mahsun, Publisher: Raja Grafindo Perkasa, 2007.

   (l) Discourse Analysis, Herudjati Purwoko, Publisher: Indeks, 2008.

   (m) Analisis Kalimat, Putrayasa, Ida Bagus, Publisher: Rafika Aditama, 2007.

5. Specific course information:

   (a) This course discusses about the criteria for Indonesian Language it its scientific range and its application in approving scientific works and scientific presentations

   (b) Pre-requisite: N/A

   (c) Course type: Required (R)

6. Specific goals for the course:

   (a) Student will able to express scientific thoughts, ideas and attitudes into various forms of quality scientific work

   (b) Student will able to use Indonesian correctly in scientific presentations (seminars, discussions, thesis examinations, orations/speeches)

   (c) Student will able to use Indonesian language skills to develop themselves throughout life

7. Brief list of topics to be covered:

   (a) History, Position, and Indonesian Language Functions

(b) Spelling
(c) Characteristics and Criteria for Various Scientific Languages
(d) Choice of Words
(e) Sentences
(f) Paragraphs
(g) Oral Presentation
(h) Enhanced Spelling
(i) Characteristic of Various Scientific Languages
(j) Choice of Words
(k) Sentence Formation and Sentence Effectiveness
(l) Formation and Development of Paragraphs
(m) Topic and Title
(n) Outline
(o) Citation

A.3 Calculus 1

1. Course code: 016U0033
   Course title: Calculus 1
2. Credits: 3
   Contact hours: 42 hours
3. Instructors:
   (a) Andi Galsan Mahie
   (b) Muhammad Rizal Firmansyah
4. Text book, title, author, publisher and year:
   (a) Calculus, 9th Ed, Dale Varberg, Edwin Purcell, Steve Ridgon, Publisher: Pearson, 2011.
   (b) Diktat Matematika Dasar, Tim Dosen Matematika, Publisher: Universitas Hasanuddin , 2012.
   (c) Elementary Linier Algebra, Anton Howard, Publisher: Wiley, 2010.
5. Specific course information:
   (a) This course discusses about real number system, functions and graphs, and linear system equations
   (b) Pre-requisite: N/A
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) Student will able to understand and demonstrate basic theory for real functions
   (b) Student will able to evaluate function derivative
   (c) Student will able to understand and solve problems related to linear system equations forms
   (d) Student will able to apply his knowledge to solve some practical problems
7. Brief list of topics to be covered:
   (a) Real Number System
   (b) Functions and Graphs
   (c) Continuity Limit
   (d) Function Derivative
   (e) Derivative Application
   (f) Integral
   (g) Determinant and Square Matrix Inverse
   (h) Linear System Equations

A.4 Physics 1

1. Course code: 020U0033
   Course title: Physics 1
2. Credits: 3
   Contact hours: 42 hours
3. Instructors:
   (a) University Teaching Team
4. Text book, title, author, publisher and year:
   (a) Diktat Fisika Dasar 1, Tim Dosen Fisika, Publisher: Universitas Hasanuddin , n.d.
   (b) Diktat Fisika Dasar 1 (Mekanika), Tim Dosen Fisika, Publisher: Institut Teknologi Bandung, n.d.
   (c) Fisika Universitas, 10th Ed, Hugh D. Young, Roger A. Freedman, Publisher: Erlangga, 2002.
5. Specific course information:
   (a) This course examines and explains particle mechanics and thermal physics which includes the re-clarification of unit systems, basic measurement standards, mathematical foundations for physics, equations of motion, force, energy momentum, oscillator, static fluid elasticity, fluid dynamics, temperature, heat and thermodynamics and proof of several phenomena through several experiments in the laboratory
   (b) Pre-requisite: N/A
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) The student will be able to understand the benefits of applied basic science in physics in studies of their respective faculties
   (b) The student will able to know the importance of derivative units and units and being able to take measurements carefully
   (c) The student will able to explain the meaning of kinematics and dynamics
   (d) The student will able to explain various form of energy and can use energy conservation laws for various physical and applied studies
   (e) The student will able to practice various basic instruments of physics properly and correctly
   (f) The student will able to arrange laboratory instruments based on sequence of functions
   (g) The student will able to describe the nature and application of static and dynamic fluids
   (h) The student will able to describe the characteristics and applications of temperature, heat, and thermodynamics
7. Brief list of topics to be covered:
   (a) Mathematics Introduction
   (b) Zarrah Kinematics
   (c) Dynamics of Zarrah Particles
   (d) Work and Energy

(e) Linear Momentum and Collision
(f) Angular Momentum and Rigid Objects
(g) Harmonic Oscillator
(h) Elasticity
(i) Temperature and Heat
(j) Static Fluids
(k) Dynamic Fluids
(l) The Kinetic Theory of Gas
(m) Thermodynamics 1
(n) Thermodynamics 2

A.5 Electric Circuit 1

1. Course code: 101D4113
   Course title: Electric Circuit 1
2. Credits: 3
   Contact hours: 42 hours
3. Instructors:
   (a) Zaenab Muslimin
   (b) Sri Mawar Said
   (c) Hasniaty A.
4. Text book, title, author, publisher and year:
   (a) Introductory Circuit Analysis, 12th Ed, Robert L. Boylestad, Publisher: Prentice Hall, 2014.
   (b) Principles of Electrical Circuits Electron Flow Version, Thomas L. Floyd, 6th Ed, Publisher: Prentice Hall, 2003.
5. Specific course information:
   (a) This course discusses about Basic understanding of electrical circuits, Series-Parallel Network, Source Conversions, Methods of Analysis, Circuit of Equation, Complex Numbers, Sinusoidal Alternating Waveforms, Phasor and Resonance
   (b) Pre-requisite: Calculus 1 , Calculus 2 , Physics 1 , Physics 2
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) The student will able to understand the basic understanding of DC electric power circuits and the basic law of electricity
   (b) The student will able to analyse series and parallel circuits
   (c) The student will able to analyse circuits with one source or two sources and are able to convert voltage sources into current sources and vice versa
   (d) The student will able to understand the notion of AC electricity and are able to apply complex numbers to basic analysis of AC electrical circuits
   (e) The student will able to understand the meaning of phasor and are able to analyse resonance circuits
7. Brief list of topics to be covered:
   (a) Basic understanding of electrical circuits
   (b) Series-Parallel Network
   (c) Source Conversions
   (d) Methods of Analysis
   (e) Circuit of Equation
   (f) Complex Numbers
   (g) Sinusoidal Alternating Waveforms
   (h) Phasor
   (i) Resonance

A.6 Logic Circuits

1. Course code: 102D4112
   Course title: Logic Circuits
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Andani Achmad
   (b) Faizal Arya Samman
   (c) Ida Rachmaniar Sahali
   (d) Andini Dani Achmad
4. Text book, title, author, publisher and year:
   (a) Digital System Principle and Application, W. Tocci, Publisher: Prentice Hall International Edition, 1995.
   (b) Digital Principles and Application, Leach Malvino, Publisher: McGraw Hill, 1990.
   (c) Switching Theory and Logical, F.J. Hill, G.R. Paterson, Publisher: John Willy & Sons, 1981.
   (d) Digital Engineering Design, Richard F. Tinder, Publisher: Prentice Hall International Edition, 1991.
5. Specific course information:
   (a) This course discusses about Boolean Algebra, de Morgan Theory, Binary Codes, Basic Logic Gates, Simplification of Circuits, Designing Combinational Digital Circuits
   (b) Pre-requisite: N/A
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) The student will able to understand about Binary Codes
   (b) The student will able to understand about Boolean Algebra and de Morgan Theory
   (c) The student will able to design simple logic circuit
   (d) The student will able to understand working principle of several combination circuits
7. Brief list of topics to be covered:
   (a) Introduction: Logic Circuits and Digital Systems
   (b) Digital Number System
   (c) Logic Gates
   (d) Boolean Algebra
   (e) Simplification of Boolean
   (f) Combinational Circuit

A.7 Engineering Drawing

1. Course code: 103D4112
   Course title: Engineering Drawing

2. Credits: 2
   Contact hours: 27 hours

3. Instructors:

   (a) Zahir Zainuddin

   (b) Muhammad Anshar

4. Text book, title, author, publisher and year:

   (a) Mastering AutoCAD 2016 and AutoCAD LT 2016, George Omura with Brian Benton, Publisher: John Wiley & Sons, Inc., 2015.

   (b) AutoCAD 2018 Tutorial First Level 2D Fundamentals, Randy H. Shih, Publisher: SDC Publications, 2017.

   (c) Designing Circuit Boards with EAGLE: Make High-Quality PCBs at Low Cost, Matthew Scarpino, Publisher: Prentice Hall, 2014.

   (d) Engineering Drawing, A. Basant and C.M. Agrawal, Publisher: Tata McGraw-Hill, 2008.

5. Specific course information:

   (a) This course consists of engineering drawing, electronics symbols, computer-based drawing (AutoCAD, Eagle)

   (b) Pre-requisite: -

   (c) Course type: Required (R)

6. Specific goals for the course:

   (a) Student can draw properly and correctly in accordance with ISO standards

   (b) Students can draw installation/implementation installation and one-line diagram, analog and digital circuit properly and correctly

   (c) Students can use CAT and Eagle computer application to draw installation/implementation installation and one-line diagram, analog and digital circuit properly and correctly

7. Brief list of topics to be covered:

   (a) Engineering Drawing

   (b) Electronics Symbols

   (c) Engineering Drawing Computer-Based

A.8 Advanced Chemistry

1. Course code: 104D4112
   Course title: Advanced Chemistry
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Christoforus Yohannes
   (b) Hasniaty A.
4. Text book, title, author, publisher and year:
   (a) Fundamental of Chemistry, James E. Brady, John Wiley & Sons, 1981.
   (b) Kimia untuk Universitas, Keenan, Kleinfelter, Wood, Publisher: Erlangga, 1986.
   (c) Problem Solving Thermodynamic & Thermo Chemistry, G. S. Upadhyaya, 1982.
   (d) Diktat Mata Kuliah Kimia Teknik, Agus Solehudin, Publisher: Universitas Pendidikan Indonesia, 2003.
5. Specific course information:
   (a) This course discuss engineering application of chemistry concepts, stoichiometry, chemical reaction equation, chemical periodic reaction equation of the elements, thermochemical, electrolyte and electrochemical, and chemical application in electrical engineering area
   (b) Pre-requisite: N/A
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) The student will able to analyse engineering application of chemistry concepts, stoichiometry, chemical reaction equation, chemical periodic reaction equation of the elements, thermochemical, electrolyte and electrochemical, and chemical application in electrical engineering area
7. Brief list of topics to be covered:
   (a) Chemical introduction
   (b) Stoichiometry
   (c) Chemical reaction equation and balance reaction
   (d) Grouping of metals and non-metals
   (e) Chemical properties of non-metals, acid and base
   (f) Thermochemical
   (g) Energy changes in chemical reactions
   (h) Electrolyte
   (i) Electrolysis
   (j) Galvanized cell application and metallurgy
   (k) Combustion motor and welding process
   (l) Refrigerant and machining waste

A.9 State Ideology: Pancasila

1. Course code: 012U0032
   Course title: State Ideology: Pancasila
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Rahman Saeni
   (b) Esan Lamban
4. Text book, title, author, publisher and year:
   (a) Masih Adakah Harapan Bagi Kaum Miskin?, Amartya Sen, Publisher: Mizan, 2001.
   (b) Keadilan dan Demokrasi: Telaah Filsafat Politik John Rawls, Andre Ata Ujan, Publisher: Kanisius, 2001.
   (c) Teori Pembangunan Dunia Ketiga, Arief Budiman, Publisher: Gramedia, 1995.
   (d) Sistem Perekonomian Pancasila dan Ideologi Ilmu Sosial di Indonesia, Arief Budiman, Publisher: Gramedia, 1990.
   (e) Kapitalisme sebagai Fenomena, Peter L. Berger, Publisher: LP3ES, 1990.
   (f) Kritik terhadap Marxisme and Marxisme sebagai Kritik terhadap Pembangunan Kapitalis, M. Dawam Rahardjo, Publisher: LP3ES, Jakarta, 1988.
5. Specific course information:
   (a) This course discusses about history, the position and nature of the precepts of Pancasila, responding the actual problems of the nation and state, and values and role of the Pancasila in every daily life
   (b) Pre-requisite: N/A
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) Student will able to explain and understand Pancasila in the study of the history of the Indonesian nation
   (b) Student will able to analyse and evaluate Pancasila as national principle
   (c) Student will able to analyse and compare Pancasila as state ideology
   (d) Student will able to understand and explain Pancasila as philosophical system
   (e) Student will able to understand and make Pancasila as an ethical system
   (f) Student will able to analyse and make Pancasila as science development value
7. Brief list of topics to be covered:
   (a) Pancasila in the study of the history of the Indonesian people
   (b) Pancasila as the basis of the country
   (c) Pancasila as the state ideology
   (d) Pancasila as the philosophical system
   (e) Pancasila as an ethical system
   (f) Pancasila as science development value

A.10 English

1. Course code: 010U0032
   Course title: English
2. Credits: 2
   Contact hours: 27 hours
3. Instructors: General Course Unit of Universitas Hasanuddin
4. Text book, title, author, publisher and year: (-)
5. Specific course information:
   (a) This course contains the development of student personality towards the formation of educated people who are proficient at communicating in English. This lecture emphasizes on bilingual dictionaries, previewing and predicting, skimming and scanning, understanding paragraphs, and patterns of organization
   (b) Pre-requisite: N/A
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) Student have an ability to applies various kind of reading strategies in various reading
   (b) Student will able to understand the contents of various texts
   (c) Student will able to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
7. Brief list of topics to be covered:
   (a) Bilingual Dictionaries
   (b) Previewing and Predicting, Book-Covers and Picture, etc.
   (c) Skimming and Scanning
   (d) Understanding Paragraphs and Reading Passage
   (e) Patterns of Organization Reading Passage
   (f) Reading Passages in Various Disciplines

A.11 Calculus 2

1. Course code: 017U0033
   Course title: Calculus 2
2. Credits: 3
   Contact hours: 42 hours
3. Instructors:
   (a) Naimah Aris
   (b) Sitti Sahriman A.
4. Text book, title, author, publisher and year:
   (a) Calculus, 9th Ed, Dale Varberg, Edwin Purcell, Steve Ridgon, Publisher: Pearson, 2011.
   (b) Diktat Matematika Dasar, Tim Dosen Matematika, Publisher: Universitas Hasanuddin , 2012.
   (c) Elementary Linier Algebra, 10th Ed, James Stewart, Publisher: Wiley, 2010.
5. Specific course information:
   (a) This course discusses the concepts of many variable calculus and elementary linear algebra, the functions of two or more variables, limit and continuity of many variable functions, partial and derivative, extreme values of many variable functions, multiple integral, differential equations, matrix theory, determinants and inverse matrix, and linear equation system
   (b) Pre-requisite: N/A
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) Student will able to understand the concepts of many variable calculus, operations on matrices, and differential equations
   (b) Student will able to resolve problems in limit, derivative, and multiple integrals
   (c) Student will able to resolve problems in systems of linear equations and first-order differential equations
   (d) Student will able to apply many variable calculus concepts, operations on matrices and differential equations to solve problems in the fields of mathematics or science and technology in general
7. Brief list of topics to be covered:
   (a) Function of two or more variables
   (b) Limit and continuity
   (c) Partial derivatives and directed derivatives
   (d) Partial derivative applications, Taylor series, and extreme values of functions of two variables or more
   (e) Duplicate integral and triple integral
   (f) Introduction to matrix theory
   (g) Linear equation system
   (h) Differential equations

A.12 Physics 2

1. Course code: 022U0033
   Course title: Physics 2
2. Credits: 3
   Contact hours: 42 hours
3. Instructors:
   (a) University Teaching Team
4. Text book, title, author, publisher and year:
   (a) Diktat Fisika Dasar 2, Tim Dosen Fisika, Publisher: Universitas Hasanuddin , n.d.
   (b) Diktat Kuliah Fisika Dasar II, Mikrajuddin Abdullah, Publisher: Institut Teknologi Bandung, 2006.
   (c) Fisika Universitas, 10th Ed, Hugh D. Young, Roger A. Freedman, Publisher: Erlangga, 2002.
5. Specific course information:
   (a) This course examines and explains the basic conceptions of physics and their simple applications regarding electricity, magnetism, optics, and modern physics
   (b) Pre-requisite: Physics 1
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) The student will be able to understand the concept of electrical charges
   (b) The student will able to understand the Coulomb Law and able to apply it in calculations
   (c) The student will able to understand the meaning of electric field, electric field strength, electric line energy and dielectric strength
   (d) The student will able to understand the Gauss Law and able to apply it in calculations
   (e) The student will able to electric potential, electric current, electrical resistance, and electrical circuits
   (f) The student will able to understand the Ohm Law and able to apply it in calculations
   (g) The student will able to understand the Kirchoff Law and able to apply it in calculations
   (h) The student will able to understand the magnetic field and magnetic fluxes
   (i) The student will able to determine the magnitude and direction of magnetic fields
   (j) The student will able to determine the moment and style that arises in the current conductor
   (k) The student will able to determine the magnetic field caused by electric current flowing in various conductors
   (l) The student will able to understand the Faraday and Lenz Law and able to apply it in calculations
   (m) The student will able to understand the mechanical and non-mechanical wave
   (n) The student will able to understand the sound physically and mathematically
   (o) The student will able to understand the concepts of optics and lenses

(p) The student will able to know various kind of optical instruments

(q) The student will able to understand the concepts of black matter radiation, photoelectric effect, and Compton effect

7. Brief list of topics to be covered:

   (a) Electricity

   (b) Magnetic Field

   (c) Wave

   (d) Optics, Lenses, and Optical Instruments

   (e) Quantum Physics

A.13 Electric Circuit 2

1. Course code: 121D4123
   Course title: Electric Circuit 2
2. Credits: 3
   Contact hours: 42 hours
3. Instructors:
   (a) Sri Mawar Said
   (b) Zaenab Muslimin
   (c) Hasniaty A.
4. Text book, title, author, publisher and year:
   (a) Introductory Circuit Analysis, Robert L. Boylestad, 12th Ed, Publisher: Prentice Hall, 2014.
   (b) Principles of Electrical Circuits Electron Flow Version, Thomas L. Floyd, 6th Ed, Publisher: Prentice Hall, 2003.
5. Specific course information:
   (a) This course discusses about real and reactive power of an electrical circuit, Thevenin's and Norton's theorem, analysis transient in electrical circuit using differential equation, using transformation Laplace, and three phase circuits
   (b) Pre-requisite: Calculus 1 , Calculus 2 , Physics 1 , Physics 2 , Electric Circuit 1
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) The student will able to calculate real and reactive power of an electrical circuit
   (b) The student will able to using Thevenin's and Norton's theorem of an electrical circuit
   (c) The student will able to analyse transient in electrical circuit using differential equation, and using transformation Laplace
   (d) The student will able to use three phase circuits
7. Brief list of topics to be covered:
   (a) Real and reactive power
   (b) Thevenin's and Norton's theorem
   (c) Analyse transient
   (d) Three phase circuits

A.14 Digital Systems

1. Course code: 106D4122
   Course title: Digital Systems
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Faizal Arya Samman
   (b) Andani Achmad
   (c) Andi Ejah Umraeni Salam
   (d) Amil Ahmad Ilham
   (e) Muhammad Niswar
4. Text book, title, author, publisher and year:
   (a) Sistem Digital, Faizal Arya Samman, Publisher: Institute of Sciences, Technologies and Arts (IESTA), 2016.
   (b) Fundamentals of Digital Logic with VHDL Design, 3rd Ed, Stephen Brown, Zvonko Vranesic, Publisher: McGraw-Hill Higher Education, 2009.
   (c) Digital Design and Computer Architecture, 2nd Ed, David Money Harris, Sarah L. Harris, Publisher: Morgan Kaufmann, 2013.
5. Specific course information:
   (a) This course discusses about digital system design techniques and explains the basic principles of latch and flip-flop, which are the basic component of a sequential logic circuit. The sequential logic circuit will be mainly discussed in this course, which are divided into two types, i.e. Moore and Mealy Machines. Karnaugh Map method is also still an important mathematical tool used to implement the logic circuits.
   (b) Pre-requisite: Logic Circuits
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) Students are able to explain the basic principle of Latch and Flip-flop operations and their applications in sequential logic circuits such as counters and shift registers logic circuits
   (b) Students are able to design a finite state machine (Mealy and/or Moore Machines) using D flip-flop or JK flip-flop
   (c) Students are able to solve an engineering problem related to digital system topic, to model the problem using state diagram and to implement the logic circuit solution
7. Brief list of topics to be covered:
   (a) Latch logical circuits (SR-Latch, D-Latch)
   (b) Flip-flop (D-type, JK-type and T-type Flip-flop)
   (c) Sequential logic circuit: Counters (Ripple and Synchronous Counters, BCD Counters)
   (d) Sequential logic circuit: Shift Registers (Serial-in Serial-out, Serial-in Parallel-out, Parallel-in Serial-out, Parallel-in Parallel-out Shift Register types)
   (e) State Diagram and its specifications
   (f) Finite State Machine: Moore Machines
   (g) Finite State Machine: Mealy Machines

A.15 Computer Programming

1. Course code: 107D4122
   Course title: Computer Programming
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Muhammad Niswar
4. Text book, title, author, publisher and year:
   (a) The C Programming Language, 2nd Ed, Brian W. Kerninghan, Dennis M. Ritchie, Publisher: Prentice Hall, 1988.
   (b) Beginning C, 5th Ed, Ivor Horton, Publisher: Apress, 2013.
5. Specific course information:
   (a) This courses discusses about introducing C programming language, how to making decisions, loops, arrays, applications with strings and text, and pointers
   (b) Prerequisite: N/A
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) Students will understand about C language standards, standards library, creating and organize C programme
   (b) Students will be able to explain data types, using operators and expressions in C language
   (c) Students will be able to distinguish control-flow statements and implement
   (d) Student will be able to apply knowledge of mathematics, science and engineering in solving engineering problems by using a high level programming language
7. Brief list of topics to be covered:
   (a) Introduction of C Language : Getting Started, C Language Standard, Standard Library, creating C Programs, Organizing C Programs, Writing C Programs.
   (b) Types, Operators and Expressions : Variable Names, Data Types and Sizes, Constants, Declarations, Arithmetic Operators, Relational and Logical Operators, Type Conversions, Increment and Decrement Operators, Bitwise Operator, Assignment Operators and Expressions, Conditional Expressions
   (c) Control Flow : Statements and Blocks, If-Else, Else-If, Switch, Loops – While and For, Loops – Do – While, Break and Continue, Go to and Labels
   (d) Functions and Program Structure : Basics of Functions, Functions Returning Non Integers, External Variables, Header Files, Static Variables, Block Structure, Initialization, The C Preprocessor
   (e) Pointers and Arrays : Pointers and Addresses, Pointers and Arrays, Address Arithmetic, Character Pointers and Function, Pointer Arrays ; Pointersto Pointers, Multi-dimensional Arrays, Pointer vs Multi-dimensional Arrays, Pointers to Function, Complicated Declarations
   (f) Structure : Basic of structure, Structure and Functions, Arrays of Structures, Pointers of Structures, Self-Referential Structures, Table Lookup, Unions
   (g) Essential Input and Output : Standard Input and Output, Formatted Output-Printf, Variable-length Argument List, Formatted Input-Scanf, File Access, Error Handling-Stderr and Exit, Line Input and Output, Miscellaneous Functions

A.16 Electric Circuit Laboratory

1. Course code: 101D4121
   Course title: Electric Circuit Laboratory
2. Credits: 1
   Contact hours: 14 hours
3. Instructors:
   (a) Zaenab Muslimin
   (b) Sri Mawar Said
   (c) Hasniaty A.
4. Text book, title, author, publisher, and year:
   (a) Introductory Circuit Analysis, Robert L. Boylestad, 12th Ed, Publisher: Prentice Hall, 2014.
   (b) Principles of Electrical Circuits Electron Flow Version, Thomas L. Floyd, 6th Ed, Publisher: Prentice Hall, 2003.
5. Specific course information:
   (a) This course discusses about Electricity Basic Law Laboratory, Laboratory Superposition Theorem, Thevenin-Northon Theorem Laboratory, Star – Delta Equivalent Laboratory
   (b) Pre-requisites: Electric Circuit 1
   (c) Course type: Required course
6. Specific goals for the course:
   (a) The student will able to apply the basic laws of electricity
   (b) The student will able to apply the superposition theorem
   (c) The student will able to apply Thevenin-Northon theorem
   (d) The student will able to apply a series of equivalent stars-Delta
7. Brief list of topics to be covered:
   (a) Electricity Basic Law Laboratory
   (b) Superposition Theorem Laboratory
   (c) Thevenin-Northon Theorem Laboratory
   (d) Star-Delta Equivalent Laboratory

A.17 Digital Systems Laboratory

1. Course code: 109D4121
   Course title: Digital Systems Laboratory
2. Credits: 1
   Contact hours: 14 hours
3. Instructors:
   (a) Faizal Arya Samman
   (b) Andani Achmad
   (c) Andi Ejah Umraeni Salam
   (d) Amil Ahmad Ilham
   (e) Muhammad Niswar
4. Text book, title, author, publisher and year:
   (a) Sistem Digital, Faizal Arya Samman, Publisher: Institute of Sciences, Technologies and Arts (IESTA), 2016.
   (b) Fundamentals of Digital Logic with VHDL Design, 3rd Ed, Stephen Brown and Zvonko Vranesic, Publisher: McGraw-Hill Higher Education, 2009.
   (c) Digital Design and Computer Architecture, 2nd Ed, David Money Harris and Sarah L. Harris, Publisher: Morgan Kaufmann, 2013.
5. Specific course information:
   (a) This course provides students with digital system design techniques in practice. In this lab course, the students learn a software tool to design, model and simulate a digital/logic circuit. The logic circuit is implemented and tested on an FPGA device in order to validate the functional behavior of the circuit.
   (b) Pre-requisite: Logic Circuits
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) Students are able to design, model, simulate basic components of sequential logic circuits, i.e. Latch and Flip-flop using a software tool
   (b) Students are able to solve an engineering problem related to digital system topic, to model the problem using state diagram and to implement the logic circuit on a programmable logic device such as FPGA (Field Programmable Gate Array)
7. Brief list of topics to be covered:
   (a) Introductory of Quartus II, a software tool to design digital systems
   (b) Overview of a programmable logic device (FPGA)
   (c) First project in group: Seven-segment decoder design and testing
   (d) Latch design, modelling and simulation
   (e) Flip-flop design, modelling and simulation
   (f) Sequential logic circuit design and simulation: Shift Registers
   (g) Sequential logic circuit design and simulation: Counter (case study: Binary-Coded Decimal Counter)
   (h) Finite State Machine design, modelling and simulation
   (i) Second project in group: Digital Timer (Watch) design and testing

A.18 Concept of Science and Technology

1. Course code: 008U0032
   Course title: Concept of Science and Technology

2. Credits: 2
   Contact hours: 27 hours

3. Instructors:

   (a) (-)

4. Text book, title, author, publisher and year:

   (a) Undang-Undang RI Nomor 18 tentang IPTEK, Anonim, Publisher: Citra Umbara, 2002.
   (b) Alam Pikiran Manusia dan Perkembangannya, PWS Hudiyono, Publisher: Departemen Pendidikan Nasional Direktur Jendral Pendidikan Tinggi, 2003.
   (c) Perkembangan dan Pengembangan Ilmu Pengetahuan, PWS Hudiyono, Publisher: Departemen Pendidikan Nasional Direktur Jendral Pendidikan Tinggi, 2003.
   (d) Perkembangan Teknologi, PWS Hudiyono, Publisher: Departemen Pendidikan Nasional Direktur Jendral Pendidikan Tinggi, 2003.
   (e) Peranan Masyarakat Teknologi dalam Globalisasi, U. Iskandar, Publisher: BPPT, 1996.
   (f) Manusia, Ilmu dan Teknologi, T. Jacob, Publisher: PT. Tiara Wacana, 1993.
   (g) Ilmu Alamiah Dasar, M. Jasin, Publisher: PT. Raja Grafindo, 2000.
   (h) Pencemaran Lingkungan, H. Kartono, Publisher: Departemen Pendidikan Nasional Direktur Jendral Pendidikan Tinggi, 2003.
   (i) Ilmu Pengetahuan dan Teknologi bagi Kehidupan Manusia, S. Kosela, Publisher: Departemen Pendidikan Nasional Direktur Jendral Pendidikan Tinggi, 2003.
   (j) Sosiologi Kontemporer, M. Poloma, Publisher: PT. Raja Grafindo, 2000.
   (k) Konsep Teknologi, M. Purwasasmita, Publisher: Institut Teknologi Bandung, 2000.
   (l) Teknologi dan Etika, Supardan, Publisher: BPK Gunung Mulia, 1996.
   (m) Filsafat Ilmu Sebuah Pengantar Populer, Jujun Suriasumantri, Publisher: Pustaka Sinar Harapan, 2003.
   (n) Manajemen Teknologi dan Inovasi sebagai Kunci Daya Saing Bisnis, T.A. Taufik, Publisher: BPPT, 1996.

5. Specific course information:

   (a) This course discusses about the concept of knowledge and science, development of science, science and technology, technology concept, technology development, the impact of technology on various systems, the concept of art and beauty, integrity and ethical aspects of science and technology
   (b) Pre-requisite: N/A
   (c) Course type: Required (R)

6. Specific goals for the course:

   (a) Student will able to explain the basic conception of science and technology and essence of human creation, especially as Universitas Hasanuddinstudent comprehensively in accordance with university vision-mission
   (b) Student will able to explain the conception of knowledge and science in hierarchical and systematic way, especially the conception of scientific science

(c) Student will able to understand the relationship between development of science with their respective disciplines, including between scientific discipline and inter-disciplinary disciplines

(d) Student will able to explain the position and relationship between the conception of science and conception of technology

(e) Student will able to explain concept of technology as a part of the continuation science in practical forms as a consequence of increasing community needs

(f) Student will able to explain and describe the rapid development of certain science and technology in the era of globalization modern times today

(g) Student will able to understand the negative and positive impacts of technological development on various systems and explain the relation between these impacts with sociocultural, demographic, customary, ethical and religious ideologies that develop in the community

(h) Student will able to explain the values of harmony in life and connect it with the concept of art and beauty related to the work of science and technology

(i) Student will able to actualize responsibly the aspects of integrity and ethical values of science and technology from each of them both while still in the campus environment and in the community in accordance with the disciplines they pursue

7. Brief list of topics to be covered:

(a) Introduction to science and technology concept

(b) The concept of knowledge and science

(c) Science Development

(d) Science and Technology

(e) Technology Concept

(f) Technology Development

(g) Technology Impacts on Various Systems

(h) Art and Beauty Concept

(i) Integrity and Ethical of Science and Technology

A.19 Advanced Mathematics 1

1. Course code: 201D4113
   Course title: Advanced Mathematics 1
2. Credits: 3
   Contact hours: 42 hours
3. Instructors:
   (a) Ingrid Nurtanio
   (b) Intan Sari Areni
   (c) Dewiani Djamaluddin
   (d) Andini Dani Achmad
4. Text books, title, author, publisher and year:
   (a) Advanced Engineering Mathematics, 10th Ed, Kreyszig Erwin, Publisher: John Wiley & Sons, Inc, 2011.
   (b) Matematika Teknik, 5th Ed, K.A. Stroud, Publisher: Erlangga, 2004.
5. Specific course information:
   (a) This course discusses about Differential Equations (1st, 2nd and higher order), Phasa Plane, Laplace Transformation, Vector and Vector Algebra, Matrix, and Linear Equation
   (b) Pre-requisite: Calculus 1 , Calculus 2
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) The student will be able to understand and apply the theory of ordinary differential equations, differential equation systems, Laplace transforms, matrices, linear systems, vector differential calculus, eigenvalue problems, integral vector calculus
   (b) The student will be able to use mathematics as a basis for analysing, formulating and solving problems in the electrical engineering field
7. Brief list of topics to be covered:
   (a) First Order Differential Equations
   (b) Second Order Differential Equations
   (c) Higher Order Differential Equations
   (d) Differential Equation System–Phase Plane
   (e) Laplace Transforms
   (f) Matrices, Linear Systems
   (g) Eigenvalue problems
   (h) Vector Differential Calculus
   (i) Vector Integral Calculus

A.20 Basic Electrical Power

1. Course code: 202D4112
   Course title: Basic Electrical Power
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Sri Mawar Said
4. Text books, title, author, publisher and year:
   (a) Introduction to Electrical Power Systems, Mohamed E. El-Hawary, Pubisher: IEEE Press, 2008.
   (b) Dasar Teknik Tenaga Listrik dan Elektronika Daya, Zuhal, Publisher: PT Gramedia, 2000.
5. Specific course information:
   (a) This courses material discusses about the principles and basics of electrical power system in general including basic theory of electric energy system, structure of power systems, power generation, transformer, transmission, distribution system, and electricity load/ electricity energy consumption
   (b) Pre-requisite: N/A
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) The student will understand the basic theory of electric energy system and structure of power systems
   (b) The student will be able to distinguish the principle process of electricity generation from thermal power plants and power plants based renewable energy (RE)
   (c) The student will understand the working principle of transformer and its connection
   (d) The student will understand the importance of transmission network, line parameters, transmission voltages and line models
   (e) The student will understand the purpose of distribution system, distribution network, distribution equipments and protection system
   (f) The student will understand the working principle and characteristics of electric machines (DC and AC generators; and DC and AC motors)
   (g) The student will understand types of electricity loads, characteristics, and load drivers
   (h) The student will be able to calculate electricity energy consumption
   (i) The student will understand the general theory/ basic concept and working principle of the components in an electric power system
7. Brief list of topics to be covered:
   (a) Introduction: basic theory for electric energy system, components of a power system
   (b) Power generation: working principles of electricity generation (thermal power plants and electricity production based renewable energy sources)
   (c) Transformer: principle of transformer operation, transformer connections
   (d) Electric power transmission: purpose of transmission network, standard transmission voltages, line parameters, transmission line models

(e) Electric distribution system: purpose of distribution system, distribution network, distribution systems (overhead and underground), distribution equipments, distribution system protection

(f) Generator: types of generators, working principles and characteristics of DC and AC generators

(g) Electric motor: types of motors, working principle and characteristics of DC and AC motors

(h) Electrical load: types of electrical loads (residential, commercial, industrial), load characteristics, load drivers, electricity energy usage

A.21 Basic Telecommunication

1. Course code: 203D4112
   Course title: Basic Telecommunication
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Dewiani Djamaluddin
   (b) Wardi Djuaeni
   (c) Andini Dani Achmad
4. Text book, title, author, publisher and year:
   (a) Electronic Communication, Dennis Roddy, John Coolen, Translated by: Kamal Idris,IR, Publisher: Erlangga, 1990.
   (b) Electronic Communication, Rodden, Publisher: Prentice Hall, 1985.
   (c) Martin, Telecommunication and Computer.
   (d) Data Network Concept,Theory and Practice, Uyless Black, Publisher: PHI, 1989.
   (e) Sistem Telekomunikasi, PH Smale, Translated by: Chris Timotius, Publisher: Erlangga, 1995.
   (f) Fundamentals of Telecommunications, Roger L. Freeman, Publisher: John Wiley & Sons, Inc, New York, 1999.
   (g) Telecommunications and Networks, K.M. Hussain D.S. Hussan, Publisher: Butterworth-Heinemann, Oxford, 1997.
5. Specific course information:
   (a) The course material discusses about recognize the principles and basics of telecommunication system in general including signals, frequency spectrum, modulation and demodulation systems, quality system, types of telecommunication system, and future telecommunication technology
   (b) Prerequisite: N/A
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) The student will understand the basic concept of telecommunication
   (b) The student will understand the classification of transmission media of telecommunication and kinds of the transmission media
   (c) The student will understand types of topology telecommunication network
   (d) The student will understand frequency spectrum, antenna working principle, and types of radio propagation
   (e) The student will understand analogue modulation and demodulation techniques
   (f) The student will be able to calculate the quality of telecommunication system
   (g) The student will understand working principle several kinds of system telecommunication
   (h) The student will understand the basic concept of data communication
   (i) The student will understand the future technology of telecommunication
   (j) The student outcomes listed in 3 or any other outcomes are addressed by the course

7. Brief list of topics to be covered:
   (a) Basic Concepts of Telecommunication
   (b) Telecommunication Transmission Media
   (c) Topology Telecommunication Network
   (d) Antenna and Radio Wave Propagation
   (e) Analogue Modulation and Demodulation
   (f) Decibels Concept
   (g) Introduction of Quality Telecommunication System
   (h) Introduction of Cable Network Telecommunication System
   (i) Introduction of Optic Telecommunication System
   (j) Introduction of Radio Telecommunication System
   (k) Introduction of Satellite System
   (l) Basic Concepts of Data Communication and Network Classification
   (m) Future Technology of Telecommunication

A.22 Basic Electronics

1. Course code: 233D4102
   Course title: Basic Electronics
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Andani Achmad
   (b) Faizal Arya Samman
   (c) Wardi Djuaeni
   (d) Andi Ejah Umraeni Salam
   (e) Muhammad Anshar
4. Text books, title, author, publisher and year:
   (a) Electronic Devices and Circuit Theory, 11th Ed, Robert C. Boylestad, Publisher: Pearson Education, 2013.
   (b) Principles of Electronics, 8th Ed, Albert Paul Malvino, David Bates, Publisher: McGraw-Hill Education, 2016.
   (c) Microelectronic Circuit Design, 4th Ed, Richard C. Jaeger, Travis N. Blalock, Publisher: McGraw-Hill, 2011.
5. Specific course information:
   (a) The course material discusses about the characteristics of electronic devices such as diode, bipolar junction transistor (BJT) and field effect transistor (FET), as well as their applications in basic electronic circuits
   (b) Pre-requisite: Electric Circuit 1 , Electric Circuit 2
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) The student will be able to explain the use of electronic circuits in many embedded and consumer electronic applications
   (b) The student will be able to explain the voltage-current characteristics of diode, bipolar junction transistor (BJT) and field effect transistor (FET), especially metal-oxide silicon field effect transistor (MOSFET)
   (c) The student will be able to explain the basic applications of diode such in rectifier, clamping and clipping circuits
   (d) The student will be able to analyses a simple electronic circuit with a DC bias voltage configuration, such fixed-bias, collector feedback bias, voltage-divider bias, etc.
   (e) The student outcomes listed in 3 are addressed by the course
7. Brief list of topics to be covered:
   (a) Electronic devices overviews: diode (PN junction, zener, schottky, LED, photodiode), bipolar junction transistor (BJT) and field effect transistor (FET), especially metal oxide silicon FET or MOSFET
   (b) Diode characteristics and applications in rectifier, clipping and clamping circuits
   (c) BJT's VI characteristics: NPN and PNP types

(d) BJT circuit biasing techniques: DC load curves, DC operating points

(e) MOSFET's VI characteristics: N-channel MOS (NMOS) and P-channel MOS (PMOS)

(f) MOSFET circuit DC biasing techniques: DC load curves, DC operating points

(g) BJT small signal operation: AC and DC signal analysis

(h) BJT applications in power amplifier: class A, class B, class AB and class C power amplifier

(i) BJT applications in simple voltage regulator: shunt regulator, series regulator

(j) Operational amplifier (Op-Amp): basic model and its applications as integrators, inverting and non-inverting amplifier, filter, etc.

(k) Transistors in digital domain: resistor-transistor logic (RTL) and transistor-transistor logic (TTL)

A.23 Electrical Engineering Materials

1. Course code: 205D4112
   Course title: Electrical Engineering Materials
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Syafruddin Syarif
   (b) Intan Sari Areni
4. Text book, title, author, publisher and year:
   (a) Electronic Communication Systems, Kennedy, Publisher: McGraw Hill, 1992.
   (b) Teknik Radio Benda Padat, Herbert, Publisher: Universitas Indonesia, 1990.
   (c) Electronic Communication, Rodden, Dennis & Coolen, John, Publisher: Prentice Hall, 1981.
   (d) Sistem Televisi dan Video, Bernard Grob, Sahat Pakpahan, Publisher: Erlangga, 1991.
   (e) Ilmu Bahan dan Teknologi, Van Vlack, Publisher: Erlangga, 1991.
   (f) William Caster, Introduction to Material Science
5. Specific course information:
   (a) This course discuss about insulation material, glass and porcelain, plastic, optical fibre, conductor, magnetic material, semiconductor and superconductor
   (b) Pre-requisites: Calculus 1 , Physics 1 , Advanced Chemistry
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) The student will able to understand and explain isolation material and its problems
   (b) The student will able to understand and explain glass and porcelain material
   (c) The student will able to understand and explain plastic material
   (d) The student will able to understand and explain optical fibre material
   (e) The student will able to understand and explain conductor
   (f) The student will able to understand and explain magnetic material
   (g) The student will able to understand and explain semiconductor and superconductor
   (h) The student will able to understand and explain material for directly changing energy devices
7. Brief list of topics to be covered:
   (a) Isolation material
   (b) Gas isolation material
   (c) Liquid isolation material
   (d) Fibre isolation material
   (e) Mineral isolation material
   (f) Glass and porcelain

(g) Plastic
(h) Optical fibre
(i) Conductor
(j) Magnetic Materials
(k) Semiconductor and Superconductor
(l) Material for directly changing energy devices

A.24 Advanced Physics

1. Course code: 206D4112
   Course title: Advanced Physics
2. Credits: 2
   Contact hours: 27 hours
3. (a) Indar Chaerah Gunadin
4. Text book, title, author, publisher and year:
   (a) Konsep Fisika Modern (Translated by The Houw Liong), Arthur Beiser, Publisher: Erlangga, 1981.
   (b) Modern Physics, Serway, Moses dan Moyer. Publisher: Saunders College Publishing, 1997.
   (c) Modern Physics from α to Z, William J. Rohlf, Publisher: John Wiley & Sons Inc., 1994.
5. Specific course information:
   (a) This course discusses about the field of physics specifically in themes related to modern physics
   (b) Pre-requisite: N/A
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) The student will able to understand the basic theory of relativity. Relativity includes special relativity, the principle of light-propagating relativity, experimentation Michelson-Morley, special relativity postulate, the consequences of special relativity: dilated time, long contractions, twin paradoxes; Galileo Galilei's transformation, Lorentz transformation, relativistic momentum, relativistic energy, mass as a measure energy, the law of conservation of relativistic, mass and energy
   (b) The student will able to distinguish the Quantum theory from light includes Hertz experiments, black body radiation, Rayleigh & Jeans lawand Planck's law, quantization of light and photoelectric effects, Compton effects and x-rays, wave complement - particles
   (c) The student will able to understand the atomic model includes atoms as constituent matter, the composition of atoms (the price of elementary charge) the atomic model of Rutherford, atoms Bohr (spectral line, Bohr quantum model of atoms), correspondence principle, experiment Frank Hertz
   (d) The student will able to understand the wave of material includes the de Broglie postulate and explanation de Broglie about quantization in the Bohr model, the Davisson-Germer experiment, group wave and dispersion, Heisenberg's uncertainty principle, material wave function, duality of electron diffraction particle wave descriptions in function terminology wave of matter
   (e) The student will able to understand the atomic structure includes magnetic orbitals and Zeeman effects normal, electron spin, spin orbit interaction and other magnetic effects, symmetry exchange and the exclusion principle, periodic table, x-ray spectrum and Moseley's law
   (f) The student will able to understand the Structure of molecules include bonding mechanisms (ionic, covalent, Hewidinger, Van der Waals), molecular and vibration rotation, molecular spectrum
   (g) The student will able to understand about the solid substances include: bonds in substances solid, classical free electron models, Ohm's Law, energy band theory, and devices semiconductor

(h) The student will able to understand the core structure includes: mass and charge, structure and core size core stability, core spin and magnetic moment, bond energy and core force, core model radioactivity, decay processes (alpha, beta, and gamma), natural radioactivity

(i) The student will able to understand the applications of core physics include: core reactions, cross-sectional reactions, nuclear fission, reactors nuclear, nuclear fusion, particle interaction with matter, and radiation detector

7. Brief list of topics to be covered:

   (a) Explanation of descriptions and syllabi, special relativity, the principle of relativity, Michelson-Morley experiment, special relativity postulate the consequences of special relativity

   (b) Galileo Galilei's transformation, Lorentz transformation, momentum relativistic, relativistic energy, mass as a measure of energy, law eternity: relativistic, mass, and energy momentum. Transformer: Principle of transformer operation, transformer connections

   (c) Quantum Theory of light

   (d) Atomic model: atom as the constituent of matter, atomic model Thompson, Rutherford's atomic model, atomic spectrum

   (e) Bohr florets model of atoms, correspondence principle, experiment Frank–Hertz

   (f) The nature of the wave from the material

   (g) Magnetic orbitals and normal Zeeman effect, electron spin, spin orbit interactions and other magnetic effects

   (h) Symmetry exchange and the exclusion principle, table periodic, spectrum light x and Moseley's law

   (i) Molecular structure: the mechanism of bonding atoms in molecules, levels molecular rotational energy level

   (j) Level of molecular vibrational energy level, molecular spectrum

   (k) Solid substances: bonds in solids, classical free electron models

   (l) Core structure: mass and particle loading of the core, structure and core size, core stability, bond energy and core style

   (m) Core model, radioactivity, decay process, natural radioactivity

   (n) Core physics application: core reaction, cross section reaction, nuclear fission

   (o) Nuclear reactors, nuclear fusion, particle interactions with matter, detectors radiation

A.25 Basic Electric Power Laboratory

1. Course code: 207D4111
   Course title: Basic Electric Power Laboratory
2. Credits: 1
   Contact hours: 14 hours
3. Instructors:
   (a) Sri Mawar Said
   (b) Yusri Syam Akil
4. Text book, title, author, publisher and year:
   (a) Penuntun Praktikum Dasar Tenaga Listrik, Laboratorium Mesin-Mesin Listrik, Publisher: Universitas Hasanuddin.
5. Specific course information:
   (a) This course contains the characteristic of 3-phase synchronous electric generator, terminal generator voltage as a function of strengthening current, Pico Hydro power plant, and wind power.
   (b) Pre-requisite: Basic Electrical Power
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) The student will able to understand characteristic of 3-phase synchronous electric generator in a no-load state where the output voltage is a field current function
   (b) The student will able to understand determine the relationship between terminal generator voltage as a function of strengthening current
   (c) The student will able to understand basic principle of wind power
7. Brief list of topics to be covered:
   (a) Basic AC generator
   (b) Basic DC generator
   (c) Piko Hydro power plant (PLTPH)
   (d) Wind power plant

A.26 Basic Telecommunication Laboratory

1. Course code: 208D4111
   Course title: Basic Telecommunication Laboratory
2. Credits: 1
   Contact hours: 14 hours
3. Instructors:
   (a) Dewiani Djamaluddin
   (b) Intan Sari Areni
   (c) Wardi Djuaeni
   (d) Merna Baharuddin
   (e) Andini Dani Achmad
4. Text book, title, author, publisher and year:
   (a) Electronic and Radio Engineering, Terman, Frederick Emmons, Publisher: McGraw-Hill Book Company, 1995.
   (b) Telecommunication, Switching, Traffic and Network, J.E. Flood, Publisher: Prentice Hall, 1995.
   (c) Fundamental Technical Plan 1996, A.A. Nasution, Publisher: PT. Telekomunikasi Indonesia, 1996.
5. Specific course information:
   (a) This course contains the characteristic of signal modulations: amplitude modulation, frequency modulation, phase modulation, and pulse code modulation.
   (b) Pre-requisite: Basic Telecommunication
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) The student will able to understand amplitude modulation generate process: single and double side-band
   (b) The student will able to understand frequency modulation generate process
   (c) The student will able to understand phase modulation generate process
   (d) The student will able to understand pulse code modulation generate process
7. Brief list of topics to be covered:
   (a) Amplitude Modulation
   (b) Frequency Modulation
   (c) Phase Modulation
   (d) Pulse Code Modulation

A.27 Basic Electronics Laboratory

1. Course code: 209D4112
   Course title: Basic Electronics Laboratory
2. Credits: 1
   Contact hours: 14 hours
3. Instructors:
   (a) Andani Achmad
   (b) Faizal Arya Samman
   (c) Wardi Djuaeni
   (d) Andi Ejah Umraeni Salam
   (e) Muhammad Anshar
4. Text books, title, author, publisher and year:
   (a) Electronic Devices and Circuit Theory, 11th Ed, Robert C. Boylestad, Publisher: Pearson Education, 2013.
   (b) Principles of Electronics, 8th Ed, Albert Paul Malvino, David Bates, Publisher: McGraw-Hill Education, 2016.
   (c) Microelectronic Circuit Design, 4th Ed, Richard C. Jaeger, Travis N. Blalock, Publisher: McGraw-Hill, 2011.
   (d) SPICE for Power Electronics and Electric Power, 2nd Ed, Muhammad H. Rashid, Hasan M. Rashid, Publisher: CRC Taylor & Francis, 2006.
5. Specific course information:
   (a) The course material contains some lab works on how to use measurement instrumentation such as oscilloscope, multi tester, function generator, etc. and how to analyse in practice some basic electronic circuit.
   (b) Pre-requisite: Electric Circuit 1 , Electric Circuit 2
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) The student will be able to use instrumentations to measure electric or electronic signals
   (b) The student will be able to design and analyse in practice some basic electronic circuits using electronic devices such as diode, transistor (BJT)
   (c) The student will be able to explain the role of the electronic device in the practised circuit
7. Brief list of topics to be covered:
   (a) The calibration of measurement instrumentations
   (b) The use of measurement instrumentations to measure electronic signals in a basic electronic circuit
   (c) Diode application in rectifier, clamping and clipping circuits
   (d) BJT transistor biasing technique
   (e) Transistor application in a simple power amplification circuit
   (f) Transistor application in a simple DC regulator circuit
   (g) Transistor application as an electronic switch
   (h) Transistor application in digital regime: Resistor-Transistor Logic, Transistor-Transistor Logic (TTL)

A.28 Social Science of Maritime Culture

1. Course code: 007U0032
   Course title: Social Science of Maritime Culture

2. Credits: 2
   Contact hours: 27 hours

3. Instructors: (-)

4. Text book, title, author, publisher and year:

   (a) Benua Maritim Indonesia, Publisher: BPPT, 1996.
   (b) Kerangka Kebijakan Pengembangan Pola Ilmiah Pokok, Radi A.Gani, Publisher: Universitas Hasanuddin , 1999.
   (c) Pembangunan Kelautan Indonesia: Perspektif Kemandirian Lokal, Mappadjantji, Publisher: BKS PTN INTIM, 1999.
   (d) Makassar Abad XIX, Edward L.Poelinggomang, Publisher: Kepustakaan Populer Gramedia, 2002.
   (e) Malay Fishermen: Their Peasant Economy, Raymond Firth, Publisher: W.W. Norton Library, 1966.
   (f) Sailing Craft of Indonesia, Adrian Horridge, Publisher: Oxford University Press, 1986.
   (g) Maritime Trade and State Development in Early South-east Asia, Kenneth R.Hall, Publisher: University of Hawaii Press, 1985.
   (h) Those Who Live from the Sea: A Study in Maritime Anthropology, M.Estellie Smith, 1977.
   (i) Dimensi Sosial Kawasan Pantai, Mukhlis Paeni, Publisher: The Toyota Foundation, 1988.
   (j) Upaya Memahami Kebudayaan Maritim, Mukhlis Paeni, Publisher: Universitas Hasanuddin , 1994.
   (k) Pinggawa-Sawi: Suatu Studi Kelompok Kecil, Arifin Sallatang, Publisher: Universitas Hasanuddin , 1982.
   (l) Strategi-strategi Adaptif yang Digunakan Nelayan Madura Dalam Kehidupan Ekonomi Perikanan Lautnya, Munsi Lampe, Publisher: Universitas Indonesia, 1989.
   (m) Studi Analisis Sosial-COREMAP Sulawesi Selatan, Munsi Lampe, Publisher: Universitas Hasanuddin , 1996.
   (n) Pemanfaatan Sumberdaya Alam/Laut (Resource use), Munsi Lampe, Publisher: Universitas Hasanuddin , 2001.
   (o) Maritime Anthropological Studies, Rob van Ginkel, J.Verrips, 1988.

5. Specific course information:

   (a) This course discusses about continental maritime, maritime potential and resource, demographic facts and Indonesian maritime history, community and maritime culture
   (b) Pre-requisite: N/A
   (c) Course type: Required (R)

6. Specific goals for the course:

   (a) Student will able to understand and explain continental maritime characteristic, proportion of sea and land area, and the Indonesia jurisdiction of the sea area

(b) Student will able to understand maritime potential and resource, and its benefit for improving people's welfare

(c) Student will able to know and understand the categories and mobility of the maritime population

(d) Student will able to know the history of maritime Indonesia

(e) Student will able to understand and apply the concepts of social and cultural science in examining the problems of developing the maritime continent

(f) Student will able to know and understand characteristic, institutional and dynamics of maritime society

(g) Student will able to know and understand maritime culture that related with elements and cultural values that have potential to be developed as a model of destructive exploitation that is environmentally friendly

(h) Student will able to understand the principles of integrated and sustainable development, and are able to detect problems in the marine environment

7. Brief list of topics to be covered:

(a) Maritime Continent

(b) Maritime Potential and Resources

(c) Demographic Facts and Indonesian Maritime History

(d) Basic Concepts of Social and Cultural Systems

(e) Maritime Society

(f) Maritime Culture

(g) Development of the Maritime Continent

A.29 Advanced Mathematics 2

1. Course code: 210D4123
   Course title: Advanced Mathematics 2
2. Credits: 3
   Contact hours: 42 hours
3. Instructors:
   (a) Yusran
   (b) Intan Sari Areni
   (c) Hasniaty A.
   (d) Andini Dani Achmad
4. Text book, title, author, publisher and year:
   (a) Advanced Engineering Mathematics, 10th Ed, Kreyszig Erwin, Publisher: John Wiley & Sons, Inc, 2011.
   (b) Advanced Modern Engineering Mathematics, 1st Ed, James Glyn, Publisher: Wesley Publishing Company Inc., 1993.
5. Specific course information:
   (a) This course discusses about series and Fourier transforms, Z transforms, and analysis of complex numbers
   (b) Pre-requisite: Advanced Mathematics 1
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) The student will able to analyse application techniques using series and Fourier transforms, Z transforms and analysis of complex numbers
7. Brief list of topics to be covered:
   (a) Fourier Series
   (b) Fourier Transforms
   (c) Z Transforms
   (d) Analysis of Complex Numbers

A.30 Linear Systems

1. Course code: 241D4102
   Course title: Linear Systems
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Rhiza Samsoe'oed Sadjad
4. Text books, title, author, publisher and year:
   (a) Signals and Systems, 2nd Ed, Alan V. Oppenheim, Alan S. Willsky, S. Hamid Nawab, Publisher: Pearson, 2015.
   (b) Schaum Outline Series: DiStefano III, Joseph J., et.al., "Feedback and Control Systems"
5. Specific course information:
   (a) The Catalog description: Understanding of the System, System Linear and Non-linear Systems, Linearization, Character Transfer Modelling, Modelling of Transfer Function, State Space Modelling, Relationship of Transfer Ratio
   (b) Pre-requisite: Basic Control Systems , Calculus 1 , Calculus 2
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) The student will be able to understanding the meaning of the system, input, output, signal, noise, disturbance
   (b) The student will be able to Understand system representations in a diagram block, diagram block algebraic
   (c) The student will be able to understanding memory/ non-memory system, casual and non-casual system, invertible/ non-invertible system systems, time-varying/ time-invariant system, linear and non linear system and examples
   (d) The student will be able to using the linearisation method to change the non-linear system to linear
   (e) The student will be able to understand the importance of system modelling
   (f) The student will be able to model the system in the transfer character model
   (g) The student will be able to model the system in the transfer function modelling using Laplace transforms for the concept of Impedance
   (h) The student will be able to model the system in state space modelling
   (i) The student will be able to explain the relationship of the transfer function modelling to the state space modelling
7. Brief list of topics to be covered:
   (a) Understanding of systems and signals, representing a system as diagram block, as a differential equation and as a difference equation and System Represents
   (b) System Types: Understand about causal and non-causal systems, invertible and non- invertible, time-varying and time invariant, linear and non-linear and capable of linearizing nonlinear systems, linear and nonlinear systems
   (c) Linearization
   (d) Character Transfer Modelling

(e) Transfer Function Modelling

(f) State Space Modelling

(g) Relationship of Transfer Function

A.31 Electric Machines

1. Course code: 212D4122
   Course title: Electric Machines

2. Credits: 2
   Contact hours: 27 hours

3. Instructors:

   (a) Ansar Suyuti

   (b) Yusran

   (c) Gassing

4. Text book, title, author, publisher and year:

   (a) Electrical Machines, Kostenko and Piotrovsky, Publisher: Foreign Languages Publishing House, 1970.

   (b) Mesin Listrik Arus Searah, Rusli Harahap, Publisher: ISTN, 1988.

   (c) Mesin Arus Searah, Abdul Kadir, Publisher: Djambatan, 1984.

   (d) Electric Machines, Nagrath, IJ., Kothari, DP., Publisher: Tata McGraw-Hill, 1985.

   (e) Mesin dan Rangkaian Listrik 6th ed, Lister Eugene C., Publisher: Erlangga, 1993.

   (f) Dasar-Dasar Mesin Listrik, Mochtar Wijaya, Publisher: Djambatan, 2001.

5. Specific course information:

   (a) This course discuss concept of electric machines, work principle of electric machines, generator and strengthening of electric machines, and electric motor

   (b) Pre-requisite: Electromagnetics , Electric Circuit 1 , Electric Circuit 2

   (c) Course type: Required (R)

6. Specific goals for the course:

   (a) The student will able to distinguish between branches, snares and vertices, using Kirchoff Law for current and voltage, and solve snare and node equations using matrices

   (b) The student will able to use the concept of superposition, determine the Thevenin and Norton equivalent circuit of a series, use source transformation to reduce circuit complexity, calculate load resistance which will result in maximum power transfer

   (c) The student will able to choose an analysis strategy to determine a particular series of responses

   (d) The student will able to understand the definition of time constants for RL and RC circuits, recognize natural and forced responses, calculate the total response of a series of RL and RC, know the effect of the initial conditions of the circuit on the circuit response

   (e) The student will able to determine power for a moment, define average power, use complex power to determine average power and reactive power, determine and repair the power factor of a load

   (f) The student will able to complete total responses and calculate average power, active power and complex power and power factor improvements

   (g) The student will able to resolve problems and apply concepts correctly

7. Brief list of topics to be covered:

(a) Basic concepts, definitions, construction, commutators and brushes on direct current electric machines
(b) Coils, anchor reactions working principles of direct current electric machines
(c) Generator and reinforcement on direct current electric machines
(d) Efficiency and parallel current generator work
(e) Motor and direct current generator reinforcement
(f) Small power motor with permanent magnet strengthening
(g) Scavenging, braking, control/regulation of speed and direct current motor safety

A.32 Basic Multimedia

1. Course code: 213D4122
   Course title: Basic Multimedia
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Indrabayu
   (b) Intan Sari Areni
4. Text book, title, author, publisher and year:
   (a) Fundamentals of Multimedia, Ze-Nian Li and Mark. S. Drew, Publisher: Prentice-Hall, 2003. ISBN 0130618721.
   (b) Introduction to Data Compression, K. Sayood, Publisher: Morgan-Kauffman, 2000. ISBN 1558605584.
   (c) Multimedia Database Management Systems, G. Lu, Publisher: Artech House, 1999. ISBN 0890063427.
   (d) QoS Measurement and Evaluation of Telecommunications Quality of Service, W.C. Hardy, Publisher: Wiley, 2001. ISBN 0470845910.
   (e) Information Hiding Techniques for Steganography and Digital Watermarking, S. Katzenbeisser and F.A.P Petitcolas, Publisher: Artech House Publisher, 2000. ISBN 1580530354
   (f) Introduction to Digital Audio Coding and Standards, M. Bosi and R.E. Goldberg, Publisher: Springer, 2006. ISBN 1402073571.
   (g) Video Demystified, 4th ed., K. Jack, Publisher: Elsevier, 2005. ISBN 0750678224.
5. Specific course information:
   (a) This course discuss about multimedia introduction, multimedia content production, multimedia data representation, multimedia data storage and retrieval, multimedia networking, multimedia distribution, and multimedia security
   (b) Pre-requisite: N/A
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) Student will able to understand concept and various kinds of multimedia
   (b) Student The student will able to understand multimedia content production process
   (c) Student will able to understand various of multimedia data compressions and its format
   (d) Student will able to understand multimedia data storage and retrieval technique
   (e) Student will able to understand infrastructure and standard of multimedia networking
   (f) Student will able to understand multimedia data distribution technique using any kinds of methods
   (g) Student will able to understand protection methods and multimedia data security
7. Brief list of topics to be covered:
   (a) Multimedia basics
   (b) Multimedia content production

(c) Multimedia data representation
(d) Multimedia data compression
(e) Multimedia data storage and retrieval
(f) Multimedia network
(g) Multimedia distribution
(h) Multimedia security

A.33 Integrated Electronics

1. Course code: 214D4122
   Course title: Integrated Electronics

2. Credits: 2
   Contact hours: 27 hours

3. Instructors:

   (a) Faizal Arya Samman

   (b) Andreas Vogel

   (c) Andi Ejah Umraeni Salam

4. Text books, title, author, publisher and year:

   (a) CMOS VLSI Design A Circuits and Systems Perspective, Neil H. E. Weste, David M. Harris, Publisher: Addison-Wesley, 2011.

   (b) Principles of Electronics, 8th edition, Albert Paul Malvino, David Bates, Publisher: McGraw-Hill Education, 2016.

   (c) Microelectronic Circuit Design, 4th edition, Richard C. Jaeger, Travis N. Blalock, Publisher: McGraw-Hill, 2011.

5. Specific course information:

   (a) The course material covers the topics about principles techniques to design, simulate and layout integrated circuit using a Computer-Aided Design (CAD) software

   (b) Pre-requisite: Basic Electronics

   (c) Course type: Required (R)

6. Specific goals for the course:

   (a) The student will be able to use a CAD software to design, simulate and layout CMOS analogue and digital integrated circuits

   (b) The student will be able to explain CMOS transistor characteristics

   (c) The student will be able to explain CMOS integrated circuit design methodologies

   (d) The student will be able to design CMOS logic circuit

   (e) The student outcomes listed in 3 are addressed by the course

7. Brief list of topics to be covered:

   (a) CMOS design methodologies: Full-custom and Semi-Custom design (Standard-cell technology)

   (b) Integrated circuit design rules

   (c) NMOS and PMOS transistor layout and their characteristics

   (d) Differential amplifier circuit configuration

   (e) Current mirror circuit

   (f) CMOS operational amplifier circuit

   (g) CMOS logic gates

   (h) Stick diagram and CMOS logic circuit

   (i) Digital integrated circuit design using standard-cell design methodology

   (j) Case study: digital adder, multiplier, etc.

   (k) Case study: memory cell design

A.34 Microprocessor Systems and Interfaces

1. Course code: 205D4121
   Course title: Microprocessor Systems and Interfaces
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Zahir Zainuddin
   (b) Christoforus Yohannes
4. Text book, title, author, publisher and year:
   (a) Microprocessor and Interfacing-Programming and Hardware, 2nd Ed., E Hall D.V., Tata McGraw-Hill Publishing Company Limited, 2008.
   (b) Microprocessor Architecture, Programming and Applications, 5th Ed., Gaonkar R.S., Penram International, 2007.
   (c) Microprocessor Systems- Hardware, Software and Programming, Stewart J., Prentice Hall International Edition, 1990.
   (d) Microprocessors and Programmed Logic, 2nd Ed., Short K. L., Pearson Education,2008.
5. Specific course information:
   (a) The The course material covers the topics about of the microprocessor architecture and organization, Bus architectures, types and buffering techniques, Memory and I/O subsystems, organization, timing and interfacing, Peripheral controllers and programming. Practice of the design of a microprocessor system.
   (b) Pre-requisite: Digital Systems
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) The student will be able to explain comprehension of microprocessor structure
   (b) The student will be able to know how to use sets of instructions and machine language
   (c) The student will be able to analyse capacity of architecture based on microprocessor
   (d) The student will be able to use capacity of hardware description language
7. Brief list of topics to be covered:
   (a) Introduction of Microcomputer System
   (b) Semiconductor Memories
   (c) Architecture of 8-bit Microprocessor
   (d) Operation and Control of Microprocessor
   (e) Instruction Set
   (f) Assembly Language Programming
   (g) Interfacing
   (h) Interrupts
   (i) Programmable Peripheral interface
   (j) Programmable Interval Timer

A.35 Basic Control Systems

1. Course code: 246D4102
   Course title: Basic Control Systems
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Nadjamuddin Harun
   (b) Rhiza Samsoe'oed Sadjad
   (c) Faizal Arya Samman
   (d) Indar Chaerah Gunadin
4. Text books, title, author, publisher and year:
   (a) Basic Control System, Faizal Arya Samman, Publisher: IESTA, 2016.
   (b) Automatic Control Systems, Benjamin C. Kuo, Publisher: Prentice-Hall, 1995.
   (c) Modern Control Engineering, Katsuhiko Ogata, Publisher: Prentice-Hall, 2010.
5. Specific course information:
   (a) The course material discuss about the basic principles of control system engineering analysis including the introduction of control system components
   (b) Pre-requisite: Advanced Mathematics 1 , Advanced Mathematics 2
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) The student will be able to explain the use of control engineering in many industrial applications
   (b) The student will be able to explain an open loop and closed loop control system, and main components of a control systems
   (c) The student will be able to find the transfer function of a closed loop control system and then analysis it stability, its time domain and frequency domain characteristic as well as its root locus characteristic
   (d) The student outcomes listed in 3 are addressed by the course
7. Brief list of topics to be covered:
   (a) Overview of control engineering applications in manufacture industries, process industries, automotive, aircraft, power system generations, etc.
   (b) Mathematical foundations: Laplace Transform, differential equation and its solution using Laplace Transform
   (c) Control system components introductions: sensor, actuators, control unit, signal conditioner
   (d) Transfer functions and block diagrams
   (e) Closed loop transfer function analysis using block diagram algebra, signal flow graphs and Mason gain formulas
   (f) Control system stability analysis based on characteristic equation of a control system using Routh-Hurwitz method
   (g) Time domain analysis: time domain specification, transient response and steady-state response analysis

(h) Frequency domain analysis: Bode plot and Nyquist plot, relative stability analysis based on gain and phase margins presented on the Bode and/or Nyquist curves of a control system

(i) Root locus analysis

A.36 Electrical Installation Laboratory

1. Course code: 217D4122
   Course title: Electrical Installation Laboratory
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Ansar Suyuti
   (b) Ikhlas Kitta
   (c) Gassing
4. Text book, title, author, publisher and year:
   (a) Instalasi Listrik Rumah Tangga, 12th ed, Brian Scaddan, Publisher: Erlangga, 2006.
   (b) Pemasangan Instalasi Listrik Dasar, Priyo Handoko, Publisher: Kanisius, 2000.
   (c) Instalasi Listrik Dasar, Trevor Linsley, Publisher: Erlangga, 2004.
   (d) Perhitungan Instalasi Listrik, Watkins, A.J., Parton, R.K., Publisher: Erlangga, 2005.
5. Specific course information:
   (a) This course discuss about cable, electric equipment, electrical lighting installation, motor/circuit/control electrical installation, protection against electrical hazards, designing residential installations, cable installation and connection, electrical inspection and testing
   (b) Pre-requisite: Electric Circuit 1 , Electric Circuit 2
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) The student will able to understand how to choose a cable that fits the load
   (b) The student will able to choose and install electrical installation equipment correctly
   (c) The student will able to draw electrical lighting residential installation
   (d) The student will able to choose and know how to install motor electric
   (e) The student will able to know danger of electricity and how to avoid them
   (f) The student will able to design residential installation
   (g) The student will able to connect cable
   (h) The student will able to do examine and test installation
7. Brief list of topics to be covered:
   (a) Preliminary
   (b) Cable and loading
   (c) Electric installation equipment
   (d) Lighting connection and contacts
   (e) Electric lightning installation
   (f) Protection against electrical hazards
   (g) Designing residential installation
   (h) Cable installation and connection
   (i) Electrical inspection and testing

A.37 Integrated Electronics Laboratory

1. Course code: 218D4121
   Course title: Integrated Electronics Laboratory

2. Credits: 1
   Contact hours: 14 hours

3. Instructors:

   (a) Faizal Arya Samman

   (b) Andreas Vogel

   (c) Andi Ejah Umraeni Salam

4. Text books, title, author, publisher and year:

   (a) CMOS VLSI Design A Circuits and Systems Perspective, Neil H. E. Weste, David M. Harris, Publisher: Addison-Wesley, 2011.

   (b) Principles of Electronics, 8th edition, Albert Paul Malvino, David Bates, Publisher: McGraw-Hill Education, 2016.

   (c) Microelectronic Circuit Design, 4th edition, Richard C. Jaeger, Travis N. Blalock, Publisher: McGraw-Hill, 2011.

5. Specific course information:

   (a) The laboratory course material covers the topics about practical techniques to design, simulate and layout integrated circuit using a Computer-Aided Design (CAD) software

   (b) Pre-requisite: Basic Electronics

   (c) Course type: Required (R)

6. Specific goals for the course:

   (a) The student will be able to use a CAD software to design, simulate and layout CMOS analogue and digital integrated circuits

   (b) The student will be able to design CMOS logic circuits using CMOS standard-cell technology library

   (c) The student will be able to design CMOS logic circuits using full-custom technique

7. Brief list of topics to be covered:

   (a) Integrated circuit design rules

   (b) NMOS and PMOS transistor layout and their characteristics

   (c) CMOS analog integrated circuit design

   (d) CMOS logic gates design: Inverter (NOT), NOR, NAND, OR and AND gates

   (e) Stick diagram and CMOS logic circuit

   (f) CMOS integrated circuit design using standard-cell (semi-custom) design methodology

   (g) CMOS integrated circuit design using full-custom design methodology

   (h) Project design: digital adder and digital multiplier

A.38 Microprocessor Systems and Interface Laboratory

1. Course code: 205D4121
   Course title: Microprocessor Systems and Interface Laboratory
2. Credits: 1
   Contact hours: 14 hours
3. Instructors:
   (a) Muhammad Anshar
   (b) Zahir Zainuddin
4. Text book, title, author, publisher and year:
   (a) Mazidi, M.A., McKinlay, R.D., Causey, D. and Microcontroller, P.I.C., 2008. Embedded Systems. Pearson, New Jersey.
   (b) Kumar N. S., Saravanan, M., Jeevananthan, S. and Shah, S.K. 2012. Microprocessors and Interfacing 8086, 8051, 8096, and advanced processors. Oxford University Press, India.
5. Specific course information:
   (a) This course discusses about Early Classes in Microprocessor and Microcontroller, Class of MCS-51, Project Oriented-based MCS-51 Programming
   (b) Pre-requisite: Logic Circuits , Digital Systems
   (c) Co-requisite: Basic Electronics , Basic Control Systems
   (d) Course type: Required (R)
6. Specific goals for the course:
   (a) The student will able to understand and have the ability to differentiate between General Purpose Microprocessor and Microcontroller
   (b) The student will able to develop the programming for a simple project utilizing microcontroller simulator
   (c) The student will able to utilize microcontroller-based SDK, which covers MCS-51, AVR Class, Arduino and Raspberry Pi
   (d) The student will able to apply knowledge of digital components and processors into applied electronic projects
7. Brief list of topics to be covered:
   (a) History of microprocessor and microcontroller
   (b) Development stage and variety of MCS-51 Class
   (c) Features of MCS-51 and Programming approaches, particularly assembly language
   (d) Simple project using MCS-51 Simulator
   (e) Real project circuit, covering the programming, simulation and integration to chip downloading process
   (f) Features of AVR microcontroller class, and SDK utilization
   (g) Simple project demonstration, demonstrating input, output, interfacing with external sensor
   (h) Integration with electronic loads

(i) Aduino SDK, program development to circuit applications
(j) Various basic projects implementation
(k) Introduction to utilization of Raspberry PI
(l) Integrating OS into Raspberry PI

A.39 Engineering Economics

1. Course code: 301D4112
   Course title: Engineering Economics
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Ansar Suyuti
   (b) Ikhlas Kitta
4. Text book, title, author, publisher and year:
   (a) Engineering Economy, 10th Edition, Paul Degarmo, William G. Sullivan, Publisher: Macmillan Coll, 1993.
   (b) Ekonomi Teknik, Ristono, Agus and Puryani, Publisher: Graha Ilmu, 2011.
5. Specific course information:
   (a) This course is part of microeconomics that is specifically related to operational planning problems of business activities which involve many technical aspects in it
   (b) Pre-requisite: Calculus 1 , Calculus 2 , Probability and Statistics
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) The student will able to understand economic considerations in evaluating an engineering proposal
   (b) The student will able to understand the meaning of cash flow, the concept of equivalence, and changes in the value of money against time
   (c) The student will able to master methods of analysing investment feasibility for private projects and public projects
   (d) The student will able to understand the concept of depreciation and tax related to the flow of cash flow
   (e) The student will able to analyse the effect of financing and engine turnover on cash-flow
7. Brief list of topics to be covered:
   (a) Engineering economics basic principles
   (b) Time value of money
   (c) Cash flow evaluation
   (d) Annual worth analysis
   (e) Net present value analysis
   (f) Internal rate of return analysis
   (g) Benefit cost analysis
   (h) Payback period and break-even analysis
   (i) Depreciation
   (j) Tax effect on cash-flow
   (k) Inflation
   (l) Financing analysis
   (m) Engine replacement analysis

A.40 Probability and Statistics

1. Course code: 302D4112
   Course title: Probability and Statistics
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Andani Achmad
   (b) Dewiani Djamaluddin
   (c) Zulfajri Basri Hasanuddin
4. Text book, title, author, publisher and year:
   (a) Metode Statistika, Sudhjana, Publisher: Tarsito, 1995.
   (b) Teknik Analisis Regresi dan Korelasi, Sudjana, Publisher: Tarsito, 1988.
   (c) Stastistika untuk Penelitian, Sugiono, Publisher: Alfa Beta, 2001.
   (d) Statistics, M. Spiegel, Publisher: Schoums Outline Series, 1983.
   (e) Statistika Jilid I dan II, Suprian AS., Publisher: FPTK IKIP, 1992.
   (f) Prosedur Penelitian suatu Pendekatan Praktik, Suharsimi Arikunto, Publisher: Rineka Cipta, 1998.
   (g) Statistik Non Parametrik, Sugiyono, Publisher: Tarsito, 1999.
5. Specific course information:
   (a) This course discusses the table of frequency distribution, central symptom size and location size, deviation size, slope moment and kurtosis, opportunity theory, sampling, hypothesis test, regression and correlation analysis and non-parametric statistics
   (b) Pre-requisite: N/A
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) The student will be able to create and calculate the concept of calculation of frequency distribution table
   (b) The student will be able to calculate central symptom and location size
   (c) The student will be able to calculate deviation size
   (d) The student will be able to calculate slope and kurtosis moments
   (e) The student will be able to calculate opportunity theory, sampling, hypothesis testing, regression and correlation analysis
   (f) The student will be able to use non-parametric statistics
7. Brief list of topics to be covered:
   (a) Introduction to statistics and probability
   (b) Table of Frequency Distribution and Graphics
   (c) Size of Central Symptoms
   (d) Size Deviation
   (e) Slopes and Kurtosis

(f) Opportunity Theory
(g) Distribution of Sampling
(h) Testing Hypotheses
(i) Regression Analysis
(j) Correlation Analysis
(k) Non-Parametric Statistics

A.41 Electric Measurements

1. Course code: 303D4112
   Course title: Electric Measurements

2. Credits: 2
   Contact hours: 27 hours

3. Instructors:

   (a) Ansar Suyuti

   (b) Indar Chaerah Gunadin

   (c) Yusri Syam Akil

   (d) Muhammad Bachtiar Nappu

4. Text book, title, author, publisher and year:

   (a) Circuits Engineering Concept and Analysis of Linier Circuits, Bruce Carlson, Publisher: Brooks / Cole Thomson Learning,2000.

   (b) Electric Circuits Theory and Engineering Application, Carl H.Durney; L.Dale Harris; Charles L.Alley, Publisher: Holt-Saunders international Edition, n.d

   (c) Theory and Problems of Electric Circuits, 3rd ed, Joseph A. Edminister, Publisher: Schaum's Outline Series McGRAW-HILL, n.d

   (d) Introductory Circuit Analysis 10th ed, Robert L. Boylestad, Publisher: Prentice Hall Pearson Education International,2003.

   (e) Principles of Electric Circuits-Electron, 6th ed, Thomas L.Floyd, Publisher: Prentice Hall Electronics Supersite, 2003.

   (f) Rangkaian Listrik Jilid 1 6th ed, William H.Hayt. JR, Jack E.Kemmerly, Steven M.Durbin, , Publisher: Erlangga, 2005.

5. Specific course information:

   (a) This course studies the characteristics of measuring devices for electrical quantities, methods of using electrical measuring devices and their use in measuring electrical quantities.

   (b) Pre-requisite: Electric Circuit 1 , Electric Circuit 2

   (c) Course type: Required (R)

6. Specific goals for the course:

   (a) The student will able to explain about the importance of learning electrical measurement knowledge, the basic of measurement, and error theory

   (b) The student will able to describe the various types of circuits used in the instrument, and how the direct current instruments works

   (c) The student will able to describe the various types of circuits used in the instrument, and how the alternating current instrument works

   (d) The student will able to explain the potentiometer concept, its use in electrical measurement, and how it works

   (e) The student will able to explain the concept of a direct current bridge, alternating current drawing and how it works

   (f) The student will able to explain the concept of electronic transducers through the presentation papers

7. Why study electrical measurements

8. Basic definition of electrical measurement
9. Error theory
10. Direct current instrument set
11. How the direct current instrument works
12. A series of alternating current instruments
13. How the alternating current instrument works
14. Potentiometer concept
15. Use of measurement
16. Direct current bridge concept
17. The concept of alternating current bridges
18. Series, and how it works
19. Transducer concepts
20. Concepts of electronic instruments

A.42 Electromagnetics

1. Course code: 304D4112
   Course title: Electromagnetics
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Salama Manjang
   (b) Elyas Palantei
   (c) Yusran
4. Text book, title, author, publisher and year:
   (a) The Finite Element Method in Electromagnetics, 3rd Ed, Jian-Ming Jin, Publisher: John Wiley & Sons, Inc., 2014
   (b) Engineering Electromagnetics, 3rd Ed, Nathan Ida, Publisher: Springer, 2015
   (c) Electromagnetics, 3rd Ed, R. Edward J. and C. Michael J., Publisher: CRC Press, 2018
5. Specific course information:
   (a) The electromagnetic course will discuss material about vector analysis, coordinate systems, electrical forces, electric fields, electric field intensities, electrical fluxes, electrical potential and energy, magnetic fields, magnetic forces, electromagnetic induction, electromagnetic waves and their applications in the field of Electrical Engineering.
   (b) Pre-requisite: -
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) Students are able to understand and explain the concepts of electric magnetism and the interrelationship between concepts, applying them to solve the problem
7. Brief list of topics to be covered:
   (a) Scalars and Cartesian Diagram Vector
   (b) Component and Unit Vector
   (c) Dot and Cross Product
   (d) Coulomb Law
   (e) Electric Field Intensity
   (f) Potential and Un-uniform Electric Fields
   (g) Single Electric Potential and Superposition Electric Potential
   (h) Capacitance and Inductance
   (i) Poisson and Laplace Equation

A.43 Numerical Methods

1. Course code:342D4122
   Course title: Numerical Methods
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Syafaruddin
4. Text books, title, author, publisher and year:
   (a) Fundamental Numerical Methods for Electrical Engineering, Stanisław Rosłoniec, Publisher: Springer.
5. Specific course information:
   (a) This courses material discusses about the methods for numerical solution of linear equations, methods for numerical solving the single non-linear equations, methods for numerical solution of non-linear equations, methods for the interpolation and approximation of one variable function, methods for numerical integration of one and two variable functions, methods for numerical integration of ordinary differential equations
   (b) Prerequisite: (Mathematics I, C-minimum grade), (Mathematics II, C-minimum grade)
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) The student will understand the principle of numerical solution in electrical engineering problem
   (b) The student will be able to solve linear and non-linear equations using numerical methods
   (c) The student will understand the difference between interpolation and approximation techniques in engineering problems
   (d) The student will be able to implement certain interpolation and approximation algorithms in engineering problems
   (e) The student will be able to solve mathematical integration problems based numerical methods
   (f) The student will be able to compute mathematical differentiation cases using numerical methods
   (g) The student will have an ability to apply knowledge of engineering mathematics and calculus to solve problems in engineering process with numerical methods
7. Brief list of topics to be covered:
   (a) Direct Methods: Gauss Elimination Method, Gauss–Jordan Elimination Method, LU Matrix Decomposition Method, Method of Inverse Matrix
   (b) Indirect or Iterative Methods: Direct Iteration Method, Jacobi and Gauss–Seidel Methods
   (c) Determination of the Complex Roots of Polynomial Equations: Lin's Method, Bairstow's Method, Laguerre Method
   (d) Iterative Methods Used for Solving Transcendental Equations: Bisection Method of Bolzano, Secant Method, Method of Tangents (Newton–Raphson), Optimization Methods

(e) Method of Direct Iterations: Iterative Parameter Perturbation Procedure, Newton Iterative Method

(f) Fundamental Interpolation Methods: Piecewise Linear Interpolation, Lagrange Interpolating Polynomial, Aitken Interpolation Method, Newton–Gregory Interpolating Polynomial

(g) Fundamental Approximation Methods for One Variable Functions: Equal Ripple (Chebyshev) Approximation, Maximally Flat (Butterworth) Approximation

(h) Fundamental Methods for Numerical Integration of One Variable Functions: Rectangular and Trapezoidal Methods of Integration, Romberg Integration Rule, Simpson Method of Integration

(i) Calculating the Derivatives of One Variable Function Differentiation of the Corresponding Interpolating Polynomial: Differentiation of the Newton–Gregory Polynomial and Cubic Spline Functions

(j) Methods for Numerical Integration of Ordinary Differential Equations: Euler Method and its Modified Version, Heun Method, Runge–Kutta Method (RK 4), Runge–Kutta–Fehlberg Method (RKF 45)

A.44 Energy Conversion

1. Course code: 343D4122
   Course title: Energy Conversion
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Syafaruddin
4. Text books, title, author, publisher and year:
   (a) Energy Conversion, D. Yogi Goswami, Frank Kreith, Publisher: CRC Press-Taylor & Francis Group, 2017.
5. Specific course information:
   (a) Catalogue description: Solar energy resources, Solar Thermal Energy Conversion: Photovoltaic Fundamentals, Technology and Application, Wind energy resources, Biomass Energy, Biomass Conversion Processes For Energy Recovery, Ocean Energy Technology, Geothermal Energy, Fuel Cells, Direct Energy Conversion
   (b) Prerequisite: Basic Electrical Power
   (c) Co-requisite: Electric Machines
   (d) Course type: Required (R)

   Specific goals for the course:
   (a) The student will understand and be able to explain the classification and types of energy
   (b) The student will be able to explain the principle process of energy conversion of solar energy, wind energy, biomass energy, ocean energy, geothermal energy
   (c) The student will be able to distinguish the principle process of thermionic converters, thermoelectric converters, fuel cells
   (d) The student will be able to do some parameter measurements in solar energy, wind energy, biomass energy, ocean energy, geothermal energy
   (e) The student will be able to quantify some parameter measurements in thermionic converters, thermoelectric converters, fuel cells
   (f) The student will be able to develop hybrid systems of energy conversion in the electrical grid network
   (g) The student outcomes addressed by the course
   (h) The student will have an ability to apply knowledge of mathematics, science and technology related to the energy conversion process
6. Brief list of topics to be covered:
   (a) Solar energy resources: Solar Energy Availability, Earth–Sun Relationships, Solar Time, Solar Radiation on a Surface, Solar Radiation on a Horizontal Surface, Solar Radiation on a Tilted Surface, Solar Radiation Measurements, Solar Radiation Data
   (b) Solar Thermal Energy Conversion: Active Solar Heating Systems, Solar Heat for Industrial Processes, Passive Solar Heating, Cooling, and Daylighting, Solar Cooling
   (c) Photovoltaics Fundamentals, Technology and Application: Photovoltaic, Thin-Film PV Technology, Concentrating PV Technologies

(d) Wind energy resources: Wind Origins, Wind Power, Wind Shear, Wind Energy Resource, Wind Characterization, Wind Energy Potential

(e) Biomass Energy: Biomass Feedstock Technologies, Biomass Conversion Technologies

(f) Biomass Conversion Processes For Energy Recovery: Energy Recovery, Power Generation, Biofuels

(g) Ocean Energy Technology: Ocean Thermal Energy Conversion, Tidal Power, Wave Power

(h) Geothermal Energy: Heat Flow Types of Geothermal Systems, Geothermal Energy Potential, Geothermal Applications, Environmental Constraints, Operating Conditions, Management of the Geothermal Resource for Power Production, Geothermal Steam Supply, Geothermal Power Production-Steam Turbine Technologies

(i) Fuel Cells: Principle of Operation for Fuel Cells, Typical Fuel Cell Systems, Performance of Fuel Cells Fuel Cell Electrode Processes, Cell connection and Stack Design Considerations, Six Major Types of Fuel Cells

(j) Direct Energy Conversion: Thermionic Energy Conversion, Thermoelectric Power Conversion, Magnetohydrodynamic Power Generation

A.45 Environmental Science

1. Course code: 344D4122
   Course title: Environmental Science
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Yusran
4. Text book, title, author, publisher and year:
   (a) Introduction to Environmental Engineering and Science, 3rd Ed, Gilbert M Masters, Publisher: Prentice-Hall of India Pvt.Ltd, 2007.
   (b) Introduction to Environmental Engineering, Mackenzie L. Davis, David A. Cornwell, Publisher: McGraw-Hill Education, 2012.
5. Specific course information:
   (a) The course material covers the topics about of subjects like understanding of earth processes, evaluating alternative energy systems, pollution control and mitigation, natural resource management, effects of global climate change.
   (b) Pre-requisite: Concept of Science and Technology
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) The student will be able to obtain and apply scientific knowledge about environmental problems
   (b) The student will be able to develop a deeper understanding of environmental problems by connecting scientific knowledge with another perspective
   (c) The student will be able obtain the necessary problem solving skills that will enable them to examine and propose alternative for various environmental problems
7. Brief list of topics to be covered:
   (a) Ecosystem Dynamics
   (b) Biodiversity Components
   (c) Natural Resources and Forest Management
   (d) Physic Chemical Environment
   (e) Environmental Techniques and Impact Assessment
   (f) Pollution Control
   (g) Industrial Hygiene
   (h) Radiation Protection
   (i) Hazardous Waste Management
   (j) Toxic Material Control
   (k) Water supply and water management

A.46 Management and Entrepreneurship

1. Course code: 345D4122
   Course title: Management and Entrepreneurship
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Ansar Suyuti
4. Text book, title, author, publisher and year:
   (a) Be a Smart and Good Entrepreneur, Chandra Hendro, Publisher: CLA Publishing, 2006.
5. Specific course information:
   (a) This course provide understanding and skills in the fields of business such as marketing, production, finance, human resources, accounting finance, organizations and management as well as business ethics. In this lecture also discussed internal aspects of human resources in terms of concepts, mental attitude, motivation and entrepreneurial thinking
   (b) Pre-requisite: N/A
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) The student will able to have understanding and skills in the fields of business such as marketing, production, finance, human resources, accounting finance, organizations and management as well as business ethics
   (b) The students will able to compile a business plan based on owned talents and expertise follow industry trends
7. Brief list of topics to be covered:
   (a) Entrepreneurship landscape
   (b) Entrepreneurial process
   (c) Inspiration, creativity, and business mind
   (d) Creating and starting new business
   (e) Build a company
   (f) Quality concept
   (g) Strategic and management concept
   (h) Operational concept
   (i) Marketing concept
   (j) Selling skill

A.47 Practical (On Job) Training

1. Course code: 401D4112
   Course title: Practical (On Job) Training
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Assigned Lecturer
   (b) Company Supervisor
4. Text book, title, author, publisher and year:
   (a) Penulisan Karangan Ilmiah, Mukayat D. Brotowidjoyo, Publisher: Akademika, 1985.
   (b) How to Write a Research Paper Step by Step, Phyllis Cash, Publisher: Monarch Press, 1997.
   (c) J.W. Creswell, V.L.P. Clark, Designing and Conducting: Mixed Methods Research, Publisher: Sage Publications Inc, 2007.
   (d) Filsafat Ilmu Pengetahuan, Jalaluddin, Publisher: Raja Grafindo Persada, 2013.
   (e) Filsafat Ilmu Sebuah Pengantar Populer, Suriasumantri Jujun, Publisher: Pustaka Sinar Harapan, 2009.
   (f) Pengantar Filsafat, Louis O. Kattsoff, Publisher: Tiara Wacana Jogja, 1992.
   (g) How to Write for University: Academic Writing for Success, K. Mc. Millan, Jonathan Wayers, Publisher: Person Education Limited, 2014.
   (h) Metodologi Penelitian, 6th Ed, Nazir Moh, Publisher: Ghalia Indonesia, 2005.
   (i) Theories of Scientific Method: An Introduction (Philosophy and Science), H. Sankey, Publisher: McGill-Queen's University Press, 2007.
5. Specific course information:
   (a) This course is conduct practical work at the company, industry, and services/agencies engaged in Electrical Engineering fields
   (b) Pre-requisite: All basic courses and expertise courses
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) The student will able to have experience in real applications in the field of electrical engineering
   (b) The students will able to gain experience in seeing and engaging themselves directly in activities that carried out in the working world of electrical engineering
   (c) The students will able to describe in detail the work activities that exist in the location of practical (on job) training
   (d) The students will able to apply various basic knowledges of electrical engineering that obtained in the appropriate field of work
   (e) The students will able to describe the result of practical (on job) training in the form of written reports
7. Brief list of topics to be covered:
   (a) Introduction to the Fields of Electrical Engineering Work and the Determination of the Location of Practical (on job) Training
   (b) Implementation of Practical (on job) Training
   (c) Reports

A.48 Research Methods and Scientific Writing

1. Course code: 402D4112
   Course title: Research Methods and Scientific Writing
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Salama Manjang
   (b) Syafaruddin
4. Text book, title, author, publisher and year:
   (a) Penulisan Karangan Ilmiah, Mukayat D. Brotowidjoyo, Publisher: Akademika, 1985.
   (b) How to Write a Research Paper Step by Step, Phyllis Cash, Publisher: Monarch Press,1997.
   (c) Designing and Conducting: Mixed Methods Research, Creswell, J.W. and Clark, V.L.P., Publisher: Sage Publications, Inc., 2007.
   (d) Filsafat Ilmu Pengetahuan, Jalaluddin, Publisher: Raja Grafindo Persada, 2013.
   (e) Filsafat Ilmu Sebuah Pengantar Populer., Jujun, Suriasumantri,Publisher: Pustaka Sinar Harapan, 2009.
   (f) Pengantar Filsafat, Louis O. Kattsoff, Publisher: Tiara Wacana Jogja, 1992.
   (g) How to Write for University: Academic Writing for Success, Mc. Millan, K. and Jonathan Wayers, Publisher: Person Education, 2014.
   (h) Metodologi Penelitian, 6th Ed, Nazir Moh, Publisher: Ghalia Indonesia, 2005.
   (i) Theories of Scientific Method: An Introduction (Philosophy and Science), H. Sankey, Publisher: McGill-Queen's University Press, 2007.
5. Specific course information:
   (a) This course contains basic concepts of quantitative research, research design using a quantitative approach, and conduct quantitative research. This course also expects students to have a good attitude of responsibility, personality, morality, and independence in completing their duties as educators.
   (b) Pre-requisite: Indonesian Language
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) The student will able to understand basic concepts of nature and role of science
   (b) The students will able to understand the concept of scientific research
   (c) The students will able to master the concept of science research methods
   (d) The students will able to design simple scientific research
   (e) The students will able to master the library techniques
   (f) The students will able to master the plagiarism and paraphrasing techniques
   (g) The students will able to master the various kinds of data collection techniques of quantitative scientific research
   (h) The students will able to make abstract and research
   (i) The students will able to master the preparation and presentation techniques

7. Brief list of topics to be covered:
   (a) The Nature and Role of Science
   (b) Scientific Research
   (c) Research Methods
   (d) Proposal Research
   (e) Library Techniques
   (f) Plagiarism and Paraphrasing Techniques
   (g) Data Collection Technique
   (h) Abstract and Publication
   (i) Preparation and Presentation Techniques

A.49 Final Project Proposal

1. Course code: 403D4112
   Course title: Final Project Proposal
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Assigned Lecturer as adviser/ preceptor
4. Text book, title, author, publisher and year:
   (a) All related literatures
5. Specific course information:
   (a) This course is a final project proposal seminar that explained the first three parts of the research that will be carried out, namely: chapter 1 as introduction, chapter 2 as literature review/ basic theory, and chapter 3 as research methodology
   (b) Pre-requisite: Research Methods and Scientific Writing , more than 120 credits
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) The student will able to prepare final project proposal properly
   (b) The student will able to make presentation material from final project proposal properly
   (c) The student will able to present their final project proposal properly
7. Brief list of topics to be covered:
   (a) Research background
   (b) Formulation of the problem
   (c) Research purposes
   (d) Benefits of research
   (e) Scope of problem
   (f) Writing system
   (g) Literature review
   (h) Types of research
   (i) Research time
   (j) Research sites
   (k) Data collection and evaluation techniques
   (l) Data analysis technique
   (m) Research flow

A.50 Student Community Service Programs

1. Course code: 491D4124
   Course title: Student Community Service Programs
2. Credits: 4
   Contact hours: 54 hours
3. Instructors:
   (a) Assigned Lecturer as Supervisor
   (b) Village/ Sub-District Officials
4. Text book, title, author, publisher and year:
   (a) All related literatures
5. Specific course information:
   (a) This course is community-based learning activities on and/or outside campus, according to the learning outcomes that are in accordance with the learning guidelines of each type of community service program. This course has basic principles: integration of the implementation of the Tridharma Perguruan Tinggi, an interdisciplinary and comprehensive approach, broad-scale-cross sectoral and pragmatic, participation of partners and the community, and sustainable empowerment and resource development
   (b) Pre-requisite: 130 credits
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) The student will able to plan, implement, monitor and evaluate community service program activities
   (b) The student will able to be discipline, tolerant, and collaborate between disciplines and diverse cultures/habits
   (c) The student will able to act creatively and innovatively
   (d) The student will able to raise awareness for the community
   (e) The student will able to cooperate in teams, and
   (f) The student will able to improve personality values; nationalism, work ethic and responsibility, independence, leadership and entrepreneurship
7. Brief list of topics to be covered:
   (a) Students arrive at their respective locations
   (b) Initial socialization with sub-district and village governments, community leaders, religious leaders, youth, etc.
   (c) Selection and preparation of work programs
   (d) Problem observation/identification and potential analysis
   (e) Village level work program seminar
   (f) Sub-district level work program seminar
   (g) Implementation of work programs
   (h) Program evaluation seminar
   (i) Withdrawal from location
   (j) Final seminar

A.51 Final Project Result

1. Course code: 492D4122
   Course title: Final Project Result
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Assigned Lecturer as adviser/ preceptor
4. Text book, title, author, publisher and year:
   (a) All related literatures
5. Specific course information:
   (a) This course is a final project result seminar that explained the first three parts of the research that will be carried out, namely: chapter 1 as introduction, chapter 2 as literature review/basic theory, and chapter 3 as research methodology, chapter 4 as discussion/analysis, and chapter 5 as closing. In this seminar, student will get some suggestions for improvements related to the result of the research from seminar participants
   (b) Pre-requisite: 142 credits
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) The student will able to prepare final project result report properly
   (b) The student will able to make presentation material from final project result properly
   (c) The student will able to present their final project result report properly
   (d) The student will able to get some suggestions for improvements related to the results of the research for final project report
7. Brief list of topics to be covered:
   (a) Research background
   (b) Formulation of the problem
   (c) Research purposes
   (d) Benefits of research
   (e) Scope of problem
   (f) Writing system
   (g) Literature review
   (h) Types of research
   (i) Research time
   (j) Research sites
   (k) Data collection and evaluation techniques
   (l) Data analysis technique
   (m) Research flow
   (n) Discussion/analysis
   (o) Conclusion
   (p) Suggestion/recommendation

A.52 Final Project Report

1. Course code: 493D4122
   Course title: Final Project Report
2. Credits: 4
   Contact hours: 54 hours
3. Instructors:
   (a) Assigned Lecturer as adviser/ preceptor
4. Text book, title, author, publisher and year:
   (a) All related literatures
5. Specific course information:
   (a) This course is a final project report and seminar that explained the all parts of the research that will be carried out, namely: chapter 1 as introduction, chapter 2 as literature review/basic theory, chapter 3 as research methodology, chapter 4 as discussion/analysis, and chapter 5 as closing. This report covering all the improvements that have been made based on the previous final project result seminar
   (b) Pre-requisite: 144 credits
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) The student will able to make all improvements based on the previous final project result seminar properly
   (b) The student will able to prepare final project report properly
   (c) The student will able to make presentation material from final project report properly
   (d) The student will able to present their final project report properly
7. Brief list of topics to be covered:
   (a) Research background
   (b) Formulation of the problem
   (c) Research purposes
   (d) Benefits of research
   (e) Scope of problem
   (f) Writing system
   (g) Literature review
   (h) Types of research
   (i) Research time
   (j) Research sites
   (k) Data collection and evaluation techniques
   (l) Data analysis technique
   (m) Research flow
   (n) Discussion/analysis
   (o) Conclusion
   (p) Suggestion/recommendation

A.53 Alternating Current Transmission System

1. Course code: 305D4112
   Course title: Alternating Current Transmission System
2. Credits: 3
   Contact hours: 42 hours
3. Instructors:
   (a) Ikhlas Kitta
   (b) Ardiaty Arief
   (c) Tajuddin Waris
4. Text book, title, author, publisher and year:
   (a) Teknik Tenaga Listrik, A. Arismunandar, S. Kuswara, Publisher: PT. Pradnya Paramita, 1982.
   (b) Transmisi Daya Listrik, Hutahuruk T.S, Publisher: Erlangga, 1985.
   (c) Power System Stability and Control; Electrical Power System Reasearch Institute, Praba Kundur, Publisher: McGraw-Hill, 1993.
   (d) Power System Analysis, John Grainger, William D Stevenson, Publisher: McGraw-Hill, 1993.
   (e) Grisby, Leonard Lee. Power System Stability and Control, 2nd Ed, Publisher: CRC Press, 2006.
   (f) Hadi Saadat, Power System Analysis, Publisher: McGraw Hill, .
   (g) Turan Gonen, Electrical Power Transmission System, Publisher: McGraw-Hill,
5. Specific course information:
   (a) This course discuss the equivalent circuit of the transmission line, determination of transmission channel constants, power flow equations, current and voltage relationships. This course is the basis for strengthening the power system analysis course. This course presents the determination of the transmission line model, calculation of value per unit, power flow on the transmission line, the wave phenomenon running on the transmission line. At the end of the section will be presented the basics of planning alternating current transmission lines
   (b) Pre-requisite: Advanced Mathematics 1 , Advanced Mathematics 2 , Electromagnetics , Electric Circuit 1 , Electric Circuit 2
   (c) Course type: Elective (E)
6. Specific goals for the course:
   (a) Student will able to explain the function and work principle of power system components
   (b) Student will able to calculate and determine model and parameter of alternating current transmission line
   (c) Student will able to calculate and explain power flow on line transmission
   (d) Student will able to calculate and explain variables relationship on alternating current transmission line
   (e) Student will able to design a basic air transmission for alternating current
7. Brief list of topics to be covered:
   (a) Electrical power system components

(b) Alternating current air transmission parameter
(c) Alternating current air transmission capacitance
(d) Current and voltage relationship on transmission
(e) Power flow on transmission
(f) Basic design of transmission

A.54 Power Systems Analysis

1. Course code: 306D4112
   Course title: Power Systems Analysis
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Ardiaty Arief
4. Text book, title, author, publisher and year:
   (a) Power System Analysis and Design, J. Duncan Glover, Mulukutla S. Sarma, Thomas J. Overbye, Publisher: Cengage Learning, 2011.
5. Specific course information:
   (a) This course discusses about History of electric power systems, power system structure, Per Unit systems, Systems modelling, iterative solutions to algebraic equations, power flow analysis, symmetrical faults, symmetrical components and unsymmetrical faults
   (b) Pre-requisite: Alternating Current Transmission System
   (c) Co-requisite: Advanced Mathematics 1 , Advanced Mathematics 2 , Basic Electrical Power , Electric Circuit 1 , Electric Circuit 2
   (d) Course type: Required (R)
6. Specific goals for the course:
   (a) The student will be able to understand the history of electric power systems and power systems structure
   (b) The student will be able to understand the per unit systems
   (c) The student will be able to understand the power systems modelling
   (d) The student will be able to analyse the power flow with iterative solutions
   (e) The student will be able to analyse and calculate the current of symmetrical faults
   (f) The student will be able to understand the symmetrical components
   (g) The student will be able to analyse and calculate the current of asymmetrical faults
7. Brief list of topics to be covered:
   (a) History of electric power systems
   (b) Power systems structure
   (c) Per Unit systems and systems modelling
   (d) Iterative solutions to algebraic equations
   (e) Gauss Elimination
   (f) Jacobi and Gauss–Seidel
   (g) Newton–Raphson
   (h) Power flow analysis
   (i) Power flow solution by Gauss–Seidel
   (j) Power flow solution by Newton–Raphson
   (k) Fast Decoupled Power Flow

(l) Symmetrical faults
(m) Symmetrical components
(n) Asymmetrical faults
(o) Single line-to-ground fault
(p) Line-to-line fault
(q) Double line-to-ground fault
(r) Sequence bus impedance matrices

A.55 Electric Machine Analysis 1 + Laboratory

1. Course code: 307D4112
   Course title: Electric Machine Analysis 1 + Laboratory
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Sri Mawar Said
4. Text book, title, author, publisher and year:
   (a) A Textbook of Electrical Technology AC and DC Machines, B.L. Theraja and A.K. Theraja, Publisher: S. Chand & Company Ltd, 2005.
   (b) Dasar Teknik Tenaga Listrik dan Elektronika Daya, Zuhal, Publisher: PT Gramedia, 2000.
5. Specific course information:
   (a) This course discuss about the principles and analyse the characteristic of DC generator, DC motor, and transformer
   (b) Pre-requisite: N/A
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) Students will understand the working principle of DC Generator
   (b) Students will know the types of DC Generator and their differences
   (c) Students will understand No Loaded, Loaded, and External characteristic of each DC Generator types
   (d) Students will understand why a type of DC generator is used
   (e) Students will understand the working principle of DC Motor
   (f) Students will know the types of DC Motor and their differences
   (g) Students will understand Torque, Speed, and Mechanic characteristic of each DC Motor types
   (h) Students will understand why a type of DC motor is used
   (i) Students will understand the working principle of Transformer
   (j) Students will know the types of Transformer and their differences
   (k) Students will be able to determine the ratio between primary winding with secondary winding on Single Phase Transformer
   (l) Students will know how to determine the polarity of Transformer
   (m) Students will know the losses on Transformer and theirs cause
   (n) Students will understand how to determine the connection of Three Phase Transformer
   (o) Students will understand why a type of connection is used on Transformer
7. Brief list of topics to be covered:
   (a) Introduction:
   Basic theory of electrical machines

(b) DC Generator:

Working principle of DC Generator; Types of DC Generator (Self-excited, Series, Shunt, and Compound); Characteristics of DC Generator (No Loaded, Loaded, and External characteristic); Application of DC Generator

(c) DC Motor:

Working principle of DC Motor; Types of DC Motor (Self-excited, Series, Shunt, and Compound); Characteristics of DC Motor (Torque, Speed, and Mechanic characteristic); Application of DC Motor

(d) Transformer:

Working principle of Transformer; Construction of Transformer; Types of Transformer; Losses in Transformer; Transformer connection on Three Phase Transformer

A.56 Protection System 1

1. Course code: 308D4112
   Course title: Protection System 1
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Sri Mawar Said
   (b) Sonny Tanyadji
4. Text book, title, author, publisher and year:
   (a) Protective Relays, Their Theory And Practice, 3rd Ed , A.R. Van C Warrington, Publisher: John Wiley & Sons, 1994.
   (b) The Art and Science of Protective Relaying, C. Russel Mason, Publisher: J. Wiley, 1956.
   (c) Protective Relays for Power System, Publisher: GEC ALSTOM T& D., 1997.
   (d) The Protective Gear Handbook, F.E. Wellman, Publisher: Sir Isaac Pitman and Sons Ltd, 1968.
   (e) Numerical Differential Protection, Principles and Applications, Gerhard Ziegler, Publisher: Publicis Kommunikations Agentur GmbH GWA, 2005.
   (f) Numerical Distance Protection, Principles and Applications, 3rd Ed, Gerhard Ziegler, Publisher: Publicis Kommunikations Agentur GmbH,GWA, Erlangen, 2008.
   (g) Protective Relaying for Power System, Stanley H. Horrowits, Publisher: IEEE, 1980.
   (h) Protective Relaying, 2nd Ed, Stanley H.Horowits, Arun G Phanke, Publisher: John Wiley and Sons Inc, 1995.
   (i) Sistem Proteksi Tenaga Listrik, 1st Ed, Sonny Tanyadji, Sarma Thaha, Publisher: Universitas Hasanuddin , 2015.
5. Specific course information:
   (a) This course discuss protection system basic philosophy, protection zone, main and back up protection, protection relay's operating principle, instrument transformator, over-current protection, differential protection, distance protection, pilot protection
   (b) Pre-requisite: Basic Electrical Power , Electric Machines , Power Systems Analysis
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) Students are able to explain basic concept and operating system of all components which are involved in power system protection
   (b) Students are able to decide which is the most suitable protection system, to have a proper protection coordinator
   (c) Students are able to make use the protection relay operating characteristic, to decide the proper protection setting of the relay
7. Brief list of topics to be covered:
   (a) Basic philosophy, protection zone, restricted and unrestricted protection
   (b) Main protection, remote and local back up protection

(c) Current transformer and voltage transformer
(d) Non directional and directional overcurrent relay
(e) Longitudinal and percentage differential relay
(f) Distance relay and pilot relay

A.57 Electric Power Generation System

1. Course code: 309D4112
   Course title: Electric Power Generation System
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Ardiaty Arief
   (b) Yusran
4. Text book, title, author, publisher and year:
   (a) Pembangkit Tenaga Listrik, Abdul Kadir, Publisher: Universitas Indonesia (UI-Press), 2010.
   (b) Energi: Sumber Daya, Inovasi, Tenaga Listrik dan Potensi Ekonomi, Abdul Kadir, Publisher: Universitas Indonesia (UI-Press), 2010.
   (c) Elektronika dan tegangan Listrik, Muchsin Ismail, Publisher: UMB, 2014.
   (d) Perubahan Paradigma Kebijakan Energi Menuju Pembangunan yang Berkelanjutan, Sugiyono Andre, Publisher: Universitas Indonesia, 2004.
5. Specific course information:
   (a) This course discuss the basics of electricity generation. This lecture teaches the main parts/ components of the power plant, the working principle, the advantages and disadvantages of each.
   (b) Pre-requisite: Basic Electrical Power , Energy Conversion
   (c) Course type: Elective (E)
6. Specific goals for the course:
   (a) Student will able to explain basic electric power systems
   (b) Student will able to explain basic electric power generation
   (c) Student will able to explain the main components, work principle, types, and advantages/disadvantages of central hydroelectric power plant
   (d) Student will able to explain the main components, work principle, types, and advantages/disadvantages of central electric steam power plant
   (e) Student will able to explain the main components, work principle, types, and advantages/disadvantages of central gas power plant
   (f) Student will able to explain the main components, work principle, types, and advantages/disadvantages of central gas steam power plant
   (g) Student will able to explain the main components, work principle, types, and advantages/disadvantages of central diesel power plant
   (h) Student will able to explain the main components, work principle, types, and advantages/disadvantages of new and renewable power plant
7. Brief list of topics to be covered:
   (a) Central hydroelectric power plant
   (b) Central electric steam power plant
   (c) Central gas power plant

(d) Central gas steam power plant
(e) Central diesel power plant
(f) Central nuclear power plant
(g) New and renewable power plant center

A.58 Control and Stability of Power Systems

1. Course code: 310D4112
   Course title: Control and Stability of Power Systems
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Indar Chaerah Gunadin
   (b) Ardiaty Arief
4. Text book, title, author, publisher and year:
   (a) Power System Control and Stability, P.M. Anderson, A.A. Fouad, Publisher: The Iowa State University Press, 1977.
   (b) Power System Transient Stability Analysis Using the Transient Energy Function Method, A.A. Fouad, Publisher: Prentice-Hall, 1992.
   (c) Electrical Transient in Power Systems, A. Greenwood, Publisher: Wiley Interscience, 1971.
   (d) Power System Analysis, Hadi Saadat, Publisher: McGraw-Hill, 1999.
   (e) Analisis Sistem Tenaga Listrik, William D. Stevenson, Publisher: Erlangga, 1984.
5. Specific course information:
   (a) The course material covers the topics about of the various instabilities in a power system that can lead to major power outages, and also how to avoid these instabilities using control technology
   (b) Pre-requisite: Basic Control Systems
   (c) Course type: Elective (E)
6. Specific goals for the course:
   (a) The student will be able to explain basic of the reliability and stability of the electric power system
   (b) The student will be able to explain mathematical to a generator
   (c) The student will be able to explain the concept of steady-state stability and transient stability
7. Brief list of topics to be covered:
   (a) Reliability and stability of the electric power system
   (b) Mathematical equation on the generator
   (c) Steady-state stability
   (d) Transient Stability
   (e) Modelling equations on the generator with Matlab

A.59 Electric Power Distribution + Laboratory

1. Course code: 347D4122
   Course title: Electric Power Distribution + Laboratory
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Salama Manjang
   (b) Ikhlas Kitta
4. Text book, title, author, publisher and year:
   (a) Electric Power Distribution Engineering, 3rd Ed, Turan Gonen, Publisher: CRC Press, 2014.
   (b) Sistem Distribusi Daya Listrik, A.S. Pabla, Publisher: Erlangga, 1994.
5. Specific course information:
   (a) This course provides learning experiences to student about aspects of the electric power distribution system and design of electric power distribution system. This course is carried out in the form of lectures and laboratory
   (b) Pre-requisite: Electric Circuit 1 , Electric Circuit 2 , Basic Electrical Power
   (c) Course type: Elective (E)
6. Specific goals for the course:
   (a) The student will able to know the aspects and requirements of a low voltage air network
   (b) The student will able to understand the functions of the main and supporting equipment in a distribution substation
   (c) The student will able to now the aspects and requirements of a medium voltage air network
   (d) The student will able to know the equipment and specification of the distribution channel
   (e) The student will able to analyse the working principle of sectionalised arrester
   (f) The student will able to recognize equipment in substations and various kind of substations
   (g) The student will able to analyse the process of filling the distribution systems in one direction
   (h) The student will able to analyse the process of filling the distribution systems in two directions
   (i) The student will able to analyse the process of filling the distribution system with the ring system (bracelet)
   (j) The student will able to determine and calculate losses on a distribution network
   (k) The student will able to analyse the use of capacitors on the distribution network
   (l) The student will able to design electric power distribution systems
7. Brief list of topics to be covered:
   (a) Introduction to electric power distribution systems
   (b) Low voltage air network

(c) Electric power distribution substation
(d) Medium voltage air network
(e) Electrical power distribution line equipment
(f) Cut-out, arrester, sectionalizer
(g) Substation
(h) Charging distribution system in one direction
(i) Charging power in an electric voltage distribution system in two directions
(j) Charging power in electric power distribution system with a ring (bracelet) system
(k) Loss on distribution network
(l) Capacitors using on distribution network
(m) Design of electric power distribution system

A.60 Protection System 2 + Laboratory

1. Course code: 348D4122
   Course title: Protection System 2 + Laboratory
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Sri Mawar Said
   (b) Sonny Tanyadji
4. Text book, title, author, publisher and year:
   (a) Protective Relays, Their Theory And Practice, 3rd Ed, A.R. Van C Warrington, Publisher: John Wiley & Sons, 1994.
   (b) The Art and Science of Protective Relaying, C. Russel Mason, Publisher: J. Wiley, 1956.
   (c) Protective Relays for Power System, Publisher: GEC ALSTOM T&D, 1997.
   (d) The Protective Gear Handbook, F.E.Wellman, Publisher: Sir Isaac Pitman and Sons Ltd, 1968.
   (e) Numerical Differential Protection, Principles and Applications, Gerhard Ziegler, Publisher: Publicis Kommunikations Agentur GmbH, 2005.
   (f) Numerical Distance Protection, Principles and Applications, 3rd Ed, Gerhard Ziegler, Publisher: Publicis Kommunikations Agentur GmbH,GWA, Erlangen, 2008.
   (g) Protective Relaying for Power System, Stanley H. Horrowits, Publisher: IEEE Press, 1980.
   (h) Protective Relaying, 2nd Ed, Stanley H.Horowits, Arun G Phanke, Publisher: John Wiley & Sons Inc, 1995.
   (i) Sistem Proteksi Tenaga Listrik, 1st Ed, Sonny Tanyadji, Sarma Thaha, Publisher: Universitas Hasanuddin , 2015.
5. Specific course information:
   (a) This course discuss generator protection, transformer protection, bus protection, Line Protection, motor, reactor and capacitor protection
   (b) Pre-requisite: Basic Electrical Power , Electric Machines , Power Systems Analysis , Protection System 1
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) Students are able to explain what kind and how, electric and non- electric parameter change during abnormal condition at the main part of the electric system
   (b) Students are able to decide what is the most suitable protection system, to be able properly response to that kind of abnormal condition
   (c) Students are able to make use the protection relay operating characteristic, to decide the proper protection setting of the relay
7. Brief list of topics to be covered:
   (a) Generator protection:
   Short circuit condition, stator and rotor winding fault protection; Non short circuit condition, loss of excitation, unbalance load, out of step, overloaded, over and under voltage and frequency, prime mover failure

(b) Transformer protection:

Internal incipient fault: Core fault, oil insulation failure, over-fluxing; Internal active fault: Winding shorted, inter-turn shorted, Phase to ground shorted; Electric parameter protection relays; Non electric parameter protection relays

(c) Line Protection:

Line phase fault and ground fault; Non pilot current protection relay: Definite time overcurrent relay, time & current overcurrent relay, inverse combined with instantaneous overcurrent relay; Non pilot distance protection relay: Coordination system of un-event section length, Infeed factor due to line configuration; Distance relay with pilot system; Base on communication medium: Wire Pilot, Power Line Carrier Pilot, Fibre Optic Pilot, Radio Frequency Pilot (microwave pilot); Base on operation system: Blocking Pilot, Permissive Under reaching Transfer Trip, Permissive Overreaching Transfer Trip; Line Differential Protection; Differential current detection method: Magnitude comparison, phase comparison, phasor comparison; Non directional and Directional overcurrent relay

(d) Bus Protection:

Protection Philosophy: Fast, Stable, CB Selective, Simple interlock; Bus protection types: Frame earth system protection, Differential system protection, Phase Comparison protection, Directional blocking protection

(e) Motor Protection:

Phase and Ground Fault Protection; Unbalance Voltage Protection; Overload Protection

(f) Reactor Protection:

Phase and ground fault protection; Unbalance voltage protection

(g) Capacitor Protection:

Phase and ground fault protection for grounded wye three phase system; Unbalance current protection for ungrounded wye three phase system

A.61 Electric Machine Analysis 2 + Laboratory

1. Course code: 349D4122
   Course title: Electric Machine Analysis 2 + Laboratory
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Sri Mawar Said
4. Text book, title, author, publisher and year:
   (a) A Textbook of Electrical Technology Volume II AC and DC Machines, B.L. Theraja and A.K. Theraja, Publisher: S. Chand & Company Ltd., 2005.
   (b) Dasar Teknik Tenaga Listrik dan Elektronika Daya, Zuhal, Publisher: PT Gramedia, 2000.
5. Specific course information:
   (a) Brief description of the content of the course (catalog description): To recognize the principles and analyses the characteristic of Induction Motor and Synchronous Generator.
   (b) Pre-requisite: N/A
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) Course outcomes
   (b) Students will know the construction of Single Phase Induction Motor
   (c) Students will understand the working principle of Motor Capacitor and why a capacitor is used to start Motor
   (d) Students will know how to flip the rotation of Capacitor Motor
   (e) Students will know the construction of Three Phase Induction Motor
   (f) Students will understand the working principle of Three Phase Induction Motor
   (g) Students will understand the effect of the load on the Motor rotation speed
   (h) Students will understand how to adjust the Motor rotation speed
   (i) Students will know the construction of Synchronous Generator
   (j) Students will understand the principle of Synchronous Generator
   (k) Students will understand the effect of changes in load on the rotation speed of the Synchronous Generator
   (l) Students will understand the way to parallelize Synchronous Generator
   (m) Student outcomes addressed by the course
   (n) Understanding the construction and principles of Single Phase and Three Phase Induction Motor and the way to adjust the Motor rotation speed.
   (o) Understanding the construction and principles of Synchronous Generator and the effect of changes in load on the rotation speed of the Synchronous Generator.
7. Brief list of topics to be covered:
   (a) Introduction: Basic theory of AC machines.
   (b) Single Phase Induction Motor:

(c) Construction of Single Phase Indoction Motor
(d) Working principle of Capacitor Motor
(e) Application of Capacitor Motor.
(f) Three Phase Induction Motor:
(g) Construction of Single Phase Indoction Motor
(h) Working principle of Three Phase Induction Motor
(i) Slip
(j) Equivalent Circuit
(k) Rotation Adjusment
(l) Application of Three Phase Induction Motor.
(m)
(n) Synchronous Generator:
(o) Construction of Synchronous Generator
(p) Working principle of Synchronous Generator
(q) Armature Reaction
(r) No-load and Loaded Synchronous Generator
(s) Voltage Adjusment on Synchronous Generator
(t) Parallel Work of Synchronous Generator.

A.62 Electric Power Operation

1. Course code: 350D4122
   Course title: Electric Power Operation
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Muhammad Bachtiar Nappu
4. Text book, title, author, publisher and year:
   (a) Power Generation Operation and Control, Allen J. Wood, Bruce F. Wollenberg, Gerald B. Sheble, Publisher: John Wiley & Sons, Inc., 2014
5. Specific course information:
   (a) This course discusses about Economic importance of power systems operation, new and old problems in economic dispatch, power generation characteristics, economic dispatch and the general economic dispatch problem, thermal unit economic dispatch and methods of solution and optimization with constraints
   (b) Pre-requisite: Power Systems Analysis
   (c) Co-requisite: Electric Circuit 1 , Electric Circuit 2 ,Advanced Mathematics 1 , Advanced Mathematics 2 , Basic Electrical Power , Alternating Current Transmission System
   (d) Course type: Required (R)
6. Specific goals for the course:
   (a) The student will able to understand the principle of power generations systems
   (b) The student will able to explain the new and old problems in economic dispatch
   (c) The student will able to understand the characteristics for thermal and hydroelectric power generation
   (d) The student will able to solve the economic dispatch problems with mathematical optimization methods
   (e) The student will able to perform systems optimization with constraints
   (f) The student will able to explore the current issue around power systems operation
7. Brief list of topics to be covered:
   (a) Economic importance of power systems operation
   (b) New and old problems in economic dispatch
   (c) Electric power industry as a business
   (d) Power generation characteristics
   (e) Economic dispatch and the general economic dispatch problem:
      i. Economic dispatch by neglecting network losses and generations constraints
      ii. Economic dispatch by considering generations constraints
      iii. Economic dispatch by considering network losses and generations constraints
   (f) Thermal unit economic dispatch and methods of solution
   (g) Optimization with constraints
   (h) Optimal power flow techniques

A.63 High Voltage Engineering + Laboratory

1. Course code: 351D4122
   Course title: High Voltage Engineering + Laboratory
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Salama Manjang
   (b) Ikhlas Kitta
4. Text book, title, author, publisher and year:
   (a) A Text Book on Power System Engineering, A. Chakrabarti, M.L. Soni, P.V. Gupta, U.S. Bhatnagar, Publisher: DhanpatRai, 2008.
   (b) Electrical Power Systems, C.L. Wadhwa, Publisher: New Age International (P) Limited, 2008.
   (c) Power System Analysis and Design, B.R. Gupta, Publisher: S. Chand, 2009.
   (d) Power System Engineering, I.J. Nagrath, D.P. Kothari, Publisher: Tata McGraw-Hill, 2007.
   (e) Electric Power Distribution, A.S. Pabla, Publisher: McGraw-Hill, 2008.
   (f) Power System Analysis, W.D. Stevenson, Publisher: McGraw-Hill, 2007.
5. Specific course information:
   (a) This course material covers the topics about of the microprocessor architecture and organization, Bus architectures, types and buffering techniques, Memory and I/O subsystems, organization, timing and interfacing, Peripheral controllers and programming. Practice of the design of a microprocessor system.
   (b) Pre-requisite: Basic Electrical Power
   (c) Course type: Elective (E)
6. Specific goals for the course:
   (a) The student will be able to explain conceptualize the idea of high voltage and safety measures involved
   (b) The student will be able to analyse the breakdown mechanism of solids, liquids and gases
   (c) The student will be able to analyse and calculate the circuit parameters involved in generation of high voltages
   (d) The student will be able to measure direct, alternating and impulse high voltages signals
   (e) The student will be able to measure dielectric loss and partial discharge involved in non-destructive high voltage tests
7. Brief list of topics to be covered:
   (a) Breakdown in Gases
   (b) Breakdown in Solids
   (c) Generation of High Voltages
   (d) Measurement of High Voltages
   (e) Non-Destructive High Voltages Tests

A.64 Antenna and Propagation + Laboratory

1. Course code: 311D4113
   Course title: Antenna and Propagation + Laboratory
2. Credits: 3
   Contact hours: 42 hours
3. Instructors:
   (a) Merna Baharuddin
   (b) Elyas Palantei
4. Text book, title, author, publisher and year:
   (a) Antennas, John D Krauss, Publisher: Mcgraw Hill, 1988.
   (b) Digital Transmission Engineering, G.B. Anderson, Publisher: IEEE Press, 1999.
   (c) Teknik Antena : Transmisi Gelombang Radio dan Microwave (diktat kuliah), Milchan, M. & Miura, M. , Publisher: Politeknik Elektronika dan Telekomunikasi Institut Teknologi Sepuluh November, 1991.
5. Specific course information:
   (a) This course contains the definition and parameters of the antenna, radiation intensity, point source, linear antenna, dipole antenna, antenna with reflector and antenna measurement
   (b) Pre-requisite: Advanced Mathematics 1 , Advanced Mathematics 2 , Basic Telecommunication , Probability and Statistics
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) The student will able understand principle of antenna working and antenna as part of telecommunication system
   (b) The student will able to understand important characteristic of antenna
   (c) The student will able to understand antenna properties
   (d) The student will able to understand source with four kinds of power patterns
   (e) The student will able to understand the nature and purpose of an array in increasing gain
   (f) The student will able to know how to design antenna
7. Brief list of topics to be covered:
   (a) Basic antenna concept
   (b) Antenna parameter
   (c) Point sources
   (d) Array as radiation point source
   (e) Electric dipole antenna and thin linear antenna
   (f) Antenna and propagation
   (g) Various kinds of antenna and application
   (h) Measurement techniques for antenna work

A.65 Telecommunication Transmission Line

1. Course code: 312D4112
   Course title: Telecommunication Transmission Line
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Merna Baharuddin
   (b) Andini Dani Achmad
4. Text book, title, author, publisher and year:
   (a) Transmission Lines and Wave Propagation, Philip C. Magnusson, Publisher: Allyn and Bacon Series in Electrical Engineering, 1965.
   (b) Network Analysis, GK Mithal, Publisher: McGraw-Hill, 1951.
   (c) Saluran Transmisi Telekomunikasi, M. Alaydrus, Publisher: Graha Ilmu, 2009.
   (d) Foundations for Microwave Engineering, RE Collins, Publisher: McGraw-Hill, 1992.
   (e) Telecommunications: Advances and Trends in Transmission, Networking and Applications, C. Charles Casimiro, C. Ricardo Fialho, and B. Paulo Ceza, Publisher: Unifor, 2006.
5. Specific course information:
   (a) This course discusses about primary constants, infinite channels, reflective channels on SWR, impedance transformation, matching circuit, wire channels, smith diagrams, wave guides, and optical dielectric wave guide
   (b) Pre-requisite: Basic Telecommunication , Electromagnetics
   (c) Course type: Elective (E)
6. Specific goals for the course:
   (a) Student will understand transmission media in line transmission
   (b) Student will understand wave propagation in line transmission
   (c) Student will understand UMTS, WCDMA, and Wi-Max Technology
   (d) Students will understand technology of optic telecommunication: PON and HFC
   (e) Student will be able to implement a channel system of Smith Diagrams, wave guides and fibre optics in electronic communication systems
7. Brief list of topics to be covered:
   (a) Transmission Line
   (b) Reflection and Reflection Factor
   (c) Impedance Transformation
   (d) Matching Circuit
   (e) Transient
   (f) Maxwell Equation and Solution
   (g) Coaxial and Double Parallel Cable
   (h) Wave guides
   (i) Optical Dielectric Wave Guides

A.66 Cellular Communication

1. Course code: 352D4122
   Course title: Cellular Communication
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Dewiani Djamaluddin
   (b) Wardi Djuaeni
4. Text book, title, author, publisher and year:
   (a) Introductory Circuit Analysis, Robert L. Boylestad, 10th Ed, Publisher: Prentice Hall Pearson Education International, 2003
   (b) CIRCUITS-Engineering Concepts and Analysis of Linier Electric Circuits, A. Bruce Carlson, Publisher: Brooks/ Cole Thomson Learning, 2000.
   (c) Principles of Electric Circuits-Electron Flow Version, 6th Ed, Thomas L.Floyd, Publisher: Prentice Hall Electronics Supersite, 2003.
   (d) Theory and Problems of Electric Circuits, 3rd Ed, Joseph A. Edminister, Publisher: Schaum's Outline Series McGraw-Hill, 1965.
5. Specific course information:
   (a) The course material covers topics about the development of cellular communication, frequency management, the principle of transmission and applying and analysing the calculation of power in cellular communication
   (b) Pre-requisite: Traffic Engineering , Telephone Telecommunication Network
   (c) Course type: Elective (E)
6. Specific goals for the course:
   (a) The students are able to explain basic of cellular communication
   (b) The students were able to analysis parameters on frequency management channel assignment
   (c) The students are able to explain and configuration GSM900 and CDMA
   (d) The students are able to explain about connection mikcell and technology cellular network
   (e) The students are able to explain principle cellular transmission
7. Brief list of topics to be covered:
   (a) Frequency Management
   (b) Case Study: Frequency Management and Channel assignment
   (c) GSM900
   (d) Measurement Receiver Power with use theory okumura-Hata and Non LOS
   (e) CDMA
   (f) Antenna on BTS
   (g) Signal Transmission in cellular network
   (h) Mikrocell

A.67 Wireless Technology

1. Course code: 353D4122
   Course title: Wireless Technology
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Andani Achmad
   (b) Syafruddin Syarif
   (c) Zulfajri Basri Hasanuddin
4. Text book, title, author, publisher and year:
   (a) Fundamentals of Wireless Communication, Tse, David., Viswanath, Prmod, Publisher: Cambridge Univeristy Press. 2005.
   (b) Wireless Networking Technology—From Principles to Successful Implementation, Rackley, Steve, Publisher: Newness, Elsevier. 2007.
   (c) Wireless Communications: Principles and Practice 2nd Ed. Rappaport, Theodore S., Prentice Hall, 2002.
   (d) Wireless Communications and Networking., Garg, Vijay K. Publisher: Elsevier Inc. 2007
5. Specific course information:
   (a) This course discuss about wireless communication technology and types of wireless networks
   (b) Pre-requisite: Basic Telecommunication
   (c) Course type: Elective (E)
6. Specific goals for the course:
   (a) Student will able to apply analyze wireless communication system
7. Brief list of topics to be covered:
   (a) Wireless communication history, advantages and disadvantages
   (b) Types of wireless communications
   (c) Topology computer network
   (d) Computer and wireless network formed
   (e) Wireless transmission media
   (f) Wireless networks

A.68 Access Network Technology

1. Course code: 322D4112
   Course title: Access Network Technology
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Merna Baharuddin
   (b) Andini Dani Achmad
4. Text book, title, author, publisher and year:
   (a) Local Access Network Technologies, Paul France, Publisher: The Institution of Engineering and Technology, London, United Kingdom, 2004.
   (b) End-to-End DSL Architectures, Wayne C. Vermillion, Publisher: Cisco Press, 2003.
   (c) WCDMA for UMTS, Harri Holma, Antti Toskala, Publisher: John Wiley and Sons, Ltd., 2004.
   (d) Fundamentals of WiMAX: Understanding Broadband Wireless Networking, Jeffrey G. Andrews, Arunabha Ghosh, Rias Muhamed, Publisher: Pearson Education, 2007.
   (e) Ethernet Passive Optical Networks, Glen Kramer, Publisher: The McGraw-Hill Companies, Inc., 2005.
5. Specific course information:
   (a) This course discusses about access network in telecommunication technology which cover multiple access technology and duplexing technology, Digital Subscriber Line technology, UMTS, WCDMA, Wi-MAX, PON, and HFC
   (b) Pre-requisite: Basic Electronics
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) The student will understand the concept of multiple access technology and duplexing technology
   (b) The student will understand the Digital Subscriber Line Technology and its types
   (c) The student will understand UMTS, WCDMA, and Wi-Max Technology
   (d) The student will understand technology of optic telecommunication: PON and HFC
   (e) The student will understand the technology of network telecommunication
7. Brief list of topics to be covered:
   (a) Concept of Multiple Access Technology and Duplexing Technology
   (b) Digital Subscriber Line
   (c) Universal Mobile Telecommunication System (UMTS) and Wideband Code Division Multiple Access (WCDMA)
   (d) Worldwide Interoperability Microwave Access (WIMAX)
   (e) Passive Optical Network (PON) and Hybrid Fiber Coaxial (HFC)

A.69 Data Communication

1. Course code: 321D4112
   Course title: Data Communication
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Wardi Djuaeni
   (b) Ida Rachmaniar Sahali
4. Text book, title, author, publisher and year:
   (a) Data Communications and Networking 4th Ed, Behrouz A. Forouzan, Publisher: McGraw – Hill Forouzan Networking Series, 2007.
5. Specific course information:
   (a) The course material discuss about the data communication concepts, network models, and three first layers in OSI Model
   (b) Pre-requisite: Basic Telecommunication, Advanced Mathematics
   (c) Course type: Elective (E)
6. Specific goals for the course:
   (a) The student will be able to explain concepts of data communication in telephone and computer networks.
   (b) The student will be able to explain the function of each layers in OSI Model.
   (c) The student will be able to define analog and digital transmission
7. Brief list of topics to be covered:
   (a) Overview of data communication, networks, the internet, protocols and standards.
   (b) Network Model : brief explanation about layered tasks, OSI Model, layers in OSI Model, TCP/IP Protocol Suite, and addressing.
   (c) Data and Signals : analog and digital, periodic analog signals, digital signals, transmission impairment, data rate limits, network performance.
   (d) Digital Transmission : digital-to-digital conversion, analog-to-digital conversion, transmission modes.
   (e) Analog Transmission : digital-to-analog conversion, analog-to-analog conversion.
   (f) Bandwidth Utilization (Multiplexing and Spread Spectrum). Frequency division multiplexing (FDM), wavelength division multiplexing (WDM), synchronous time-divison multiplexing, statistical time-division multiplexing, frequency hopping spread spectrum (FDSS), direct sequence spread spectrum (DSSS).
   (g) Transmission Media : Guided media (twisted-pair, coaxial cable, fiber-optic cable). Unguided media / wireless (radio waves, microwaves, infrared).
   (h) Switching : Circuit-switched networks, datagram networks, virtual-switched networks, structure of a switch.
   (i) Multiple Access : Random Access (ALoHA, CSMA, CSMA / CD, CSMA / CA), Controlled Access, Channelization.

A.70 Control Systems + Laboratory

1. Course code: 329D4113
   Course title: Control Systems + Laboratory
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Rhiza Samsoe'oed Sadjad
   (b) Andi Ejah Umraeni Salam
4. Text book, title, author, publisher and year:
   (a) Control System Design, Bernard Friedland, Publisher: McGraw-Hill, 1987.
   (b) Modern Control Engineering, Katsuhiko Ogata, Publisher: Prentice Hall, 1997.
   (c) Automatic Control Systems, Benjamin C Kuo, Publisher: Prentice Hall, 1991.
5. Specific course information:
   (a) This course discuss State space modelling with transformation, Solution of first-order differential equation (review),Transition matrix and Similarity Transformation, Stability Control Systems and Controllability and Observability
   (b) Pre-requisite: Electric Measurements , Basic Control Systems , Advanced Mathematics 1
   (c) Course type: Elective (E)
6. Specific goals for the course:
   (a) Student will be able to understand the State space modelling (review) and model conservation Transfer Function to State Space and State Space to Transfer Function
   (b) Student will be able to understand the Solution of first-order differential equation (review),Transition matrix and Similarity Transformation
   (c) Student will be able to understand the Stability Control Systems and Controllability and Observability
   (d) Student will be able to understand State variable feedback and pole placement design and Observer System: full-order, reduced order
7. Brief list of topics to be covered:
   (a) State space modelling (review)
   (b) Model conservation: Transfer Function to State Space and State Space to Transfer Function
   (c) Solution of first-order differential equation (review)
   (d) Transition matrix
   (e) Similarity Transformation
   (f) Stability Control Systems
   (g) Controllability and Observability
   (h) State variable feedback and pole placement design
   (i) Observer System: full-order, reduced order

A.71 Process Control Technology

1. Course code: 330D4112
   Course title: Process Control Technology
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Andani Achmad
   (b) Rhiza Samsoe'oed Sadjad
4. Text book, title, author, publisher and year:
   (a) Process Control Instrumentation Technology, Johnson, Curtis D,Publisher: John Wiley and Sons Inc, 1982.
   (b) Principles and Practice of Automatic Process Control, Smith, Carlos A. and Armando B. Corripio, Publisher: John Wiley and Sons , Inc, 2005.
5. Specific course information:
   (a) The Catalog description: learn the process control, system and to implement the theory of control in the analysis and design of process control system implementation in manufacturing industry.
   (b) Pre-requisite: Basic Control Systems , Control Systems + Laboratory
   (c) Course type: Elective (E)
6. Students are able to understand the the differences between Process Control System in General, First-order process, Self-regulation, Non-self-regulation
7. Students are able to understand Process with dead-time,Second-order process, and higher order process and final control
8. Students are able to understand the Design aspects of process control system, Control Algorithm, Classification of Process Control System
9. Students are able to understand the Industrial application of Process Control System and Instrumentation Equipment
10. Students are able to understand the Modelling and Simulation: liquid level-control, liquid flow-control, PID controller, temperature+level control
11. Brief list of topics to be covered:
    (a) The differences between Process Control System in General
    (b) First-order process
    (c) Self-regulation
    (d) Non-self-regulation
    (e) Process with dead-time
    (f) Second-order process, and higher order process.
    (g) Final control
    (h) Design aspects of process control system
    (i) Control Algorithm
    (j) Classification of Process Control System
    (k) Industrial application of Process Control System
    (l) Instrumentation Equipment
    (m) Modelling and Simulation: liquid level-control, liquid flow-control, PID controller, temperature+level control

A.72 Optimal Control System

1. Course code: 373D4122
   Course title: Optimal Control System
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Rhiza Samsoe'oed Sadjad
   (b) Andi Ejah Umraeni Salam
4. Text book, title, author, publisher and year:
   (a) Modern Control Engineering, Ogata, K., Publisher: Prentice Hall of India, 2009.
   (b) Practical Methods of Optimization, Fletcher, R., Publisher: John Wiley & Sons, Chichester, 2000. Optimal Control, Michael and Peter L. Falb, Publisher: McGraw-Hill Book Company, 2006.
5. Specific course information:
   (a) The Catalog description: optimization methods and their application to various problems, both general and related to the world of Electrical Engineering, especially in the analysis and design of optimal control systems.
   (b) Pre-requisite: Basic Control Systems , Control Systems + Laboratory
   (c) Course type: Elective (E)
6. Specific goals for the course:
   (a) Students are able to understand the Linear Programming,Problems Routing,Traveling Salesman Problems,Block City Police Patrol Problems
   (b) Students are able to understand the components of the data acquisition system
   (c) Students are able to understand the working principle of sensors
   (d) Students are able to know the classification of sensors
   (e) Students are able to understand the searching Methods like Line Searching, Gradient Descent Monte Carlo,Cannon Shooting Cases
   (f) Students are able to understand the Optimal Control System like Linear Quadratic Regulator, Ricati equation, LQR for diskrit systems
7. Brief list of topics to be covered:
   (a) Linear Programming
   (b) Problems Routing,
   (c) Traveling Salesman Problems,
   (d) Block City Police Patrol Problems
   (e) Searching Methods: Line Searching
   (f) Gradient Descent
   (g) Monte Carlo
   (h) Cannon Shooting Cases
   (i) OPTIMAL CONTROL SYSTEM: Linear Quadratic Regulator
   (j) Ricati equation
   (k) LQR for discrete systems

A.73 Digital Control Systems + Laboratory

1. Course code: 372D4123
   Course title: Digital Control Systems + Laboratory
2. Credits: 3
   Contact hours: 42 hours
3. Instructors:
   (a) Rhiza Samsoe'oed Sadjad
   (b) Andi Ejah Umraeni Salam
4. Text book, title, author, publisher and year:
   (a) Computer-Controlled Systems, Karl J. Astrom, Bjorn Wittenmark, Publisher: Prentice Hall, 1996.
   (b) Digital Control Systems, Benjamin C. Kuo, Publisher: Holt, Rinehart and Winston, 1980.
   (c) Digital Control of Dynamic Systems, Gene F. Franklin, Publisher: Addison Wesley Publishing Company, 1990.
   (d) Digital Control Systems: Analysis and Design, Charles L. Phillips, H. Troy Nagle, Publisher: Prentice Hall, 1984.
5. Specific course information:
   (a) This course discusses about principles and brief history of the development of digital control system and hardware configuration, Digital Controller, Sampling, ZOH, Z transformation, Transfer Function Modelling, State Space Modelling, Stability Analysis and open loop digital filter system discrete
   (b) Pre-requisite: Electric Measurements , Integrated Electronics Laboratory
   (c) Course type: Elective (E)
6. Specific goals for the course:
   (a) Students are able to understand the Common Configuration of Digital Control System and Other terms of Digital Control System
   (b) Students are able to understand the brief history of the development of Digital Control System and hardware configuration
   (c) Students are able to understand the Digital Controller, Sampling, ZOH, Z transformation,
   (d) Students are able to understand Transfer Function Modelling and Signal Flow Diagram
   (e) Students are able to understand the State Space Modelling and Solution of State Equation
   (f) Students are able to understand the Stability Analysis and Open loop Digital Filter System Discrete
7. Brief list of topics to be covered:
   (a) Common Configuration of Digital Control System
   (b) Other terms of Digital Control System
   (c) Brief history of the development of Digital Control System
   (d) Hardware Configuration
   (e) Digital Controller

(f) Sampling and Zero Order Hold
(g) Z transformation
(h) Transfer Function Modelling
(i) State Space Modelling
(j) Signal Flow Diagram
(k) Solution of State Equation
(l) Stability Analysis
(m) Open loop Digital Filter System Discrete

A.74 Control System Design

1. Course code: 375D4122
   Course title: Control System Design
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Rhiza Samsoe'oed Sadjad
   (b) Andani Achmad
4. Text book, title, author, publisher and year:
   (a) All thesis/final assignment/final project report in the field of control systems
5. Specific course information:
   (a) This course is a "project" course. At the end of semester student is expected to complete a design, simulation, and make a control system.
   (b) Pre-requisite: Basic Control Systems , Linear Systems , Numerical Methods , Control Systems + Laboratory
   (c) Course type: Elective (E)
6. Specific goals for the course:
   (a) Students by working in groups are expected to be able to understand a control system design selected from the final tasks in the field of control systems, realize it in the laboratory, arrange practical guidance based on the design at the end of the semester and test it to fellow college participants.
7. Brief list of topics to be covered:
   (a) Design selection
   (b) Hardware and software preparation
   (c) Try and modify as needed as the design chosen so that they fit as laboratory material
   (d) Arrange laboratory/practical guide
   (e) Test practical of guides to fellow college participants
   (f) Compile the final report on the evaluation of laboratory work

A.75 Industrial Robotics

1. Course code: 331D4112
   Course title: Industrial Robotics
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Rhiza Samsoe'oed Sadjad
   (b) Andi Ejah Umraeni Salam
4. Text book, title, author, publisher and year:
   (a) Industrial Robotics, Groover, Mikell P., et.al., Publisher: McGraw-Hill Book Company, 1986.
   (b) Robotic and Automated Manufacturing, Sharon, D., et.al., Publisher: Financial Times Prentice Hall , 1987.
5. Specific course information:
   (a) The Catalog description: to learn the basic theory and application of robotics in industry and to participate in the activity corresponds to annual national robotic contest
   (b) Pre-requisite: Electric Measurements , Integrated Electronics Laboratory , Electronic Instrumentation System + Laboratory
   (c) Course type: Elective (E)
6. Specific goals for the course:
   (a) Students are able to understand the The basic of robotics technology: robot anatomy, work volume, robot manipulator system, control system dan dynamic performance, precision, end effector, sensors, programming.
   (b) Students are able to understand the Robot application
   (c) Students are able to know the Control system components
   (d) Students are able to understand the Motion analysis and control of robot
   (e) Students are able to know the Robot Vision
7. Brief list of topics to be covered:
   (a) History of robotics
   (b) Definition of industrial robot
   (c) The basic of robotics technology: robot anatomy, work volume, robot manipulator system, control system dan dynamic performance, precision, end effector, sensors, programming.
   (d) Robot application,
   (e) Control system components
   (f) Motion analysis and control of robot
   (g) Robot Vision

A.76 Electronic Instrumentation System + Laboratory

1. Course code: 333D4113
   Course title: Electronic Instrumentation System + Laboratory
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Rhiza Samsoe'oed Sadjad
   (b) Andi Ejah Umraeni Salam
4. Text book, title, author, publisher and year:
   (a) Handbook of Modern Sensor, Physics, Designs, and Application, Fraden,Jacob, Publisher: Springer-Verlag, 2010.
5. Specific course information:
   (a) The Catalog description: Principles and work methods of data acquisition, data compilation components, Types of sensors and classifications, Types of Signal Conditioners and Their Working Principles, ADCs and DAC
   (b) Pre-requisite: Electric Measurements , Integrated Electronics Laboratory
   (c) Course type: Elective (E)
6. Specific goals for the course:
   (a) Students are able to understand the working principles of the Data Acquisition system
   (b) Students are able to understand the components of the data acquisition system
   (c) Students are able to understand the working principle of sensors
   (d) Students are able to know the classification of sensors
   (e) Students are able to understand the working principle of various signal conditioners, such as OP-AMP, wheatstone bridge, Thevenin circuit, Filter.
   (f) Students are able to know the working principles of various ADCs and DAC
   (g) Students are able to understand the working principle of sensor types based on their input / stimulus
7. Brief list of topics to be covered:
   (a) Data Acquisition system
   (b) Students are able to understand the components of the data acquisition system
   (c) sensors and their classification
   (d) Signal conditioning system, such as OP-AMP, wheatstone bridge, Thevenin circuit, Filter,
   (e) ADC and DAC

A.77 Microprocessor Based System + Laboratory

1. Course code: 319D4113
   Course title: Microprocessor Based System + Laboratory
2. Credits: 3
   Contact hours: 42 hours
3. Instructors:
   (a) Zahir Zainuddin
4. Text book, title, author, publisher and year:
   (a) Getting Started with Arduino, Massimo Banzi, Publisher: O Reilly, 2011.
   (b) Practical Arduino. Cool Projects for Open Source Hardware, Jonathan Oxer, Hugh Blemings, Publisher: Apress, 2009.
   (c) Atmospheric Monitoring with Arduino, Patric, Emily, Publisher: O Reilly, 2013.
   (d) Foundations for Microwave Engineering, RE Collins, Publisher: McGraw-Hill, 1992.
   (e) Beginning Arduino, Ichael Mc Roberts, Publisher: Tia, 2010
5. Specific course information:
   (a) This course discuss systems design knowledge that use microprocessor systems as the main component. This course is advanced course of digital-based courses.
   (b) Pre-requisite: Digital Systems , Microprocessor Systems and Interfaces
   (c) Course type: Elective (E)
6. Specific goals for the course:
   (a) Student will able to know and understand systems design knowledge that need microprocessor as the main system.
   (b) Student will able to be innovated in completing microprocessor-based projects.
7. Brief list of topics to be covered:
   (a) Microprocessor device that implemented in microcontroller
   (b) Microcontroller programming
   (c) Microcontroller applications
   (d) Microcontroller-based project

A.78 Digital System Design + Laboratory

1. Course code: 335D4113
   Course title: Digital System Design + Laboratory
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Faizal Arya Samman
   (b) Andreas Vogel
4. Text book, title, author, publisher and year:
   (a) Fundamentals of Digital Logic with Verilog Design, 3rd Ed, Stephen D. Brown, Zvonko G. Vranesic, Publisher: McGraw-Hill Education, 2013.
   (b) Digital Design-An Embedded System Approach using Verilog, 1st Ed, Peter J. Ashenden, Publisher: Elsevier, 2008
   (c) FPGA Prototyping by Verilog Examples, 1st Ed, Pong P. Chu, Publisher: Wiley-Interscience, 2008
5. Specific course information:
   (a) This course material introduces digital design techniques for combinational and sequential circuits using the hardware description language (HDL) Verilog
   (b) Pre-requisite: Digital Systems ,Integrated Electronics
   (c) Course type: Elective (E)
6. Specific goals for the course:
   (a) The student will be able to explain the design flow of developing digital systems and implementing it in FPGA platforms
   (b) The student will be able to understand the difference between system (frontend) and interface (backend) design
   (c) The student will be able to apply different verification strategies in the development of digital systems
   (d) The student will be able to code combinational and sequential digital systems in Verilog HDL
   (e) The student will be able to implement digital systems into FPGA boards
7. Brief list of topics to be covered:
   (a) Introduction to digital systems:
   History of the scale of system integration, design abstraction levels, design tools, hardware description languages, implementation technology
   (b) Design flow overview:
   Design steps of frontend (system design) and backend (interface design and implementation)
   (c) Verilog HDL coding:
   Employing module, input and output declarations and active code descriptions of the system function
   (d) Combinational and sequential system functions:
   Difference between functional, structural and behavioural coding styles

(e) Arithmetic and logic functions:
Number format (signed and unsigned), adder, multiplier, ALU, comparator

(f) Combinational systems:
Multiplexer, demultiplexer, decoder, priority encoder, binary coded decimal (BCD) conversion, seven-segment decoder

(g) Sequential systems:
Register and latch, counter, shift register

(h) Advanced topics: Register-transfer logic (RTL) and pipe-lining techniques, block description transfer of finite state machines (FSM) into Verilog HDL code

(i) Interface design and implementation matters:
Pin assignment, timing constraints, synchronization circuits

A.79 Embedded Systems Design

1. Course code: 380D4123
   Course title: Embedded Systems Design
2. Credits: 3
   Contact hours: 42 hours
3. Instructors:
   (a) Faizal Arya Samman
   (b) Andreas Vogel
   (c) Muhammad Anshar
4. Text book, title, author, publisher and year:
   (a) Computer Organization and Embedded Systems, 6th Ed, Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, Publisher: McGraw-Hill Education, 2011.
   (b) Embedded SoPC Design with Nios II Processor and VHDL Examples, 1st Ed, Pong P. Chu, Publisher: Wiley, 2011
   (c) Embedded System Design-Embedded Systems Foundations of Cyber-Physical Systems, 2nd Ed, Peter Marwedel, Publisher: Springer, 2013
5. Specific course information:
   (a) This course discussed about system on chip (SoC) architectures containing microprocessors, hardcore peripherals, direct memory access (DMA) components, accelerators, and their respective controllers, the application development (including device drivers) of embedded systems will be introduced.
   (b) Pre-requisite: Digital System Design + Laboratory ,Systems-on-Chip
   (c) Course type: Elective (E)
6. Specific goals for the course:
   (a) The student will be able to explain the hardware and software codesign flow suitable for implementation platforms of FPGA-SoCs
   (b) The student will be able to explain the use of hardware abstraction layer (HAL) device drivers with C programs in order to simplify many programming tasks, such as the access of I/O devices in the embedded hardware system
   (c) The student will be able to make use of interrupts to perform I/O operations
   (d) The student will be able to explain the different boot stages of a hardware processing system (HPS)
   (e) The student will be able to create board support packages (BSP) for an embedded system implemented in FPGA-SoCs
7. Brief list of topics to be covered:
   (a) Embedded system design overview:
   Definition and characteristics, historical development, platforms and architectures, applications, IC integration towards SoCs, emerging new technologies
   (b) IP Core based design methodology:
   Benefits of encapsulating specific standard functionality
   (c) Platform FPGA-SoC:
   High levels of system integration, all programmable devices

(d) Introduction to the Altera Nios II soft processor:
Instruction set, register structure, accessing memory and I/O devices, addressing modes

(e) Hardware Abstraction Layers:
Device driver functions for I/O devices, develop custom device drivers, compiler and debugging HAL code

(f) Input-output transfers:
Memory-mapped access of peripheral devices, program-controlled polling versus interrupt-driven approaches

(g) Introduction to the ARM Cortex-A9 based HPS:
High-level block diagram, ARM instructions, register structure, accessing memory and I/O devices

(h) Overview on boot options of the hard processing system (HPS):
Boot flow, different boot stages, boot sources

(i) Configuration schemes of the FPGA:
Obtaining the configuration image, image formats

(j) Hardware-design handoff:
Memory layouts, physical address mapping, bridges between HPS and FPGA, preloader & device tree generation, board support package (BSP)

(k) Bare Metal overview:
Prerequisites, compilers, development flow using the ARM DS-5 Altera Edition

(l) Hardware Library Usage:
SoC Application Layer (low-level HAL) and Hardware Manager (HWMgr)

(m) Application over OS overview:
Creating an SD card, partition layout & contents, configuring the FPGA using the OS (Linux), native and cross compilation, interrupt handler, mapping physical addresses to virtual addresses

A.80 Computer Architecture 1 + Laboratory

1. Course code: 336D4113
   Course title: Computer Architecture 1 + Laboratory
2. Credits: 3
   Contact hours: 42 hours
3. Instructors:
   (a) Adnan
   (b) Ida Rachmaniar Sahali
4. Text book, title, author, publisher and year:
   (a) Computer Architecture: A Quantitative Approach, 5th Ed, J.L. Hennessy, D.A. Patterson, Publisher: Morgan Kaufmann, 2012.
   (b) Digital Designand Computer Architecture, 2nd Ed, D.M. Harris, S.L. Harris, Publisher: Morgan Kaufmann, 2012.
5. Specific course information:
   (a) This course material covers about the the basics of hardware components from basic gates to memory and I/O devices, instruction set architectures and assembly language, and designs to improve performance
   (b) Pre-requisite: Microprocessor Systems and Interfaces
   (c) Course type: Elective (E)
6. Specific goals for the course:
   (a) The student will be able to explain of fundamental circuit components and techniques for optimizing circuits
   (b) The student will be able to explain and understand the processor memory hierarchy
   (c) The student will be able to explain basic understanding of interrupts, I/O devices, and I/O protocols
   (d) The student will be able to explain general knowledge of advances in microelectronics and their implication on computer design
   (e) The student will be able to explain design process in the context of a reasonable size hardware system
7. Brief list of topics to be covered:
   (a) Introduction to Computer Hardware
   (b) Gates, Circuits, and Combinational Logic
   (c) Sequential Logic
   (d) Instruction Set Architecture
   (e) Structure of the CPU
   (f) Accelerating Performance
   (g) Buses and I/O Mechanisms
   (h) Computer Memory

A.81 Power Electronics + Laboratory

1. Course code: 379D4123
   Course title: Power Electronics + Laboratory
2. Credits: 3
   Contact hours: 42 hours
3. Instructors:
   (a) Muhammad Tola
4. Text book, title, author, publisher and year:
   (a) Power Electronic Circuits, Issa Batarseh, Publisher: Wiley, 2004.
   (b) Fundamentals of Power Electronics, 2nd Ed, Robert W. Erickson, Dragan Maksimovic, Publisher: Springer, 2001.
   (c) Principles of Power Electronics, John G. Kassakian, Martin F. Schlecht, George C. Verghese, Publisher: Pearson, 1991.
   (d) Power Electronics: Converters, Applications and Design, 3rd Ed, Ned Mohan, Tore M. Undeland, William P. Robbins, Publisher: Wiley, 2002.
5. Specific course information:
   (a) The course material covers the topics about the principles of power electronics and its applications. This includes power electronics circuits, power semiconductor devices, and converter topologies.
   (b) Pre-requisite: Electric Circuit 1 , Electric Circuit 2 , Basic Electronics
   (c) Course type: Elective (E)
6. Specific goals for the course:
   (a) The student will be able to analyse power semiconductor devices and their applications
   (b) The student will be able to analyse switching circuits, their operation mechanism and power consumption
   (c) The student will be able to analyse and design non-isolated DC-DC converters, CCM and DCM modes, non-ideal converters, fourth-order converters
   (d) The student will be able to calculate the power losses of switching converters and estimate the conversion efficiency
   (e) The student will be able to analyse the dynamics of switching converters, perform frequency analysis and design stable close loop control
7. Brief list of topics to be covered:
   (a) Power Electronics Systems
   (b) Switching Concepts and Power Semiconductor Devices
   (c) Switching Circuits, Power Computations and Component Concepts
   (d) Non-isolated DC-DC Converters
   (e) Isolated DC-DC Converters
   (f) Converter Dynamics and Control

A.82 SCADA Computer Networks Based

1. Course code: 334D4112
   Course title: SCADA Computer Networks Based
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Gassing
   (b) Christoforus Yohannes
4. Text book, title, author, publisher and year:
   (a) Instrument engineers' handbook: Process Control, Bela G. Liptak, Kriszta Venczel, Publisher: Chilton Book Co, 1985.
   (b) Overview of Industrial Process Automation, 2nd Ed, K.L.S. Sharma, Publisher: Elsevier, 2016.
   (c) Practical Distributed Control Systems (DCS) for Engineers and Technicians, IDC Technologies, Publisher: IDC Technologies, n.d.
   (d) Distributed Computer Control for Industrial Automation, Dobrivoje Popovic, Vijay P Bhatkar, Publisher: M. Dekker, 1990.
5. Specific course information:
   (a) This course material covers the topics about of general structure of DCS/ SCADA system, functional elements, data links, software and algorithms, communication and control aspects of modern plant automation system.
   (b) Pre-requisite: Basic Control Systems , Microprocessor Systems and Interfaces
   (c) Course type: Elective (E)
6. Specific goals for the course:
   (a) The student will be able to analyse current philosophy, technology, terminology, and practices used in automation
   (b) The student will be able to explain evaluate computer based automation system used in industries ranging from discrete, continuous process to hybrid processes
   (c) The student will be able to select hardware and software for modern automation system required for industrial application
   (d) The student will be able to analyse the performance of three-phase synchronous generators and motors
   (e) The student will be able to demonstrate of hardware and software of computer based automation system
7. Brief list of topics to be covered:
   (a) DCS-Basic Packages
   (b) Standing-alone single loop PID controller
   (c) Interfacing of different devices
   (d) Study of important features of SCADA software package
   (e) Development of GUI using different type of scripting on SCADA software
   (f) Interfacing of PLC with SCADA software Package
   (g) Communication of SCADA software with Ms-excel/SQL/MS-Access
   (h) Interfacing of I/O modules with SCADA/DCS package

A.83 Industrial Automation + Laboratory (PLC)

1. Course code: 337D4112
   Course title: Industrial Automation + Laboratory (PLC)
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Christoforus Yohannes
   (b) Ida Rachmaniar Sahali
4. Text book, title, author, publisher and year:
   (a) Programmable Logic Controllers, 5th Ed, W. Bolton, Publisher: Newnes – Elseiver Ltd, 2009.
   (b) Programmable Controllers: Theory and Implementation, 2nd Ed, L.A Bryan, E.A Bryan, Publisher: Industrial Text Company, 1997.
5. Specific course information:
   (a) This course material discuss about the hardware and programming language of PLC, design control system using PLC simulator.
   (b) Pre-requisite: Logic Circuits , Basic Control Systems
   (c) Course type: Elective (E)
6. Specific goals for the course:
   (a) The student will be able to explain concepts of control system using Programmable Logic Controller (PLC)
   (b) The student will be able to explain hardware of PLC, input and output devices for PLC systems
   (c) The student will be able to explain PLC programming methods and PLC programming techniques
   (d) The student will be able to design control system using PLC simulator
7. Brief list of topics to be covered:
   (a) Introduction of Programmable Controllers: Definition, Historical Background, Principles of Operation, PLC versus other types of Control,
   (b) Input Output Devices: Sensor, relay, mechanical switches, Proximity sensor, Photoelectric sensor, temperature sensor, smart sensor.
   (c) Digital Systems (review): Number Systems, Number Conversion, Binary Codes, Binary Concept, Logic Functions, Principles of Boolean Algebra and Logic, PLC circuits and Logic Contact Symbology
   (d) Component and System of PLC: Processor, power supply, programming devices, memory system and I/O interaction, Discrete Input/Output System, Analog Input/Output System, Communication Interface
   (e) PLC Programming Methods: Ladder Diagram, Functional Block Programming, Instruction List, Sequential Function Chart, Structured Text.
   (f) PLC Programming Techniques: Internal Relays, Jump and Call, Timers, Counter, Data Handling
   (g) Designing Control System using PLC Simulator

APPENDIX B

FACULTY VITAE

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B.1 Adnan

1. Name: Adnan
2. Education:
   (a) Bachelor degree, Electrical Engineering, Universitas Hasanuddin , 1998
   (b) Master degree, Electrical Engineering, Institut Teknologi Bandung, 2002
   (c) Philosophy of Doctor degree, High Performance Computer System, University of Tsukuba, 2012
3. Academic experience:
   (a) Assistant (2003-2004), Lecturer, 2004-now
4. Non-Academic experience: N/A
5. Certification or professional registration: Lecturer Certification (2013)
6. Membership in professional organization:
   (a) Member, IATEL Universitas Hasanuddin
7. Honors and awards:
   (a) PhD Scholarships in University of Tsukuba Japan from JBIC IP-541 (2009-2012)
8. Service activities (within and outside of the institution): N/A
9. Briefly list the most important publications and presentations from the past five years:
   (a) Adnan , "Kinerja Tanda Tangan Digital RSA 1024 bit pada Simulasi e-Voting menggunakan Prosesor Multicore", SNATI, 2014
   (b) Adnan , "Studi Pendahuluan Pengaruh Distribusi dan Tipe Beban kerja Program Parallel Pada Prosesor Mullticore dan Teknologi Hyperthreading", Prosiding Seminar Ilmiah Nasional, 2014
   (c) Adnan , "Implementasi Algoritma Bellman Ford Untuk Pencarian Rute Terpendek Pada Handset Android", Prosiding Ilmiah Nasional 2015
   (d) Intan Sari Areni , Elyas Palantei , Ansar Suyuti , Adnan , Weni Sri Yusnita, "Attenuation Measurement of Laboratory Based PLC Implementation", Internetworking Journal Indonesia, Vol 7, No 2, 2015
   (e) Adnan , Intan Sari Areni , "Prototipe Kluster Kompter Ekonomis dan Ramah Energi", Prosiding Ilmiah Nasional Sains dan Teknologi, 2016
   (f) Adnan , Intan Sari Areni , M. Iqbal, Y. Andayani, "Smart laboratory System Using Raspberry Pi 2", ICIC Express Letters, Part B Volume 8, No 4, April 2017
   (g) Adnan , Andani Achmad , Lompo Ramos Emakarim, "Leveraging ACPI-PSS Data To Estimate Energi Of Processor Core Between ACPI-CPUFreq And Intel P-State Driver On Lov-End Intel Pentium Celeron N2930", IJICIC Vol 13 No 6, December 2017
10. Briefly list the most recent professional development activities: N/A

B.2 Amil Ahmad Ilham

1. Name: Amil Ahmad Ilham
2. Education:
   (a) Bachelor degree, Electrical Engineering, Universitas Hasanuddin , 1997
   (b) Master degree, Information Technology, The University of Newcastle, 2003
   (c) Philosophy of Doctor degree, Informatics, Kyushu University, 2011
3. Academic experience:
   (a) Assistant (1999-2001), Lecturer (2001-2004), Senior Lecturer (2004-2015), Associate Professor, 2015-now
   (b) Head of Computer and Networking Laboratory , 2011
4. Non-Academic experience:
   (a) Field Engineer at PT. Lucent Technologies, 1997-1998
5. Certification or professional registration:
   (a) Lecturer Certification (2012)
   (b) Engineering Professional Certification (2018)
6. Membership in professional organization:
   (a) Member, IEEE, 2017-now
7. Honors and awards:
   (a) The 10-Year National Badge "Satya Lencana Karya Satya", 2013, from the President of the Republic of Indonesia
8. Service activities (within and outside of the institution):
   (a) ICT PURA 2012 Counselor by Indonesian Government-Ministry of Communication and Information
9. Briefly list the most important publications and presentations from the past five years:
   (a) Amil Ahmad Ilham , Indrabayu , Rezkiana H, Deasy M P, "Wavelet Analysis for Identification of Lung Abnormalities using Artificial Neural Network", Makassar International Conference on Electrical Engineering and Informatics (MICEEI), Makassar, 26-30 November 2014
   (b) Muhammad Niswar , Amil Ahmad Ilham , Adnan , Rhiza Samsoe'oed Sadjad , "The Design of Wearable Medical Device for Triaging Disaster Casualties in Developing Countries", The Fifth IEEE International Conference on Digital Information Processing and Communications (ICDIPC), Switzerland, 7-9 October 2015
   (c) Yuli Asmi Rahman, Salama Manjang , Yusran , Amil Ahmad Ilham , "The Design of Wearable Medical Device for Triaging Disaster Casualties in Developing Countries", The 6th Engineering International Conference, Universitas Negeri Semarang, 11 Oktober 2017
   (d) Midarto Dwi Wibowo, Ingrid Nurtanio , Amil Ahmad Ilham , "Indonesian Sign Language Recognition Using Leap Motion Controller", The 11th International Conference on Information & Communication Technology and System (ICTS), Surabaya, 31 Oktober 2017.

(e) Adnan , Amil Ahmad Ilham , Syahrul Usman, "Performance Analysis of Extract, Transform, Load (ETL) in Apache Hadoop atop NAS Storage using ISCSI", The 4th International Conference on Computer Applications and Information Processing Technology (CAIPT), Bali, 8-10 Agustus 2017

(f) Muhammad Sabirin Hadis, Elyas Palantei , Amil Ahmad Ilham , Akbar Hendra, "Design of Smart Lock System for Doors with Special Features Using Bluetooth Technology", International Conference on Information and Communications Technology (ICOIACT), Yogyakarta, 6-7 Maret 2018

10. Briefly list the most recent professional development activities: N/A

B.3 Andani Achmad

1. Name: Andani Achmad
2. Education:
   (a) Bachelor degree, Electrical Engineering, Universitas Hasanuddin , 1986
   (b) Master degree, Electrical Engineering, Universitas Hasanuddin , 2000
   (c) Doctor degree, Electrical Engineering, Universitas Hasanuddin , 2010
3. Academic experience:
   (a) Secretary of Electrical Engineering Department, Universitas Hasanuddin , (1997-2000)
   (b) Head of Electrical Engineering Department, Universitas Hasanuddin (2011-2016)
   (c) Dean of Engineering Faculty, Universitas Fajar, 2010-now
   (d) Head of Computer and Network Laboratory Electrical Department, Universitas Hasanuddin , 2012-now
4. Non-academic experience: N/A
5. Certifications of professional registrations: Lecturer Certification (2014)
6. Current membership in professional organizations:
   (a) Assessor Team of BAN PT
   (b) Engineer Profession
7. Honors and awards:
   (a) The 20-Year National Badge "Satya Lencana Karya Satya", from the President of the Republic of Indonesia
8. Service activities (within and outside of the institution):
   (a) Implementation of Database Applications to Support Smart Card Systems at STKIP Muhammadiyah Bone, Mei 2019
9. Briefly list the most important publications and presentations from past five years:
   (a) Dewiani Djamaluddin, Andani Achmad , Rivanto Parung, "Prototype of Vehicles Potholes Detection Based Blob Detection Method", Journal of Theoretical and Applied Information Technology, ISSN: 1992-8645., E-ISSN: 1817-3195 Vol. 95 No.1, 15 Januari 2017.
   (b) Andani Achmad , Dewiani Djamaluddin , Riklan Kango, "Crosstalk Reduction For Network Multicore Fibre With Management Core and Spectrum Method", Journal of Theoretical and Applied Information Technology, Vol. 95, No. 1, 15th January 2017. ISSN: 1992-8645, E-ISSN: 1817-3195.
   (c) Andani Achmad , Rhiza Samsoe'oed Sadjad , "Real-Time Automatic Identification System of Waste Disposal in Nickel Mining", International Journal of Applied Engineering Research, Vol. 9, Number 22 (2014) pp. 18075-18086. ISSN: 0973-4562
10. Briefly list the most recent professional development activities: N/A

B.4 Andini Dani Achmad

1. Name: Andini Dani Achmad
2. Education:
   (a) Bachelor degree, Electrical Engineering, Universitas Hasanuddin , 2009
   (b) Master degree, Electrical Engineering, Universitas Hasanuddin , 2013
3. Academic experience:
   (a) Chairman, Program Study of Electrical Engineering, Universitas Fajar, (2014-2016)
   (b) Lecturer, Electrical Engineering, Universitas Fajar, (2011-2016)
   (c) Lecturer, Electrical Engineering, Universitas Hasanuddin , 2015-now
4. Non-academic experience: N/A
5. Certifications of professional registrations: Lecturer Certification (2014)
6. Current membership in professional organization: N/A
7. Honors and award: N/A
8. Service activities (within and outside of the institution): N/A
9. Briefly list the most important publications and presentations from past five years:
   (a) Muhammad Takdir Muslihi, Andini Dani Achmad , "The Design of Internet of Things Solutions for National Fishery Logistics System", Proceedings of The First International Conference on Materials Engineering and Management-Engineering Section (ICMEMe), Advances in Engineering Research Volume 165, Atlantis Press, March 2019. ISBN: 978-94-6252-679-2, ISSN: 2352-5401.
   (b) Arizal, Andani Achmad , Andini Dani Achmad , "Back Propagation Performance Against Support Vector Machine in Detecting Tuberculosis Based on Lung X-Ray Image", Proceedings of The First International Conference on Materials Engineering and Management – Engineering Section (ICMEMe), Advances in Engineering Research Volume 165, Atlantis Press, March 2019. ISBN: 978-94-6252-679-2, ISSN: 2352-5401.
10. Briefly list the most recent professional development activities: N/A

B.5 Andi Ejah Umraeni Salam

1. Name: Andi Ejah Umraeni Salam
2. Education:
   (a) Bachelor degree, Electrical Engineering, Universitas Hasanuddin, 1996
   (b) Master degree, Electrical Engineering, Institut Teknologi Sepuluh Nopember, 2002
   (c) Doctor degree, Electrical Engineering, Universitas Hasanuddin, 2015
3. Academic experience:
   (a) Lecturer (1997-2002), Senior Lecturer (2002-2015), Associate Professor, 2015-now
4. Non-academic experience:
   (a) PT. Oval Plan, Member consultant Electrical Engineering, Electrical Project Installation, 2010-now
5. Certification or professional registration: Lecturer Certification (2011)
6. Current membership in professional organization:
   (a) Member, Electrical Engineering Alumni Association, Universitas Hasanuddin, 1998-now
   (b) Member of ISLT (International Symposium on Lowland Technology), Saga University, Japan, 2014
   (c) Member of IEEE, 2017-now
7. Honors and awards:
   (a) A scholarship for short-term research for the Universitas HasanuddinEngineering Faculty Development Project under JBIC Loan No.IP-541, 2015
   (b) BPPS Scholarship, Doctoral Program from Indonesian Government, (2011-2014)
   (c) BPPS Scholarship, Magister Program from Indonesian Government, (1999-2002)
8. Service activities (within and outside of the institution):
   (a) Local Organizing Commitee, The International Workshop on Modern Research in Electrical Engineering (IWoRMEE 2013), Makassar, Indonesia, 2013.
   (b) Conference Chairs, Electrical Engineering, Computer Science and Informatics (EECSI 2014), Yogyakarta, Indonesia, 2014
   (c) Electrical Engineering (IWoRMEE 2013), Makassar, Indonesia, 2013.
   (d) Conference Chairs, International Conference on Engineering & Science Technology Innovation (ICESTI 2014), Bali, Indonesia, 2014
   (e) Conference Chairs, International Symposium on Lowland Technology (ISLT 2014), di Japan, Tahun 2014
   (f) Conference Chairs Makassar, International Conference On Electrical Engineering And Informatics (MICEEI 2014), Makassar, 2014
   (g) Training Renewable Energy. Power System Laboratory, Sepuluh Nopember Institute of Technology, Surabaya, Indonesia, August, 2016
9. Briefly list the most important publications and presentations from the past five years:

(a) A.Ejah U, Muh.Tola, Mary S, Farouk M, “Application Extreme Learning Machine To Predict Location And Magnitude, International Journal of Innovative, Science, Engineering & Technology, Of Pipe Leak On Water Distribution Network”, Published Vol.1 Issue 9, November 2014. ISSN: 2348-7968.

(b) A.Ejah U, Muh.Tola, Mary S, Farouk M,“On-Line Monitoring System Water Leak Detection In Pipe Networks With Artificial Intelligence”, ARPN Journal of Engineering and Applied Sciences, Vol.9. No.10.Oktober 2014, ISSN: 1819-6608.

(c) A.Ejah U, Muh.Tola, Mary S, Farouk M,“Application Of ASTAR And RBF-NN To Predict Location And Magnitude Of Pipe Leak On Water Distribution Network”, Proceeding International Symposium on Lowland Technology, 9th ISLT 2014 September 29 – October, 2014, Saga Japan, ISSN : 4 -921090-06-8.

(d) A.Ejah U, Muh.Tola, Mary S, Farouk M,“Web Based Real time Water Pressure Monitoring System”, Proceeding Electrical Engineering, Computer Science and Informatics, EECSI 2014 Conference, 20 -21 August 2014, Yogyakarta. ISSN : 978-602-70504-0-2.

(e) A.Ejah U, Muh.Tola, Mary S, Farouk M,“Water Leakage Detection System Of Pipe Line Using Radial Basis Function Neural Network”, Proceeding International Seminar on Infrastructure Development, 2nd ISID 2014, June 3, 2014, Balikpapan, Indonesia, ISSN : 978-979-530-131-8.

(f) A.Ejah U, Muh.Tola, Mary S, Farouk M,“A Leakage Detection System on the Water Pipe Network through Support Virtual Machine Method”, Proceeding Makassar International Conference On Electrical Engineering And Informatics, MICEEI 2014, 26-28 November 2014, Makassar, Indonesia. ISSN : 978-1-4799-6725-4.

10. Briefly list the most recent professional development activities:

    (a) A short term Research Program, in Ehime University, October 2015-December 2015

B.6 Andreas Vogel

1. Name: Andreas Vogel
2. Education:
   (a) Master degree, Electrical Engineering, Universitäs Dortmund, 1995
3. Academic experience:
   (a) Guest Lecturer, Dept. of Electrical Engineering, Universitas Hasanuddin , 2003-now
4. Non-academic experience:
   (a) Design Engineer for CMOS Circuits, SIEMENS AG (Munich, Germany), 1996-1999
   (b) Project Manager for VLSI Library Design (Embedded Memories), Infineon Technologies AG (Munich, Germany), 2000-2001
   (c) Educational Consultant, Socio-Economic and Educational Development for Southeast Asia (SEEDS), Singapore, 2012-now
5. Certifications or professional registrations: N/A
6. Current membership in professional organization: N/A
7. Honors and awards: N/A
8. Service activities (within and outside of the institution): N/A
9. Briefly list the most important publications and presentations from the past five years.
   (a) Andreas Vogel , "Trends in FPGA Technology and its Use in Next-Generation Designs", Presentation at 4th Makassar International Conference on Electrical Engineering and Informatics (MICEEI), Makassar, November 2014
   (b) Andreas Vogel , "Teknologi FPGA Dalam Masa Industri 4.0-Persepsi Teknik Mekatronika", Guest Lecture at Politeknik Negeri Ujung Pandang, Makassar, December 2018
   (c) Andreas Vogel , "Contribution of the Internet of Things and Smart Devices in Industry 4.0", Keynote speaker at International Seminar on Building Indonesian Education in the Industrial Revolution Era 4.0, Barru, April 2019
10. Briefly list the most recent professional development activities:
   (a) Development of courseware and laboratory work for "Embedded System Design", 2017
   (b) Development of courseware and laboratory work for "System On Chip", 2018

B.7 Ansar Suyuti

1. Name: Ansar Suyuti
2. Education:
    (a) Bachelor degree, Electrical Engineering, Universitas Hasanuddin , 1991
    (b) Master degree, Electrical Engineering, Universitas Hasanuddin , 2002
    (c) Doctor degree, Engineering Science/ Environmental Technology, Universitas Hasanuddin , 2013
3. Academic experience:
    (a) Assistant (1992-2000), Lecturer (2000-2013), Professor, 2013-now
    (b) Head of Electrical Installation Laboratory , 1997-now
    (c) Department of Electrical Engineering, Chairman, (2003-2006)
    (d) Vice Dean Financial and Administration Affair Faculty of Engineering, Universitas Hasanuddin , (2006 -2010) & (2010-2014)
    (e) Doctoral study Program in Electrical Engineering, Chairman, 2016-now
    (f) Member of Trustee Board, Universitas Hasanuddin , 2014-now
4. Non-academic experience:
    (a) PT Raja Teknik Sejati, Makassar, Electrical Contractor, (1991-1997)
    (b) PT AS Elektrikal Konstruksi, Makassar, Electrical Contractor, 1997-now
    (c) PT Tunggala Prima Teknik, Kendari, Electrical Contractor, 2000-now
5. Certifications or professional registrations:
    (a) Lecturer Certification (2010)
    (b) Lead of expert electrical power engineering, APEI & LPJK, 2000-now
    (c) Main Professional Engineer (IPU), Association of Indonesian Engineers (PII), 2017-now
6. Current membership in professional organization:
    (a) IEEE Computer Society, Member, 2013-now
    (b) International Association of Engineering (IAENG), Member, 2015-now
7. Honors and awards:
    (a) Best Graduate Program (S3) Universitas Hasanuddin on graduation Period III Year 2012/2013.
    (b) The 20-Year National Badge "Satya Lencana Karya Satya", from the President of the Republic of Indonesia
8. Service activities (within and outside of the institution):
    (a) Assessor of Electricity Competency, Ministry of Energy and Mineral Resources (ESDM) of the Republic of Indonesia.
    (b) Assessor of BAN-PT, National Accreditation Board-Higher Education (BAN-PT) Ministry of Ministry of Research, Technology and Higher Education
9. Briefly list the most important publications and presentations from the past five years.

(a) Ansar Suyuti, Muhammad Tola, Muh. Saleh Pallu, Nadjamuddin Harun, "Simple and portable Gas Emission Detector Design Using ATmega16", ICIC Express Lettes, Part B: Applications. An International Journal of Research and Surveys, Volume 4, Number 1, February 2013. ISSN 2185-2766.

(b) Ansar Suyuti, "Web-Based Gas Emission Level Monitoring of Diesel Power plant Using Multi-sensors", International Journal of Engineering and Innovative Technology (IJEIT), 2014.

(c) Ansar Suyuti, Zaenab Muslimin, Ikhlas Kitta, Fitriyanti Mayasari. "Smart Electrical Installation for Apartment", International Journal of Engineering and Innovative Technology (IJEIT), Volume 3, Issue 5, November 2013, page 274-276, ISSN: 2277-3754, ISO 9001:2008.

(d) Ansar Suyuti, Sudirman Palaloi. "Analysis of the Use of Electricity in the Installation of Drinking Water Management", Enerlink, Jurnal Energi dan Lingkungan, Vol.10 No.2, Desember 2014, ISSN 0216-9541

(e) Ansar Suyuti, Indar Chaerah Gunadin, Nuryahati, "PID Implementation on Real Time 3-phase Induction Motor Controlling and monitoring", Journal of Theoretical and Applied Information Technology, Vol. 89 No.2, 31st July 2016, ISSN: 1992 - 8645.

(f) Ansar Suyuti, Indrabayu, Herlina, "DSS for Evaluating Weighting Methodology Using Fuzzy AHP", International Journal of Emerging Research in Management & Technology ISSN: 2278-9359 (Volume-6, Issue-2, February 2017

(g) Ansar Suyuti, Ikhlas Kittaand Yusri Syam Akil, "The Impact of The Operation Planning of Power Plants for Environmental Emissions in South Sulawesi", ARPN Journal of Engineering and Applied Sciences, ISSN 1819-6608, Vol. 12, No. 11, June 2017

10. Briefly list the most recent professional development activities: N/A

B.8 Ardiaty Arief

1. Name: Ardiaty Arief
2. Education:
   (a) Bachelor degree, Electrical Engineering, Universitas Hasanuddin , 2001
   (b) Master degree, Electrical Engineering, University of New South Wales, 2004
   (c) Doctoral degree, Electrical Engineering, the University of Queensland, 2012
3. Academic experience:
   (a) Lecturer, 2001-now
4. Non-academic experience:
   (a) Internship at Powerlink Queensland, Australia (2009)
5. Certifications or professional registrations: Lecturer Certification
6. Current membership in professional organizations: N/A
7. Honors and awards:
   (a) Maude Walker Award, 2008
   Awarded by the University of Queensland, Australia for the first-year postgraduate research student.
8. Service activities (within and outside of the institution):
   (a) Speaker/ facilitator of Community Services Project for primary school students and teachers in Makassar, "Education for the usage of solar energy as an alternative and environmentally friendly energy for primary school community", Makassar, 28 September 2017
9. Briefly list the most important publications and presentations from the past five years: Journal publications:
   (a) Arief, Z.Y. Dong, M.B. Nappu, and M. Gallagher, "Under Voltage Load Shedding in Power Systems with Wind Turbine-Driven Doubly Fed Induction Generators" Electric Power System Research, ELSEVIER, vol. 96, pp. 91-100, March 2013.
   (b) M.B. Nappu, A. Arief and R.C. Bansal, "Transmission Management for Congested Power System: A Review of Concepts, Technical Challenges and Development of a New Methodology" Renewable and Sustainable Energy Reviews, ELSEVIER, Vol. 38, pp. 572–580, October 2014.
   (c) Arief, Antamil and M.B. Nappu, "Analytical Method for Reactive Power Compensators Allocation", International Journal of Technology, Volume 9(3), pp. 602-612, Scopus indexed, ISSN: 2086-9614, 2018.
   (d) M.B. Nappu, A. Arief and A.S. Duhri, "Economic Emission Dispatch for Thermal Power Plant in Indonesia", accepted for publication in International Journal of Smart Grid and Clean Energy (IJSGCE), ISSN: 2315-4462, Scopus indexed, 2018.
   (e) W.A. Ajami, A. Arief and M.B. Nappu, "Optimal power flow for power system interconnection considering wind power plants intermittency" accepted for publication in International Journal of Smart Grid and Clean Energy (IJSGCE), ISSN: 2315-4462, Scopus indexed, 2018.
   (f) W.S. Alfira, M.B. Nappu and A. Arief, "Under Voltage Load Shedding Simulation for Southern Sulawesi Power System with Integration of Wind Power Plants", accepted for publication in Advance Science Letter, Scopus indexed, ISSN: 1936-6612, 2018.

(g) Arief, Antamil and M.B. Nappu, “An Analytical Method for Optimal Capacitors Placement from the Inversed Reduced Jacobian Matrix”, Energy Procedia, ELSEVIER, Volume 100, November 2016, Pages 307-310.

(h) M.B. Nappu and A. Arief, “Network Losses-Based Economic Redispatch for Optimal Energy Pricing in a Congested Power System”, Energy Procedia, ELSEVIER, Volume 100, November 2016, Pages 311-314.

10. Conference Presentations:

(a) A. Arief, Antamil and M.B. Nappu, “An Analytical Method for Optimal Capacitors Placement from the Inversed Reduced Jacobian Matrix”, presented at the International Conference on Power and Energy Systems Engineering (CPESE 2016), Kitakyushu, Japan, 8 – 12 September 2016.

(b) A. Arief and M. B. Nappu, “Voltage Drop Simulation at Southern Sulawesi Power System Considering Composite Load Model”, Proceedings of the 3rd International Conference on Information Technology, Computer and Electrical Engineering (ICITACEE 2016), Semarang, 19-20 October 2016

(c) A. Arief and M.B. Nappu, “Optimum DG Placement and Size with Continuation Power Flow Method”, presented at the 5th International Conference on Electrical Engineering and Informatics (ICEEI), Kuta, Bali, Indonesia, 10-11 August 2015.

(d) A. Arief, “Optimal Placement of Distributed Generations with Modified P-V Modal Analysis”, presented at the 4th Makassar International Conference on Electrical Engineering and Informatics (MICEEI), Makassar, Indonesia, 26-30 November 2014.

(e) A. Arief, “DG Placement with Modified V-P Modal Analysis for Voltage Stability Improvement”, presented at the International Workshop on Modern Research Methods in Electrical Engineering (IWORMEE), Makassar, South Sulawesi, Indonesia, 5 September 2013.

11. Briefly list the most recent professional development activities: N/A

B.9 Christoforus Yohannes

1. Name: Christoforus Yohannes
2. Education:
   (a) Bachelor degree, Electrical Engineering, Universitas Hasanuddin , 1986
   (b) Master degree, Electrical Engineering, Universitas Hasanuddin , 2002
3. Academic experience:
   (a) Assistant (1987-2015), Lecturer, 2015-now
   (b) Computer, Control and Electronic Sub-Study Program, Member, 2010-2015
4. Non-Academic experience:
   (a) Part time on Data Mas (1986-1989)
   (b) Part time on PT. Esakom (1989-1992)
5. Certification or professional registration: Lecturer Certification (2011)
6. Membership in professional organization: N/A
7. Honors and awards: N/A
8. Service activities (within and outside of the institution): N/A
9. Briefly list the most important publications and presentations from the past five years:
   (a) Expert System for Instruments Requirement in Operating Room, C. Yohannes, M.P..Haspan, R.Maulana, A. Bustamin, ICIC Express Letters 12 (2):109-116, February 2018.
10. Briefly list the most recent professional development activities: N/A

B.10 Dewiani Djamaluddin

1. Name: Andini Dani Achmad
2. Education:
   (a) Bachelor degree, Electrical Engineering, Universitas Hasanuddin ,1993
   (b) Master degree, Electrical Engineering, Institut Teknologi Bandung, 2000
   (c) Doctor degree, Electrical Engineering, Kumamoto University, 2013
3. Academic experience:
   (a) Lecturer (1994-2003), Senior Lecturer (2004-2015), Associate Professor, 2016-now
4. Non-Academic Experience: N/A
5. Certification or professional registration: N/A
6. Membership in professional organization:
   (a) Member of IEEE
   (b) Member of PII (Indonesian Engineer Association)
   (c) Member of IATEL (Electrical Engineer Association), Universitas Hasanuddin
   (d) Member of CoT (Center of Technology), Universitas Hasanuddin
7. Honors and awards:
   (a) URGE (University Research for Graduate Education) Scholarships, Directorate General of Higher Education (DIKTI), Ministry of National Education, Indonesia; period 1996-1997
   (b) BPPS Scholarships from Directorate General of Higher Education (DIKTI), Ministry of National Education, Indonesia; period 1997-2000
   (c) TPSDP Grant, Directorate General of Higher Education (DIKTI), Ministry of National Education, Indonesia; period 2007
   (d) Research Grant 2007-2009 awarded by Directorate General of Post and Telecommunication, Ministry of Communication and Information, Republic of Indonesia to develop the Plug and Play Smart Antenna for the Next Wireless Communication System.
   (e) DIKTI Scholarships from Directorate General of Higher Education (DIKTI), Ministry of National Education, Indonesia; period 2009-2013
   (f) Research Grant 2014-2015 awarded by SDPPI, Directorate General of Post and Telecommunication, Ministry of Communication and Information, Republic of Indonesia to develop "Sistem Antena Reconfigurable Beamsteerable dan Friendly Environment Dengan Struktur Stripmikro Untuk Piranti Komputasi Bergerak LTE-Advanced"
   (g) Short Term Research Fellowship Grant from JICA (Japan International Cooperation Agency) as Part of Universitas Hasanuddin Engineering Faculty Development Project. The research fellowship program commenced since the mid of July until mid of October 2013 at Tokyo University of Science (TUS), Tokyo, Japan
   (h) Research Grant 2014-2015 awarded by SDPPI, Directorate General of Post and Telecommunication, Ministry of Communication and Information, Republic of Indonesia to develop "Sistem Antena Reconfigurable Beamsteerable dan Friendly Environment Dengan Struktur Stripmikro Untuk Piranti Komputasi Bergerak LTE-Advanced"
8. Service activities (within and outside of the institution):

(a) International Committee, 1st Makassar International Conference on Electrical Engineering & Informatics (MICEEI) 4-5 November 2008, Universitas Hasanuddin , Kampus Tamalanrea, Makassar, Indonesia.

(b) Reviewer of International Conference on MICEEI (Makassar International Conference in Electrical Engineering and Informatics), Makassar Golden Hotel (MGH), 29 November-1 December 2014, Losari Beach, Makassar, Indonesia.

9. Briefly list the most important publications and presentations from the past five years:

   (a) “The Simulation of Vehicle Counting System for Traffic Surveillance using Viola-Jones Method”, Proceedings of 4rd MICEEI 26 – 30 November 2014, Makassar Golden Hotel (MGH), Makassar, Indonesia, ISBN: 978-1-4799-6725-4, hal. 237.

   (b) “High Gain CP Antenna for Mobile Satellite Communications Numerically Evaluated under Various Packaging Materials”, Proceedings of 4rd MICEEI 26 – 30 November 2014, Makassar Golden Hotel (MGH), Makassar, Indonesia. ISBN: 978-1-4799-6725-4, hal. 139.

   (c) “Movement Effect on Electrical Proporties of UWB Microwave Antenna During Breast Tumor Diagnostic Scanning”, Proceeding of 2nd Asia Pasific Conference on Wireless and Mobile (APWiMob) 27 – 29 August 2015, Bandung, Indonesia, ISBN: 978-1-4799-8290-5hal. 188-191

   (d) “Early Stage Cancer Detection Technique Considering the Reflected Power from Breast Tissues”, ARPN Journal of Engineering and Applied Sciences, 2015. Vol. 10, No. 17, p. 7361-7367, September 2015, ISSN 1819-6608

   (e) “Vehicles Potholes Detection Based Blob Detection Method and Neural Network Backpropagation Model”, Proceedings of the 6th Annual International Conference Syiah Kuala University (AIC Unsyiah) in conjunction with the 12th International Conference on Mathematics, Statistics and Its Application (ICSMA), 4-5 October 2016

   (f) “Cosstalk Reduction for Network Multicore Fiber with Management Core and Spectrum Method”, Journal of Theoretical and Applied Information Technology (JATIT), 15th January 2017. Vol.95. No.1, pp 139 -146, SSN: 1992-8645, E-ISSN: 1817-3195

   (g) “Prototype of Vehicles Potholes Detection Based Blob Detection Method”, Journal of Theoretical and Applied Information Technology, Vol.95. No 11, 15 June 2017

   (h) “Implementation of RFID based raspberry Pi for user authentication and offline intelligent payment system”, 15th International Conference on Quality in Research (QiR): International Symposium on Electrical and Computer Engineering, December 2017, 978-602-50431-1-6/17

10. Briefly list the most recent professional development activities:

   (a) Visiting Researcher in Tokyo University of Science (TUS), Tokyo, July-September 2013, Japan

B.11 Elyas Palantei

1. Name: Elyas Palantei
2. Education:
    (a) Bachelor degree, Electrical Engineering, Universitas Hasanuddin , 1994
    (b) Master degree, Electrical Engineering, Asian Institute of Technology, 2001
    (c) Philosophy of Doctor degree, Griffith School of Engineering, 2012
3. Academic experience:
    (a) Assistant Lecturer (1991 -1994), Junior Lecturer (1994-1999), Senior Lecturer (2000-2003), Senior Lecturer (20032010), Associate Professor (2011-now)
    (b) Senior Researcher, Griffith School of Engineering, Griffith University, Brisbane, Australia (2009-2010)
    (c) Visiting Researcher, Space Communication and Mini Satellite, Josaphat Remote Sensing and Microwave Laboratory, Chiba University, (2011)
    (d) Visiting Researcher, Breast Cancer Monitoring and Detection, Universiti Kebangsaan Malaysia (UKM), IVIC, (2014)
4. Non-Academic experience:
    (a) Division Head of Research and Development, Jusuf Kalla-Center of Technology (JK-CoT), Faculty of Engineering, Universitas Hasanuddin , 2011-now
    (b) Head of Telecommunication, Radio, and Microwave Laboratory , 2010-now
    (c) Founder, Center of Excellence for Applied Intelligent Technologies, 2011-now
    (d) Engineer, Radius Bender Co. Ltd., Brisbane, Australia, 2005-2008
5. Certification or professional registration: Lecturer Certification (2009)
6. Membership in professional organization:
    (a) Member, Electrical Engineering Alumni Association (IATEL) Universitas Hasanuddin , 2015-now
    (b) Member, Forum Pendidikan Tinggi Teknik Elektro Indonesia (FORTEI)
    (c) Member, IEEE, 2017-now
7. Honors and awards:
    (a) International Travel Grant as the Plenary Speaker of ASEAN IVO and NICT Meeting at Pan Pacific Hotel, Hanoi, 25-26 November 2016
    (b) International Participant of CBEST Counterpart Training, Japan, 26 July-10 August 2015
    (c) Short Term Research Program Fellowships at Josaphat Microware Remote Sensing Laboratory (MRSL), Centre for Environmental Remote Sensing (CEReS), Chiba
    (d) International Travel Grants for attending the IEEE AP-S International Symposium on Antennas and Propagation and USNC/URSI from 2011-2014
8. Service activities (within and outside of the institution):
    (a) Technical Committee Member, KSCI (Konsorsium Smart Card Indonesia), 2016-2019
    (b) Vice Chairman of Indonesia Joint Chapter IEEE APS/MTT (2014)

(c) Executive Board Member, IEEE Indonesia Section (2016-2018)

(d) Executive Board Member, Ikatan Alumni Teknik Elektro (IATEL) Universitas Hasanuddin(2015-2020)

(e) Chairman of 4th Makassar International Conference in Electrical Engineering and Informatics (MICEEI), Makassar Golden Hotel (MGH), 2014

9. Briefly list the most important publications and presentations from the past five years:

(a) Elyas Palantei , Ashadi Amir, Dewiani Djamaluddin , "Early Stage Cancer Detection Technique Considering the Reflected Power from Breast Tissues", ARPN Journal of Engineering and Applied Sciences, Volume: 10.2015

(b) Elyas Palantei , Asma A, Indrabayu , "Breast Cancer Detection in Mammogram Images Exploiting GLCM,GAFeatures and SVM Algorithms", Journal of Telecommunication Electronic & Computer Engineering (JTEC), Vol. 9, pp.113-117, 2017

(c) Dewiani Djamaluddin , Elyas Palantei , Ika P, "Real Time Blood Sugar Monitoring", International Journal of Industrial Electronics and Electrical Engineering (IJIEEE), Vol.5, Issue-7, pp.114-118, July 2017

(d) Ridha A, Elyas Palantei , Intan Sari Areni , "Optimizing and Implementation Contactless Tag-Reader System for Smart Classroom and Laboratory Access", Journal of Physics: Conference Series, Vol 1090 (Conference 1), 2018

(e) Zaenab Muslimin , N Anugraha, Ansar Suyuti , Elyas Palantei , Indrabayu , "Patch Microwave Absorber for RF Energy Harvesting as Renewable Energy", Journal of Physics: Conference Series, Earth and Environmental Science, Vol 235, 2019

(f) Elyas Palantei , Merna Baharuddin , Robby R S, Afif S, "A Robust Wireless Power Transmission for Charging Low Power Consumption Appliances", IEEE Antennas and Propagation Society International Symposium (APS URSI) 2014, Memphis, 6-11 July 2014

(g) Elyas Palantei , "A Compact and Robust Telemetry Systems Construction for the Environmental Observations", The 22nd CEReS Chiba University and The 6th IJJSS, Universitas Gadjah Mada, 28-30 October 2014

(h) Dewiani Djamaluddin , Ashadi A, Elyas Palantei , Intan Sari Areni , Andani Achmad , "Movement Effect on Electrical Properties of UWB Microwave Antenna During Breast Tumor Diagnostic Scanning", APWiMob Conference, 27-29 August 2015

(i) Elyas Palantei , Intan Sari Areni , A Asmi P, Ashadi A "Improvement of UWB Patch Transducer Properties Applicable for Fetal Monitoring System", APWiMob Conference, 27-29 August 2015

(j) Elyas Palantei , Nurfitri, "Construction and Field Testing of Broadband Transceiver Modules Applied for ITS Environmental Surveillance", Proceedings of The 7th IJJSS 2016, Chiba University, Chiba, 20-24 November 2016, pp.207-212

(k) Elyas Palantei , "Emphasizing FoE UNHAS Smart Campus Roles for Creating the Neighboring Smart Societies", ICT Virtual Organization of ASEAN Institutes and NICT ASEAN IVO Forum 2016, Pan Pacific Hanoi, 25-26 November 2016

(l) Elyas Palantei , Arif Hidayat, "Low Cost Switched ArrayWide Band Antenna for Search and Rescue Disaster Management", 3rd International Conference on Science and Technology-Computer (ICST), Yogyakarta, 11 July 2017

10. Briefly list the most recent professional development activities:

(a) Scientific Publication Management Training at LIPI, Jakarta, 2016

B.12 Faizal Arya Samman

1. Name: Faizal Arya Samman
2. Education:
   (a) Bachelor degree, Electrical Engineering, Universitas Gadjah Mada, Yogyakarta, 1999
   (b) Master degree, Electrical Engineering, Institut Teknologi Bandung, 2002
   (c) Doctor degree, Electrical Engineering, Technische Universität Darmstadt, 2010
   (d) Professional Engineer degree, Electrical Engineering, Universitas Hasanuddin, 2018
3. Academic experience:
   (a) Full Professor (2019-now), Senior Lecturer (2005-2019), Lecturer (2002-2005) in Electrical Eng. Dept., Universitas Hasanuddin, full-time
   (b) Head of Electronics and Devices Laboratory, Electrical Eng. Dept., Universitas Hasanuddin, 2017-now, full-time
   (c) Principle investigator for research project title: "Multi Processor System-on-Chip for Innovative Smart Gadget Products with Multi Touchscreen" under National Strategic Superior Research Grant funded by Ministry of Research, Technology and Higher Education of the Republic of Indonesia (2017-2018)
   (d) Research fellow at Fraunhofer Institute for Structural Durability and System Reliability (LBF), Darmstadt, Germany, (2010-2012)
   (e) Research fellow for project title: "Maintenance-on-Demand (MODE)" under European Research and Development Program, FP7, funded by European Commission CORDIS, (2011-2012)
   (f) Research fellow for project title: "Facility for Antiproton and Ion Research (FAIR)" coordinated by GSI Helmholtz Center for Heavy-Ion Research, Germany, funded by German Federal Ministry of Education and Research, BMBF, (2011-2012)
   (g) Visiting researcher at the University of Melbourne, Australia, under DAAD/G08 grant with Australian Technology Network (Mar. 2012)
4. Non-academic experience: N/A
5. Certifications or professional registrations:
   (a) Professional Lecturer/Educator Certificate (2012)
6. Current membership in professional organization: N/A
7. Honors and awards:
   (a) The 10-Year National Badge "Satya Lencana Karya Satya", 2018, from the President of the Republic of Indonesia
   (b) Best paper award in the 2018 International Conference on Applied Electromagnetic Technology (AEMT)
   (c) Best paper award in the 2018 International Conference on Electrical Power, Electronics, Communications, Controls and Informatics Seminar (EECCiS)
   (d) DAAD Scholarship Awardee, 2006-2010, to purse doctoral degree in Germany
   (e) Post Graduate Program Scholarship Awardee, 2000-2002, to pursue master degree at ITB
8. Service activities (within and outside of the institution):

(a) 2016, Design and maintenance of photovoltaic-based electric power generation in Mangepong Village (remote area), Jeneponto Regency

9. Briefly list the most important publications and presentations from the past five years:

   (a) Faizal A. Samman, "Integrated control and monitoring of hybrid grid-photovoltaic electrical system with extra DC electric installation", Indonesian Patent Office, Grant No. IDP000054426, Nov. 5, 2018.
   (b) Faizal A. Samman, "Arbitration method for data packets with single and multiple priority level in network-on-chip", Indonesian Patent Office, Grant No. IDP000053087, Aug. 30, 2018.
   (c) Faizal A. Samman, "Electronic smart-book design model", Indonesian Patent Office, Filling No. P15201505188, published March 10, 2017.
   (d) Faizal A. Samman, "Network-on-chip with quality-of-service using multiple access method based on dynamic identity label", Indonesian Patent Office, Filling No. P15201505187, published March 10, 2017.
   (e) Faizal A. Samman, "Electric power supply based on renewable energies with DC and AC power terminals", Indonesian Patent Office, Filling No. P15201604471, published Jan. 12, 2018.
   (f) Faizal A. Samman, "Maximum power transfer algorithm using switching method", Indonesian Patent Office, Filling No. P15201500005, published Nov. 11, 2016.
   (g) Faizal A. Samman, "Solar-thermal electric power generation for cooling system of parking vehicles", Indonesian Patent Office, Filling No. P15201500007, published Nov. 11, 2016.
   (h) Faizal A. Samman, Khairul Jihadi, M. Arif Fitrayadi Said and Syafaruddin "Numerical Current Integration with Incident OCV Observation for Battery State-Of-Charge Estimation In Photovoltaic Systems", ICIC Express Letter, Part B: Applications, vol. 10, no. 1, Jan. 2019.
   (i) Faizal A. Samman and Thomas Hollstein, "Design Concept and Microarchitecture of Network-On-Chip With Best-Effort and Guaranteed-Throughput Services", International Journal of Innovative Computing, Information and Control (IJICIC), will be published in vol. 15, no. 1, Feb. 2019.
   (j) Faizal A. Samman, Dea Fatriziah Hamkah, Made Dharma Budy Diatmika and Ida Rahmaniar Sahali, "Voltage Regulator Using a DC-DC Converter Controlled by Interpolated PI Gain Scheduler for Solar Charge Applications", ICIC Express Letters, an International Journal of Research and Surveys, ICIC Express Letters, planning to publish in vol.12, no.11, November 2018.
   (k) Faizal A. Samman, Abd. Azis Rahmansyah, Syafaruddin. "Peak Bracketing And Decremented Window-Size Scanning-Based MPPT Algorithms For Photovoltaic Systems", International Journal of Innovative Computing, Information and Control (IJICIC), vol. 14, no. 3, June 2018. ISSN: 1349-4198.
   (l) Faizal A. Samman. "Runtime Connection-Oriented Guaranteed-Bandwidth Network-on-Chip with Extra Multicast Communication Service", Elsevier Science Journal, Microprocessors and Microsystems - Embedded Hardware Design, vol. 38, no. 2, March, 2014, pages: 170-181. ISSN: 0141-9331.
   (m) Faizal A. Samman, T. Hollstein, M. Glesner. "Runtime Contention- and Bandwidth-Aware Adaptive Routing Algorithms for Networks-on-Chip", IEEE Transaction on Parallel and Distributed Systems, vol. 24, no. 7, Juli 2013, pages 1411-1421, ISSN: 1045-9219, doi: 10.1109/TPDS.2012.200.

10. Briefly list the most recent professional development activities:

   (a) Patent application training: "From Invention to Patent", TU Darmstadt, Germany, Jan. 2012.
   (b) DAAD Research Ambassador, 2019-now.

B.13 Fitriyanti Mayasari

1. Name: Fitriyanti Mayasari
2. Education:
   (a) Bachelor degree, Electrical Engineering, Universitas Hasanuddin, 2005
   (b) Master degree, Electrical Engineering, Universitas Indonesia, 2001
3. Academic experience:
   (a) Lecturer, 2006-now
4. Non-Academic experience: N/A
5. Certification or professional registration: N/A
6. Membership in professional organization: N/A
7. Honors and awards:
   (a) Doctoral Dissertation Research Grant (2018)
   (b) International Publication Grant from Universitas Indonesia (2017 and 2018)
   (c) BPPDN Dikti Scholarship (2014)
   (d) Dikti Scholarship for Master Degree (2010)
8. Service activities (within and outside of the institution): N/A
9. Briefly list the most important publications and presentations from the past five years:
   (a) Fitriyanti Mayasari , Rinaldy Dalimi, “Assessing Bioethano Production to Fulfil Energy Demand in Indonesia using System Dynamics Modelling”, IEEE Region 10 Annual International Conference Proceedings/TENCON October 2018, 8650307, pp.741-746
   (b) Fitriyanti Mayasari , Rinaldy Dalimi, “Fuel Oil Supply Demand Projection and Planning in Indonesia using System Dynamics Modelling”, International Journal of Smart Grid and Clean Energy 2019, Vol. 8(1), pp.11-21
   (c) Fitriyanti Mayasari , Rinaldy Dalimi, “Dynamic Model of Reutealis Trisperma Production as Biodiesel Feedstock in Indonesia”, Proceedings of China International Electrical and Energy Conference (CIEEC) 2017, pp.885-860
   (d) Fitriyanti Mayasari , Rinaldy Dalimi, “Dynamic Modeling of CPO Supply to Fulfill Biodiesel Demand in Indonesia”, Proceedings of The 15th International Conference on Quality in Research (QiR), International Symposium on Electrical and Computer Engineering, December 2017, pp.388-393
   (e) Indrabayu, Basri, Andani Achmad, Intan Sari Areni, Fitriyanti Mayasari, “Blob Modification in Counting Vehicles using Gaussian Mixture Models under Heavy Traffic”, APRN Journal of Engineering and Applied Sciences, Vol.10(16), pp.7157-7163, 2015
   (f) Fitriyanti Mayasari, Rinaldy Dalimi, “Vegetable Oil Based Biodiesel Feedstock Potential in Indonesia”, Proceedings of The Makassar International Conference on Electrical Engineering and Informatics (MICEEI) 2014, 7067306, pp.37-41
10. Briefly list the most recent professional development activities: N/A

B.14 Gassing

1. Name: Gassing
2. Education:
   (a) Bachelor degree, Electrical Engineering, Universitas Hasanuddin, 1986
   (b) Master degree, Electrical Engineering, Institut Teknologi Bandung, 1995
3. Academic experience:
   (a) Lecturer (1987-1992), Senior Lecturer (1995-now)
   (b) Secretary of Department Electrical Engineering, 2010-2015
4. Non-Academic experience:
   (a) Counselling for Installation of a Safe, Economical Electrical Installation
   (b) Counselling for the Control and Saving of Electricity and Clean Water
5. Certification or professional registration: Lecturer Certification (2009)
6. Membership in professional organization:
   (a) Member, Electrical Engineering Alumni Association (IATEL) Universitas Hasanuddin, 1998-now
   (b) Member, International Symposium on Lowland Technology (ISLT), Saga University, 2014
   (c) Member, IEEE, 2017-now
7. Honors and awards:
   (a) The 20-Year National Badge "Satya Lencana Karya Satya", from the President of the Republic of Indonesia
8. Service activities (within and outside of the institution): N/A
9. Briefly list the most important publications and presentations from the past five years: N/A
10. Briefly list the most recent professional development activities: N/A

B.15 Hasniaty A.

1. Name: Hasniaty A.
2. Education:
   (a) Bachelor degree, Electrical Engineering, Universitas Hasanuddin, 1998
   (b) Master degree, Electrical Engineering, Universitas Gadjah Mada, 2002
3. Academic experience:
   (a) Lecturer, 2000-now
   (b) International Publication Capacity Enhancement Committee, Chairman, 2017–2018.
4. Non-academic experience: N/A
5. Certifications or professional registrations: N/A
6. Current membership in professional organizations: N/A
7. Honors and awards: N/A
8. Service activities (within and outside of the institution): N/A
9. Briefly list the most important publications and presentations from the past five years: N/A
10. Briefly list the most recent professional development activities: N/A

B.16 Ida Rachmaniar Sahali

1. Name: Ida Rachmaniar Sahali
2. Education:
   (a) Bachelor degree, Electrical Engineering, Universitas Hasanuddin, 2005
   (b) Master degree, Electrical Engineering, Institut Teknologi Bandung, 2012
3. Academic experience:
   (a) Assistant Lecturer (2012-2014), Lecturer, 2014-now
4. Non-academic experience:
   (a) Network Element Engineer, PT Indosat, Tbk, Makassar, (2006-2008)
5. Certifications or professional registrations: Lecturer Certification (2016)
6. Current membership in professional organizations: N/A
7. Honors and awards: N/A
8. Service activities (within and outside of the institution): N/A
9. Briefly list the most important publications and presentations from the past five years:
   (a) Christoforus Yohannes, Ida Rachmaniar Sahali, Wahyu Eko Pribadi, M. Taufan Yusuf – Controlling Temperature, Humidity and Light Intensity in Green House using Microcontroller based – Proceeding of Seminar Ilmiah Nasional Sains dan Teknologi Ke-2 – Makassar, September 7-8th, 2016.
   (b) Mukarramah Yusuf, Arisal Saila and Ida Sahali – pandaisejarah: Toward Implementation of Indonesian History with Teaching Pedagogy – Proceeding of International Seminar on Application for Technology of Information and Communication – Semarang, August 5-6th, 2016.
   (c) Ida Rachmaniar Sahali, Intan Sari Areni, Budianingsih, Dedi Setiawan, Fahmi - Implementation and Realization of Supply Chain Management to Accelerate In-ventory Process in Pervasive Environment Case Study: Purchase of Medicine Online via Mobile Phone – Proceeding of Seminar Nasional Teknik Informatika (SNATIKA), Makassar, September 6th, 2013.
10. Briefly list the most recent professional development activities: N/A

B.17 Ikhlas Kitta

1. Name: Ikhlas Kitta
2. Education:
   (a) Bachelor degree, Electrical Engineering, Hasanuddin University, 1999
   (b) Master degree, Electrical Engineering, Bandung Institute of Technology (ITB), 2003
   (c) PhD degree, Civil Engineering, Hasanuddin University, 2016
3. Academic experience:
   (a) Senior Lecturer (2013–Now), Lecturer (2008–2013)
4. Non-academic experience: N/A
5. Certifications or professional registrations:
   (a) PT Eleska IATKI, Bandung, Electrical Engineering Assessor (2011–Now)
6. Current membership in professional organization: N/A
   (a) The Indonesian Power Engineers Association (IATKI), Member (2011–now)
7. Honors and awards: N/A
8. Service activities (within and outside of the institution):
   (a) Application of EHV Transmission to optimize the distribution of renewable energy generation in South Sulawesi (2018)
   (b) Utilization of Coal-Fired power plant waste to development of HV insulators in Tropical Environments (2018)
   (c) Modelling and simulating the effect of controlling the active power and reactive power of non-renewable power plants on global warming (2016)
   (d) Development of an expert system based non-renewable power plant environmental impact assessment system (2015)
   (e) Optimizing the use of local renewable energy as an energy power plant in South Sulawesi based on a national mix energy scenario (2014)
9. Briefly list the most important publications and presentations from the past five years:
   (a) Ikhlas Kitta, Salama Manjang, Ida Rachmaniar, Faris Maricar , Tropical climate effects on corona power losses on 275 kV transmission lines in the South Sulawesi system, Przeglad Elektrotechniczny, ISSN 0033-2097, Vol. 95, No.1, 2019.
   (b) Ikhlas Kitta, Salama Manjang, Wihardi Tjaronge, Rita Irmawaty, Effect of coal fly ash filler in silicone rubber and epoxy resin as insulating material in wet environmental conditions, International Journal of Mechanical & Mechatronics Engineering 16 (02), 48–53, 2016.
   (c) Ikhlas Kitta, Salama Manjang, Wihardi Tjaronge, Rita Irmawaty, Effect of Fly Ash Filler Quantity on Electrical Properties of Silicone Rubber Insulator Material, ARPN Journal of Engineering and Applied Sciences 11 (7), 4689–4695, 2016.
   (d) Salama Manjang, Rizki Pratama Putera, Yusri Syam Akil, Ikhlas Kitta, Electrical and Mechanical Properties of Fly Ash Filled Silicone Rubber for High Voltage Insulator, ARPN Journal of Engineering and Applied Sciences 10(17), 7320–7327, 2015.

(e) Salama Manjang, Ikhlas Kitta, Khayrunnisa B Muhammadia, R Nurul Izra Mulya, Effect of water diffusion on dielectric behavior of polymer insulators, 2015 International Conference on Electrical Engineering and Informatics.

(f) Salama Manjang, Yedi George, Ikhlas Kitta, Analysis of power losses of the 150 kV transmission using Poynting vector, 2012 International Conference on Power Engineering and Renewable Energy.

(g) Salama Manjang, Ikhlas Kitta, Electrical Degradation and Aging of New Materials Insulating Under Multistress Conditions, Proceedings of The First International Workshop on Modern Research Methods in Electrical Engineering, 2009.

(h) Ikhlas Kitta, Perbaikan Level Tegangan dan Reduksi Rugi-Rugi Sistem Transmisi Sulbagsel Berbasis Ant Colony Optimization, INTEK: Jurnal Penelitian 6(1), 1–7, 2019.

(i) Tajuddin Waris, Yoshinobu Murakami, Naohiro Hozumi, Tomohiro Kawashima, Salama Manjang, Ikhlas Kitta, Improved Performance of Silicon Rubber Insulation With Coal Fly Ash Micro Filler, EPI International Journal of Engineering (EPIIJE) 1(2), 81–86, 2018.

(j) Naomi Lembang, Salama Manjang, Ikhlas Kitta, Appropriateness of Water Hyacint and Rice Husk as Filler Materials for Resin Polymer Insulation, Journal of Physics: Conference Series 1090(1), 012077, 2019.

(k) Ikhlas Kitta, Salama Manjang, Wihardi Tjaronge, Rita Irmawaty, Effect Composition of Fly Ash Filler on Electrical Properties of Silicone Rubber Insulator Material, Advanced Science Letters 23 (5), 3829-3832, 2017

(l) Ikhlas Kitta, Salama Manjang, Wihardi Tjaronge, Rita Irmawaty, Effect Of Fly Ash Filler To Dielectric Properties Of The Insulator Material Of Silicone Rubber And Epoxy Resin, International Journal of Scientific & Technology Research 5 (3), 120–124, 2016.

(m) Ansar Suyuti, Ikhlas Kitta, Zaenab Muslimin, Fitriyanti Mayasari , Smart electrical panel installation, the 2014 Makassar International Conference on Electrical Engineering and Informatics (MICEEI).

(n) Ansar Suyuti, Zaenab Muslimin, Ikhlas Kitta, Fitriyanti Mayasari, Smart electrical installation for apartment, Int. J. Eng. Innov. Technol 3 (5), 274–276, 2013.

10. Briefly list the most recent professional development activities: N/A

B.18 Indar Chaerah Gunadin

1. Name: Indar Chaerah Gunadin
2. Education:
   (a) Bachelor degree, Electrical Engineering, Universitas Hasanuddin, 1997
   (b) Master degree, Electrical Engineering, Institut Teknologi Sepuluh Nopember, 2006
   (c) Doctor degree, Electrical Engineering, Institut Teknologi Sepuluh Nopember, 2013
3. Academic experience:
   (a) Relay and Measurement Laboratory, Head of Laboratory, 2013-now
   (b) Associate Professor, 2000-now
   (c) Lecturer, 1998-now
4. Non-academic experience:
   (a) PT. Makassar Power Indonesia, Control Room, Electrical Operator, 1997-1998
5. Certification or professional registration: Lecturer Certification (2014)
6. Current membership in professional organization:
   (a) Member, Indonesian Association of Electricity Engineering Experts
   (b) Caretaker, Electrical Engineering Alumni of Universitas Hasanuddin , 2014-2019
7. Honors and awards: N/A
8. Service activities (within and outside of the institution).
   (a) Reviewers, Makara Journal of Technology, Indonesia University, 2017-now
9. Briefly list the most important publication and presentation from past five years.
   (a) Indar Chaerah Gunadin, Zaenab Muslimin, Yusran: “Steady State Stability Assesment Using Continous Power Flow Based on Load Tap Changer” International Journal of Applied Engineering Research (IJAER), ISSN 0973-4562 Volume 12, Number 24 (2017)
   (b) Indar Chaerah Gunadin, Zaenab Muslimin, Agus Siswanto, “Transient Stability Improvement Using Allocation Power Generation Methode Based on Momen Inertia”, 2017 International Conference on Electrical Engineering and Informatics (ICELTICs) ISBN: 978-1-5386-2934-1, October 18-20, 2017 Banda Aceh, Indonesia
   (c) Zaenab Muslimin, Indar Chaerah Gunadin, Muhammad Anshar “Comparative Study of the Effect of Temperature of Miniature Sun with Spotlights on Solar Pond”, Proceedings of the National Seminar on Electrical and Informatics Engineering, SBN: 978-602-18168-2-6, pp 247 – 251, November 20, 2017 Makassar, Indonesia
   (d) Indar Chaerah Gunadin, Sri Mawar Said, Muhammad Irsan, “Determination of Stability Index of Electrical Power System Using REI-Dimo Methods”, Journal of Theoretical and Applied Information Technology, 15th August 2016. Vol.90. No.1, pp.161-167.
   (e) Ansar Suyuti, Indar Chaerah Gunadin, Nurhayati, “PID Implementation on Real Time 3-Phase Induction Motor Controlling and Monitoring’, Journal of Theoretical and Applied Information Technology, 31st July 2016. Vol.89. No.2, pp. 495-501

(f) Steven Humena, Salama Manjang, Indar Chaerah Gunadin, "Optimization Economic Power Generation Using Modified Improved PSO Algorithm Methods", Journal of Theoretical and Applied Information Technology, 30th November 2016. Vol.93. No.2, pp. 522-530

(g) Andi Nurtrimarini, Sri Mawar Said, Indar Chaerah Gunadin, Mustadir Darusman B, "Impact of Penetration Wind Turbines on Transient Stability in Sulbagsel Electrical Interconnection System". Journal of Physics: Conference Series, 2018. 979(1): p. 012028.

(h) Nur Fadliah, B., G. Indar Chaerah, and Yusran, "Solar Pond Potential as A New Renewable Energy in South Sulawesi". Journal of Physics: Conference Series, 2018. 979(1): p. 012039.

10. Recent professional development activities:

    (a) Visiting Researcher in Kumamoto University, September-December 2015, Japan

B.19 Indrabayu

1. Name: Indrabayu
2. Education:
   (a) Bachelor degree, Electrical Engineering, Universitas Hasanuddin, 1999
   (b) Master degree, Business Information Technology, Monash University, 2001
   (c) Master degree, Telecommunication Multimedia, Institut Teknologi Sepuluh Nopember, 2005
   (d) Doctor degree, Electrical Engineering, Universitas Hasanuddin, 2013
3. Academic experience:
   (a) Associate Professor (2017-now), Senior Lecturer (2009-2017), Lecturer (2004-2009), Assistant (2002-2004)
   (b) Secretary of Engineering Faculty, Extension Class Program (2008-2010)
   (c) Head of Telecommunication Concentration in Electrical Department (2007-2010)
   (d) Student Affairs Secretary for Engineering (2013-2018)
   (e) Secretary of Informatics Department (2018-now)
4. Non-academic experience:
   (a) Coordinator of Student Branch IEEE Universitas Hasanuddin(2014-now)
   (b) Student Activities Coordinator of IEEE Indonesia (2017-now)
   (c) Project Coordinator of Sulawesi Economic Development Strategies, funded by DFATD Canada (2013-2017)
   (d) Expert Staff for Makassar Technopark (City Government) (2017-now)
   (e) Expert Staff for Smart City and Sombere Makassar (City Government) (2017-now)
   (f) Expert Staff for Telematic Incubator (IBTIE) for Southern Sulawesi (Province Government) (2018-now)
5. Certification or professional registration:
   (a) Lecturer Certification (2013)
   (b) Mikrotik Certification (2015)
   (c) Top Coach Certification (2017)
   (d) DGHE Indonesia International Quantum Certification for Reviewer of National Research (2017)
   (e) Engineering Professional Certification (2018)
6. Current membership in professional organization:
   (a) IEEE, Member (2014-now)
   (b) IEEE Computer Society, Member (2014-now)
   (c) IEEE Intelligent Transportation System Society, Member (2014-now)
7. Honors and awards:
   (a) The 10-Year National Badge "Satya Lencana Karya Satya", 2013, from the President of the Republic of Indonesia
   (b) Summa Cum Laude, Universitas Hasanuddin, 2013

(c) Best Coach Award, Humber College Canada, 2017

8. Service activities:

   (a) Pinrang Government Consultant

   (b) Makassar Smart City Consultant

   (c) Province Telematic Incubator Consultant

9. Briefly list the most important publication and presentation from past five years:

   (a) Mirna Andriani, Indrabayu, Intan Sari Areni, "Prediksi Pemakaian Obat di Instalasi Farmasi Rumah Sakit Pendidikan dengan menggunakan Metode Jaringan Syaraf Tiruan", Jurnal Dielektrika Vol. 2 No. 1, Februari 2015, ISSN: 2086-9487.

   (b) S. Anraeni, Indrabayu, I. Nurtanio, "Detection of Kidney Condition Using Hidden Markov Models Based on Singular Value Decomposition", SCOPUS Index, Vol. 15/ No. 2/ 2015/ Telkomnika

   (c) Indrabayu, Basri, A. Achmad, "Blob Modification in Counting Vehicles using Gaussian Mixture Models under Heavy Traffic", ARPN Journal of Engineering and Applied Sciences, SCOPUS Index, Vol. 10 No. 16, 2015

   (d) Indrabayu, B. Zamman, A.A. Ilham, Intan Sari Areni, "Prediction of Reagents Needs Using Radial Basis Function in Teaching Hospital", International Journal of Engineering and Technology (IJET), SCOPUS Index, Vol. 7 No.4, 2015.

   (e) C. Yohannes, Indrabayu, Ingrid Nurtanio, Reza Maulana, Intan Sari Areni, Elly Warni, "Apriori Algorithm for Surgical Consumable Material Standardization", International Organization of Scientific Research (IOSR), Vol. 18 Issue 6 Ver. III, November – December 2016

   (f) Intan Sari Areni, Indrabayu, Anugrahyani Bunyamin, "Improvement in Speech to Text for Bahasa Indonesia Through Homophone Impairment Training", Journal of Computers, Vol. 28 No. 5, 2017, SCOPUS Index, PP.110. DOI: 10.3966/199115992017102805001, ISSN: 19911599

   (g) Indrabayu, Y. Lesmana, A.A. Ilham, I. Nurtanio, S. Hamid, "An Intelligent Traffic Light System for Reducing Number of Queuing Cars in Complex Road Junction", ICIC Express Letters, Part B: Applications, SCOPUS Index, 2017

   (h) Intan Sari Areni, Anugrahyani, Indrabayu, "A hybrid feature extraction method for accuracy improvement in "Aksara Lontara" translation", Journal of Computer Science, ISSN Print: 1549-3636, ISSN Online: 1552-6607, SCOPUS Index, 2017

10. Recent professional development activities:

   (a) Building Smart Cities Applications for Province and Cities

   (b) Helping Technopreneur Start up in Sulawesi

B.20 Ingrid Nurtanio

1. Name: Ingrid Nurtanio
2. Education:
   (a) Bachelor degree, Electrical Engineering, Universitas Hasanuddin, 1986
   (b) Master degree, Electrical Engineering, Universitas Hasanuddin, 2002
   (c) Doctor degree, Electrical Engineering, Institut Teknologi Sepuluh November, 2013
3. Academic experience:
   (a) Assistant (1988-2011), Lecturer, 2011-now
   (b) Computer, Control and Electronic Sub-Study Program, Member, 2010-2015
   (c) Focus Group Discussion on Curriculum, Member, 2012-2017
4. Non-Academic experience:
   (a) Part time on PT. OCC (1986-1989)
   (b) Part time on PT. Esakom (1989-1992)
5. Certification or professional registration: Lecturer Certification (2014)
6. Membership in professional organization:
   (a) IEEE, Student Member (1997-1998), Member (2016-now)
   (b) Member, IEEE Engineering in Medicine and Biology Society (2016-now)
   (c) Member, IAENG (2011-now)
   (d) Member, APTIKOM (Assosiasi Perguruan Tinggi Komputer), (2016-now)
7. Honors and awards:
   (a) The 20-Year National Badge "Satya Lencana Karya Satya", 2014, from the President of the Republic of Indonesia
   (b) JBIC Loan Scholarship, (2009-2013)
8. Service activities (within and outside of the institution): N/A
9. Briefly list the most important publications and presentations from the past five years:
   (a) Basri, Indrabayu , Andani Achmad , Ingrid Nurtanio , Fitriyanti Mayasari , "Blob Modification In Counting Vehicles Using Gaussian Mixture Models Under Heavy Traffic", ARPN Journal of Engineering and Applied Sciences, pp. 7157-7163, 2015
   (b) ARY Sespajayadi, Ingrid Nurtanio , "Technical Data Analysis for Movement Prediction of Euro to USD Using Genetic Algorithm-Neural Network", International Seminar On Intelligent Technology And Its Applications (ISITIA), PP.23-26, 2015.
   (c) MD Wibowo, Ingrid Nurtanio , AA Ilham, "Indonesian Sign Language Recognition Using Leap Motion Controller", 11th International Conference On Information & Communication Technology And System (ICTS), PP.67-72, 2017
10. Briefly list the most recent professional development activities: N/A

B.21 Intan Sari Areni

1. Name: Intan Sari Areni
2. Education:
   (a) Bachelor degree, Electrical Engineering, Universitas Hasanuddin, 1998
   (b) Master degree, Electrical Engineering, Universitas Gadjah Mada, 2003
   (c) Doctor degree, Electrical Engineering, Ehime University, 2013
3. Academic experience:
   (a) Lecturer, Telecommunication and Electronics Engineering, (2000-2003)
   (b) Senior Lecturer, Telecommunication and Information, (2004-2019)
   (c) Associate Professor, Telecommunication and Information, (2010-now)
4. Non-Academic Experience: N/A
5. Certification or professional registration:
   (a) Research Reviewer Standards of SNI ISO/IEC 17024: 2012, LSP Quantum HRM International
6. Current membership in professional organization:
   (a) Member, The Institution of Engineers Indonesia, 2016-present
   (b) Member, International Association of Engineers (IAENG), 2018
7. Honors and awards:
   (a) Dean's Commendation for High Achievement, Faculty of Engineering, Universitas Hasanuddin , Indonesia, 1998.
   (b) JBIC Scholarships, from JICA (Japan International Cooperation Agency) as Part of Universitas Hasanuddin , Engineering Faculty Development Project, Japan; Period October 2009-March 2013.
   (c) Short Term Research Program Grant, from JICA (Japan International Cooperation Agency) as Part of Universitas Hasanuddin , Engineering Faculty Development Project, Japan; Period October 2015-January 2016.
   (d) JICA Knowledge Co-Creation Program, JICA, Japan, 8-14 July 2018
8. Service activities (within and outside of the institution):
   (a) Local Organizing Committee, Makassar International Conference on Electrical Engineering and Informatics (MICEEI), 2014.
   (b) Technical Program Chair, International Conference on Computational Intelligence and Cybernetics (Cybernetics.com), 2016.
   (c) Organizing Committee, EPI International Conference on Science and Engineering, 2018.
9. Briefly list the most important publications and presentations from the past five years:
   (a) Intan Sari Areni, Asmah Akhriana, Elyas Palantei, Sukriyah Buwarda: "Utilization of HF Electromagnetic Waves Availability for Charging Mobile Communication Device", Makassar International Conference on Electrical Engineering and Informatics (MICEEI), Makassar Golden Hotel, 26-30 November 2014.
   (b) Elyas Palantei, Ashadi Amir, Dewiani, Intan Sari Areni, Andani: "Early Stage Cancer Detection Technique Considering the Reflected Power from Breast Tissues", ARPN Journal of Engineering and Applied Sciences, Vol. 10, No. 17, 2015.

(c) Elyas Palentei, Intan Sari Areni, Muh.Fahmi Rustan, dan Ardiansyah: "Improvement of UWB Patch Transducer Properties Applicable for Fetal Monitoring System", IEEE Asia Pasific Conference on Wireless and Mobile (ApWiMob), Bandung, 27-29 August 2015.

(d) Indrabayu, Baizul Saman, Amil A. Ilham, Intan Sari Areni: "Prediction of Reagents Needs Using Radial Basis Function in Teaching Hospital", International Journal of Engineering and Technology (IJETIY), Vol. 4, No.17, 2015.

(e) Intan Sari Areni, Elyas Palantei, Ansar Suyuti, Adnan, Weni Sri Yusnita, Heni Susanti: "Attenuation Measurement of Laboratory-Based PLC Implementation", Vol.8, No.1, 2016.

(f) Zahir Zainuddin, Intan Sari Areni, Raden Wirawan: "Augmented Reality Application in Smart Building Information System", Jurnal Nasional Teknik Elektro dan Teknologi Informasi (JNTETI) – Universitas Gadjah Mada, Vol. 5, No. 3, August 2016.

(g) Christoforus Y., Indrabayu, Ingrid Nurtanio, Reza Maulana, Intan Sari Areni, Elly Warni: "Apriori Algorithm for Surgical Consumable Material Standardization", International Organization Of Scientific Research (IOSR),Vol. 18, Issue 6, Ver III, Nov-Dec 2016.

(h) Anugrahyani, Intan Sari Areni, Indrabayu, Novy Nurrahmillah: "Speech to Text for Indonesian Homophone Phrase with Mel Frequency Cepstral Coefficient", International Conference on Computational Intelligence and Cybernetics (Cyberneticscom), SwissBel-Hotel Makassar, 22-23 Nov 2016.

(i) Adnan, Intan Sari Areni, Muh. Iqbal, Yuni Andayani: "Smart Laboratory System Using Raspberry Pi 2", ICIC Express Letters, Part B: Applications, Vol. 8, Number 4, Pp. 763-766, April 2017.

(j) Intan Sari Areni, Anugrahyani, Indrabayu: "Improvement in Speech to Text for Bahasa Indonesia Through Homophone Impairment Training", Journal of Computers (Taiwan), Vol. 28, No. 5, pp. 1-10, 2017.

(k) Intan Sari Areni, Asyraful Insan Asry, Indrabayu: "A hybrid feature extraction method for accuracy improvement in "Aksara Lontara" translation", Journal of Computer Science, Vol.13, Issue 9, pp. 393-399, 2017.

(l) Intan Sari Areni, Sri Wahyuni, Indrabayu: "Solution to Abbreviated Words in Text Messaging for Personal Assistant Application", International Seminar on Application for Technology of Information and Communication (ISEMANTIC), Semarang, 7-8 October 2017.

(m) Indrabayu, Rizki Yusliana Bakti, Intan Sari Areni: "A Modified Pinhole Camera Model for Automatic Speed Detection of Diagonally Moving Vehicle", Journal of Engineering Science and Technology Vol. 13, No. 6 (2018), pp. 1722 – 1734, 2018.

10. Briefly list the most recent professional development activities:

(a) Short Term Research Program, October 2015 – January 2016

B.22 Merna Baharuddin

1. Name: Merna Baharuddin
2. Education:
   (a) Bachelor degree, Electrical Engineering, Universitas Hasanuddin ,1999
   (b) Master degree, Electrical Engineering Monash University, 2002
   (c) Doctor degree, Electrical Engineering, Chiba University, 2010
3. Academic experience:
   (a) Lecturer (2005-2011), Senior Lecturer (2012-now)
4. Non-Academic Experience:
   (a) PT. Bukaka SingTel International, Junior Project Engineer, Data Network Analyser, 2000
5. Certification or professional registration: N/A
6. Current membership in professional organization: N/A
7. Honors and awards:
   (a) Australian Development Scholarship (ADS), Australia, 2000-2002
   (b) Monbukagakusho Scholarship, Japan, 2006-2010
8. Service activities (within and outside of the institution).
   (a) Committee Member, The 13th CEReS International Symposium on Remote Sensing: Disaster Monitoring and Mitigation in Asia, 29 October 2007, Chiba, Japan
   (b) Committee Member, The 3rd Indonesia Japan Joint Scientific Symposium (IJJSS 2008), 9-11 September 2008 at Chiba University, Japan
   (c) Committee Member, International Workshop on Synthetic Aperture Radar (IWSAR 2009), February 16, 2009 at Chiba University, Japan.
   (d) Committee Member, The 2nd Makassar International Conference on Electrical Engineering and Informatics (MICEEI) 2010 at Makassar, Indonesia.
9. Briefly list the most important publication and presentation from past five years
   (a) Merna Baharuddin, Zulfajri Basri Hasanuddin, Misdawati, and Khairunnisa Mansur: "A Waterproof Ultrasonic Sensing System for Locating Fish in Underwater Area", International Journal of Engineering and Science Applications, Vol.3, no 2, pp. 201-206, November 2016.
   (b) Merna Baharuddin, "Pengukuran dan Analisis Kualitas Sinyal Satelit untuk Aplikasi Land Mobile Satellite (LMS) terhadap Ketinggian dan Sudut Elevasi Penerima Global Positioning System (GPS)", Seminar Nasional Fisika 2013, Universitas Hasanuddin , Makassar, Nop 2013, Makassar.
   (c) Merna Baharuddin, Elyas Palantei, "A Preliminary experiment on transmitter and receiver of nanosatellite for telemetry application", 4th Makassar International Conference on Electrical Engineering and Informatics (MICEEI), Nop 2014, Makassar.
   (d) Merna Baharuddin, Elyas Palantei, "Prototipe Receiver untuk Charging Perangkat Bergerak via Sinyal Radio Frequency (RF)", Seminar Nasional Teknologi Industri Politeknik ATI Makassar (SNTI IV 2016), November 2016, Makassar.
10. Briefly list the most professional professional development activities
    (a) Visiting Researcher in Chiba University, July-September 2013, Japan

B.23 Muhammad Anshar

1. Name: Muhammad Anshar
2. Education:
   (a) Bachelor degree, Electrical Engineering, Universitas Hasanuddin, 1999
   (b) Master degree, Computer Science by Research, University of Technology Sydney, 2009
   (c) Doctor degree, Computer Systems, University of Technology Sydney, 2017
3. Academic experience:
   (a) Senior Lecturer (2016-now), Lecturer (2005-2016), Assistant (2003-2005)
   (b) Basic Electric Laboratory, Associate Head, (2009-2011)
   (c) Students Affairs, Electrical Engineering Department, Head, (2009-2011)
   (d) Robotics Development Group, Director, (2005-2012)
   (e) Indonesia-Australia Social Robotics Research Collaboration, Director, 2016-now
4. Non-academic experience: part time in a private engineering company
   (a) PT. National Panasonic Gobel Indonesia - Branch Makassar, 1997
   (b) PT. Industri Kapal Indonesia IKI, Makassar, 1997-1998
5. Certifications or professional registrations: Lecturer Certification (2011)
6. Current membership in professional organization: BICA Society, Member (2015 - 2016)
7. Honors and awards:
   (a) Australia Partnership Scholarship - APS Australia Aid, (2006-2009)
   (b) Australia Leadership Award - ALA Australia Aid, (2012 -2016)
8. Service activities (within and outside of the institution):
   (a) Quality Enhancement of Clean Water Supply in Remote Region Maros South Sulawesi (QECeWaS), under the funding of Australian Alumni Grant Scheme (AGS) 2nd Round 2017
9. Briefly list the most important publications and presentations from the past five years:
   (a) Evolving Artificial Pain from Fault Detection Through Pattern Data Analysis, co-author: Mary-Anne Williams, Proceedings of the 2017 IEEE International Conference on Real-time Computing and Robotics (IEEE RCAR 2017) Okinawa, Japan (14-18 July 2017)
   (b) Evolving synthetic pain into an adaptive self-awareness framework for robots, co-author: Mary-Anne Williams, Journal of Biologically Inspired Cognitive Architectures, Vol. 16, Pages 8-18, Elsevier, 2016.
10. Briefly list the most recent professional development activities:
    (a) Leadership Workshop, Canberra, 2012

B.24 Muhammad Arief

1. Name: Muhammad Arief
2. Education:
   (a) Bachelor degree, Electrical Engineering, Universitas Hasanuddin , 1975
   (b) Master degree, l'Institut National Polytechnique de Toulouse, 1980
   (c) Doctor degree, l'Institut National Polytechnique de Toulouse, 1985
3. Academic experience:
   (a) Lecturer (1975-1980), Senior Lecturer (1980-1985), Associate Professor (1985-1990), Professor, 1990-now
4. Non-Academic experience: N/A
5. Certification or professional registration: N/A
6. Membership in professional organization: N/A
7. Honors and awards:
   (a) Certificate of Appreciation at Student Development Development Orientation, Directorate General of Higher Education (DIKTI), Ministry of National Education, Indonesia, 1988
   (b) Observer at the State University (Kopertis IX) Co-curricular Scientific Work Competition in the Eastern Indonesia Region, IKIP Manado, 1986
   (c) Certificate of Attendance of Research Training, Directorate General of Higher Education (DIKTI), Ministry of National Education, Indonesia, 1977
8. Service activities (within and outside of the institution):
   (a) International Committee, 1st Makassar International Conference on Electrical Engineering & Informatics (MICEEI), Universitas Hasanuddin , 4-5 November 2008
   (b) Reviewer of International Conference on Makassar International Conference in Electrical Engineering and Informatics (MICEEI), Makassar Golden Hotel (MGH), 29 November-1 December 2014
9. Briefly list the most important publications and presentations from the past five years:
   (a) The 2011 Australasian Universities Power Engineering Conference (AUPEC'11), Load Curtailment Strategy in Distribution Network with Dispersed Generations, Brisbane, 25-28 September 2011
   (b) The 9th International Power Engineering Conference (IPEC), Under Voltage Load Shedding Incorporating Bus Participation Factor, Singapore, 27-29 October 2010
10. Briefly list the most recent professional development activities: N/A

B.25 Muhammad Bachtiar Nappu

1. Name: Muhammad Bachtiar Nappu
2. Education:
    (a) Bachelor degree, Electrical Engineering, Universitas Hasanuddin, (1994-1999)
    (b) Master degree, Electrical Engineering, Institut Teknologi Bandung, (1999-2001)
    (c) M.Phil., Electrical Engineering, the University of Queensland, (2007-2009)
    (d) Doctor degree, Electrical Engineering, University of Queensland, (2009-2013)
3. Academic experience:
    (a) Head of Research and Development Center on Energy and Electricity, Research and Community Services Institute, 2016-now
    (b) Lecturer, 2003-now
4. Non-academic experience: N/A
5. Certifications or professional registrations:
    (a) Lecturer Certification
6. Current membership in professional organizations: N/A
7. Honors and awards: N/A
8. Service activities (within and outside of the institution):
    (a) 2017, Speaker/ facilitator of Community Services Project for primary school students and teachers in Makassar, "Education for the usage of solar energy as an alternative and environmentally friendly energy for primary school community", Makassar.
9. Briefly list the most important publications and presentations from the past five years Journal publications:
    (a) M.B. Nappu, A. Arief and R.C. Bansal, "Transmission Management for Congested Power System: A Review of Concepts, Technical Challenges and Development of a New Methodology" Renewable and Sustainable Energy Reviews, ELSEVIER, Vol. 38, pp. 572–580, October 2014.
    (b) M.B. Nappu, R.C. Bansal, T.K. Saha, "Market Power Implication on Congested Power System: A Case Study of Financial Withheld Strategy", International Journal of Electric Power and Energy Systems (IJEPES), vol. 47, pg. 408-415, ELSEVIER, May 2013.
    (c) A. Arief, Z.Y. Dong, M.B. Nappu, and M. Gallagher, "Under Voltage Load Shedding in Power Systems with Wind Turbine-Driven Doubly Fed Induction Generators", Electric Power System Research, ELSEVIER, vol. 96, pp. 91-100, March 2013.
    (d) A. Arief, Antamil and M.B. Nappu, "Analytical Method for Reactive Power Compensators Allocation", International Journal of Technology, Volume 9(3), pp. 602-612, Scopus indexed, ISSN: 2086-9614, 2018.
    (e) M.B. Nappu, A. Arief and A.S. Duhri, "Economic Emission Dispatch for Thermal Power Plant in Indonesia", accepted for publication in International Journal of Smart Grid and Clean Energy (IJSGCE), ISSN: 2315-4462, Scopus indexed, 2018.

(f) W.A. Ajami, A. Arief and M.B. Nappu, "Optimal power flow for power system interconnection considering wind power plants intermittency" accepted for publication in International Journal of Smart Grid and Clean Energy (IJSGCE), ISSN: 2315-4462, Scopus indexed, 2018.

(g) W.S. Alfira, M.B. Nappu and A.Arief, "Under Voltage Load Shedding Simulation for Southern Sulawesi Power System with Integration of Wind Power Plants", accepted for publication in Advance Science Letter, Scopus indexed, ISSN: 1936-6612, 2018.

(h) M.B. Nappu and A. Arief, "Network Losses-Based Economic Redispatch for Optimal Energy Pricing in a Congested Power System", Energy Procedia, ELSEVIER, Volume 100, November 2016, Pages 311-314.

(i) A. Arief, Antamil and M.B. Nappu, "An Analytical Method for Optimal Capacitors Placement from the Inversed Reduced Jacobian Matrix", Energy Procedia, ELSEVIER, Volume 100, November 2016, Pages 307-310.

10. Conference Presentations:

(a) M.B. Nappu, A. Arief, and M.I. Bachtiar, "Strategic Placement of Capacitor and DG for Voltage Improvement after Large Penetration of Renewable Energy Power Plant: An Indonesian Study", to be presented at the 7th International Conference on Renewable Energy Research and Applications (ICRERA 2018), 14-17 October 2018, Paris, France.

(b) M.B. Nappu, A. Arief and A.S. Duhri, "Economic Emission Dispatch for Thermal Power Plant in Indonesia", to be presented at the 5th International Conference on Power and Energy Systems Engineering (CPESE 2018), 19-21 September 2018, Nagoya University, Nagoya, Japan

(c) M.B. Nappu, A. Arief, "Network Losses-Based Economic Re-dispatch for Optimal Energy Pricing in a Congested Power System", the 3rd International Conference on Power and Energy Systems Engineering (CPESE 2016), 8-10 September 2016, Kitakyushu, Japan.

(d) M.B. Nappu, M.I. Bachtiar, A. Arief, "Network Losses Reduction Due To New Hydro Power Plant Integration", the 3rd International Conference on Information Technology, Computer and Electrical Engineering (ICITACEE 2016), 19 – 21 October 2016, Semarang, Indonesia.

(e) M.B. Nappu, A. Arief, "Economic Re-dispatch Considering Transmission Congestion for Optimal Energy Price in a Deregulated Power System", International Conference on Electrical Engineering and Informatics (ICEEI 2015), Denpasar – Bali, Indonesia, August 10-11, 2015.

11. Briefly list the most recent professional development activities: N/A

B.26 Muhammad Niswar

1. Name: Muhammad Niswar
2. Education:
   (a) Bachelor degree, Electrical Engineering, Universitas Hasanuddin, 1997
   (b) Master degree, Information Technology Computer Engineering, University of Newcastle, 2001
   (c) Doctor degree, Engineering, Information Science Nara Institute of Science and Technology, 2010
3. Academic experience:
   (a) Lecturer (1999-2003), Senior Lecturer (2017-now)
4. Non-Academic Experience:
   (a) Director, Directorate of Information Technology, Universitas Hasanuddin, Indonesia Developing and maintaining ICT services and infrastructures in Campus, 2012-now
   (b) Visiting Researcher, University of Washington, WA, US, ICT for Development, Fall, (2012)
   (c) Instructor, Training Center Japan (TCJ), Conducting training of Cisco Network Academy, (2010-2011)
   (d) Wireless Access Engineer, Lucent Technology, Network System Indonesia, Installation and commissioning test of Wireless Local Loop Infrastructures, (1997-1998)
5. Certifications or professional registrations:
   (a) Cisco Certified Network Associate (CCNA), Cisco ID: CSCO11859357
   (b) Certified Data Center Professional (CDCP), CDCP ID: 5863072.20604917
6. Membership in professional organizations
   (a) Member (#94036635), The Institute of Electrical and Electronics Engineer (IEEE).
   (b) Member, Asosiasi Pendidikan Tinggi Informatika dan Komputer (Association of Higher Education for Informatics and Computer Study).
7. Honors and awards:
   (a) C-BEST JICA Research Grant (2018)
   (b) Fullbright Scholarship Awardee (2012)
   (c) InSiNAS Research Grant from Ministry of Research and Technology, Indonesia (2012-2014)
   (d) Monbukagakusho Scholarship Awardee (2006-2010)
   (e) Australian Development Scholarship (ADS) Awardee (2000-2001)
8. Service activities:
   (a) Member, Center of Technology Organizing Committee, Faculty of Engineering, Universitas Hasanuddin
9. Briefly list the most important publications and presentations from the past five years:
   (a) Muhammad Niswar, Zahir Zainuddin, Yushinta Fujaya, Zagita Marna Putra, "An Automated Feeding System for Soft Shell Crab", Indonesian Journal of Electrical Engineering and Computer Science, Vol. 5, No. 3, 2017, pp.564-568

(b) Muhammad Niswar, Aksan S. Wijaya, Muhammad Ridwan, Adnan, Amil A. Ilham, Rhiza S. Sadjad, Andreas Vogel, “The Design of Wearable Medical Device for Triaging Disaster Casualties in Developing Countries”, in Proceedings of Digital Information Processing and Communication (ICDIPC 2015), Fifth International Conference on, Sierre, Switzerland, 2015, pp.207-212

(c) Muhammad Niswar, Shigeru Kashihara, Suguru Yamaguchi. “Vertical Handover Management for VoIP session over broadband Wireless Networks”, Int’l Journal of Communication, Network and System Sciences, Vol. 6, No. 6, 2013, pp. 289-299.

(d) Muhammad Niswar, et al. “Performance Evaluation of ZigBee-based wireless sensor network for Monitoring Patients’ pulse status”, In Proceeding of Information Technology and Electrical Engineering (ICITEE), 2013 IEEE International Conference on, pp.291-294, Jogjakarta, Indonesia, 7-3 October 2013

(e) Muhammad Niswar, Sabri AA, Warni E, Musa MN, “Memory Sharing Management on Virtual Private Server”, In Proceeding of ICT for Smart Society (ICISS), 2013 IEEE International Conference on, pp.1-4, Jakarta, Indonesia, 13-14 June 2013

10. Briefly list the most recent professional development activities:

    (a) Scientific Publication Management Training at LIPI, Jakarta, 2016

    (b) Workshop on Developing Online Education (DOED), Universitas Indonesia, 2013

B.27 Muhammad Tola

1. Name: Muhammad Tola
2. Education:
   (a) Bachelor degree, Electrical Engineering, Universitas Hasanuddin , 1975
   (b) Master degree, Electrical Engineering, Kagoshima University, 1982
   (c) Doctor degree, Ph.D. Electrical Engineering, Kobe University, 1985
3. Academic experience:
   (a) Lecturer (1975-1980), Senior Lecturer (1980-1985), Associate Professor, 1985-1990, Professor, 1990-now
4. Non-academic experience: N/A
5. Certifications or professional registrations: N/A
6. Current membership in professional organizations: N/A
7. Honors and awards: N/A
8. Service activities (within and outside of the institution): N/A
9. Briefly list the most important publications and presentations from the past five years:
   (a) Andi Ejah Umraeni Salam , Muhammad Tola , Mary Selintung, Farouk M, "Application Of ASTAR And RBF-NN To Predict Location And Magnitude Of Pipe Leak On Water Distribution Network", Proceeding International Symposium on Lowland Technology, 9th ISLT, Saga September-October 2014
   (b) Andi Ejah Umraeni Salam , Muhammad Tola , Mary Selintung, Farouk M, "Web Based Real time Water Pressure Monitoring System", Proceeding Electrical Enginering, Computer Science and Informatics, EECSI Conference, Yogyakarta, 20-21 August 2014
   (c) Andi Ejah Umraeni Salam , Muhammad Tola , Mary Selintung, Farouk M, "Water Leakage Detection System Of Pipe Line Using Radial Basis Function Neural Network", Proceeding International Seminar on Infrastructure Development, 2nd ISID, Balikpapan, 3rd June 2014
   (d) Syafruddin Syarif , Wihardi T, Muhammad Tola , Nadjamuddin Harun , "Detection system of Illegal Logging Image using Matching process With Discrete Cosine Transform", International Journal of Computational Engineering Research, Vol 03, Issue 6
10. Briefly list the most recent professional development activities: N/A

B.28 Nadjamuddin Harun

1. Name: Nadjamuddin Harun
2. Education:
   (a) Bachelor degree, Electrical Engineering, Universitas Gadjah Mada 1978
   (b) Master degree, Electrical Engineering,Universitas Hasanuddin , 1994
   (c) Doctor degree, Engineering Sciences, Universitas Hasanuddin , 1999
3. Academic experience: N/A
4. Non-academic experience: N/A
5. Certifications or professional registrations: N/A
6. Current membership in professional organizations: N/A
7. Honors and awards: N/A
8. Service activities (within and outside of the institution): N/A
9. Briefly list the most important publications and presentations from the past five years:
   (a) Jakobus Karion, Nadjamuddin Harun, Ansar Suyuti, Steven Humena, "Optimization of Renewable Energy Generation to Increase The Electrification Ratio in Borme District-Papua Province", ARPN Journal of Engineering and Applied Sciences Vol. 14, February 2019
   (b) A M Arif Bijaksana, M Sjahrul, Nadjamuddin Harun, Rudy Djamaluddin, "The Effect of Gas Emission Steam Power Plant on the Surrounding Residential Area", International Journal of Civil & Environmental Engineering IJCEE-IJENS Vol 12, 2012
   (c) Mahyuddin, Faizal Arya Samman, Nadjamuddin Harun, "Modelling and Simulation of Hybrid Generator of Photovoltaic, Genset and Battery", Proc. Of the 2013 International Workshop on Modern Research Methods in Electrical Engineering (IWORMEE), 2013.
   (d) Indar Chaerah Gunadin, Zaenab Muslimin, Agus Siswanto, Nadjamuddin Harun, "Transient Stability Improvement Using Allocation Power Generation Methods Based on Moment Inertia", International Conference on Electrical Engineering and Informatics (ICELTICs), 2017
10. Briefly list the most recent professional development activities: N/A

B.29 Rhiza Samsoe'oed Sadjad

1. Name: Rhiza Samsoe'oed Sadjad
2. Education:
   - (a) Bachelor degree, Electrical Engineering, Institut Teknologi Bandung, 1981
   - (b) Master degree, Electrical Engineering, University of Wisconsin, 1989
   - (c) Doctor degree, Ph.D. Electrical Engineering, University of Wisconsin, 1994
3. Academic experience:
   - (a) Lecturer (2000-2011), Assistant (1982-2000), Senior Lecturer, 2011-now
   - (b) Head of Control Systems and Instrumentation Laboratory (1995)
   - (c) Chairman of Computer, Control and Electronic Sub-Study Program (2010-2015)
   - (d) Department of Electrical Engineering, Chairman (2003)
   - (e) Focus Group Discussion on Curriculum, Chairman (2012-2017)
4. Non-academic experience:
   - (a) PT Compact Microwave Indonesia, Bandung, System Engineer (1990-1995)
5. Certifications or professional registrations: Lecturer Certification (2012)
6. Current membership in professional organizations
   - (a) IEEE, Student Member (1988-1994), Member, 2016-now
   - (b) IEEE Instrumentation and Measurement Society, Member, 2016-now
7. Honors and awards: N/A
8. Service activities (within and outside of the institution): N/A
9. Briefly list the most important publications and presentations from the past five years: N/A
10. Briefly list the most recent professional development activities: N/A

B.30 Salama Manjang

1. Name: Salama Manjang
2. Education:
   (a) Bachelor degree, Electrical Engineering, Universitas Hasanuddin , 1988
   (b) Master degree, Electrical Engineering, Institut Teknologi Bandung, 1994
   (c) Doctor degree, Electrical High Voltage Insulation Technology, Institut Teknologi Bandung - Sandwich in T.U. Braunschweig University, 2001
3. Academic experience:
   (a) Lecturer (2001-2006), Senior Lecturer (2006-2008), Professor of High Voltage Engineering, 2008-now
   (b) Chair of Department of Electrical Engineering, 2016-now
   (c) Head of Center for Electricity Energy Research and Development at the Institute for Research and Community Service (LP2M) (2014-2016)
   (d) Head of High Voltage Engineering Laboratory Electrical Engineering, 2009-now
   (e) Secretary Head of High Voltage Engineering Laboratory, Makassar (2006-2008)
   (f) Vice Head of Energy and Electricity Assessment Research Center, (2004-2014)
   (g) Chair of Post Graduate Study Program, Post Graduate Program, Universitas Hasanuddin (2004-2014)
4. Non-academic experience:
   (a) Preparation of the Road Map Village Electricity South Sulawesi, Southeast Sulawesi and West Sulawesi 2015-2019, Cooperation of PT. PLN (Persero) Wil. Sulselrabar with LPPM- Universitas Hasanuddin , 2014.
   (b) Field Investigation Study of Steam Power Plant (PLTU 2x50 MW) IPP Sulut3, North Sulawesi, Cooperation of PT. PLN (Persero) PUSENLIS Jakarta with LPPM-Universitas Hasanuddin , 2013.
   (c) Field Investigations Study of Hydropower Project (PLTA) Watunohu 1 Kolaka, Southeast Sulawesi, Cooperation of PT. PLN (Persero) PUSENLIS Jakarta with LPPM-Universitas Hasanuddin , 2013.
   (d) Document Preparation of Management Environmental Impact Analysis (AMDAL) Mini Hydro Power Plant (2x2 MW) Lapai I Southeast Sulawesi. Cooperation of PT. PLN (Persero) UIP XII with LPPM-Universitas Hasanuddin , 2013.
   (e) Optimizing the Use of Renewable Energy for Primary Energy Power Plants in South Sulawesi Scenario-Based National Energy Mix, Compete Grant Project, Higher Education of the Republic of Indonesia, 2013.
5. Certifications or professional registrations:
   (a) Reviewer certificate from the Ministry of Research, Technology and Higher Education, Republic of Indonesia (2017).
   (b) Certificate of Assessor Competency in the Installation of Electric Power, from Ministry of Energy and Mineral Resources of the Republic of Indonesia (2016)
   (c) Certificate for Energy Audit in the Building, by Renewable Energy and Energy Conservation, Ministry of Energy and Mineral Resources of the Republic of Indonesia (2015)
   (d) Certificate of Main Electric Power Engineer, Construction Services Development Board (2015).

(e) Certificate of Up Grading Assessor (IATKI's Assessor). The Indonesian Power Engineers Association (2010)

6. Current membership in professional organizations:

   (a) Electrical Engineer Alumni Association, Vice President, 2006-now.
   (b) Indonesian Engineer Association (PII), Coordinator for South Sulawesi, 2006-now.
   (c) National Consultant Association (INKINDO) South Sulawesi, Head of Expert and Advocacy, (2006-2010)
   (d) Indonesian Electrical Contractor Association (AKLINDO). Advisory Board for South Sulawesi. 2004-now.
   (e) Indonesian Electricity Expert Association (IATKI) South and Southeast Sulawesi. Chairman. 2004-now.
   (f) Indonesia Electricity Society (MKI) South and Southeast Sulawesi, member 2004-now.
   (g) Association of ITB Alumni (IA-ITB) South Sulawesi, member 2003-now.

7. Honors and awards: N/A

8. Service activities (within and outside of the institution): N/A

9. Briefly list the most important publications and presentations from the past five years:

   (a) Design Analyse of Ceramic and Polymer 150 kV Insulators for Tropical Condition Using Quicfield Software, Salama Manjang , Engineering International Conference 6th, 2017, ISSN 2540-7740.
   (b) Evaluating the Effect Placement Capation and Distributed Photovoltaic Generation for Power System Losses Minimization in Radial Distribution System, Salama Manjang , Engineering International Conference 6th, 2017, ISSN: 2540-7740.
   (c) Potential of Renewable Energy from Waste Mitigation of Gas Emissions, Salama Manjang at al, 2017 IEEE International Conference on Smart Grid and Smart Cities, July 2017, ISBN; 978-1-5386-0504-2.
   (d) Settling Basin Modeling to Reduce Fluctuation of Sediment Concentration on MHP Irrigation Channels, Arifin P,Salama Manjang , Nadjamuddi H, Jurnal IJCIET, August 2017, Vol. 8 No. 8, ISSN Online: 0976-6316.
   (e) Analisis sedimentasi pada PLTMH Saluran Irigasi dan Pemodelan Settling Basin, Arifin P, Salama Manjang , Nadjamuddi H, Jurnal Nasional Prodi S3 Teknik Sipil Unhas, January 2017, Vol. XL, Makassar, ISSN: 2087-7986.
   (f) Analysis Effect of Sedimentation at MHP Type Turbine open Flume on Irrigation Channel, Arifin P, Salama Manjang , Nadjamuddi H, Jurnal Ijera, Januari 2017, Vol. 7, No. 1, ISSN: 2248-9622.
   (g) Energy Yield of Photovoltaic (PV) Systems Support Hybrid Power Generation in Bontang City, Indonesia, Sitti Hamnah, Salama Manjang , ICIC Express Letters An International Journal Of Research And Surveys, November 2017, Vol.9, No. ISSN: 1881-803.

10. Briefly list the most recent professional development activities: N/A

B.31 Sonny Tanyadji

1. Name: Sonny Tanyadji
2. Education:
   (a) Bachelor degree, Electrical Engineering, Universitas Hasanuddin, 1976.
3. Academic experience:
   (a) Senior Lecturer, 1976–now
4. Non-academic experience:
   (a) Prima Ltd. Singapore, Deputy Chief Engineer, 1969–1982.
   (b) Prima Ceylon Ltd., Electrical Chief Engineer, 1977–1982.
   (c) PT. Kanik Utama Makassar, Person in Charge of SIKAD Engineering and Technical Director, 1982–2002.
   (d) CV. SEN Engineering Co., Director, 2002–2014.
   (e) PT. SEN Enjiniring Kelistrikan, President Director, 2014-now.
5. Certifications or professional registrations:
   (a) Professional Engineer Certificate, Electrical Engineering Competency Certificate.
6. Current membership in professional organization:
   (a) The Indonesian Power Engineers Association (IATKI).
   (b) Indonesian Association of Electrical Construction (AKLI).
7. Honors and awards: N/A
8. Briefly list the most important publications and presentations from the past five years: N/A
9. Briefly list the most recent professional development activities: N/A

B.32 Sri Mawar Said

1. Name: Sri Mawar Said
2. Education:
   (a) Bachelor degree, Electrical Engineering, Universitas Hasanuddin , 1985
   (b) Master degree, Electrical Engineering, Universitas Hasanuddin , 2004
   (c) Doctor degree, Civil Engineering, Universitas Hasanuddin , 2014
3. Academic experience:
   (a) Lecturer, 1986-now
   (b) Head of Basic Electrical Laboratory, (2010-2012)
   (c) Head of Electrical Machines Laboratory, 2016-now
4. Non-academic experience: N/A
5. Certifications or professional registrations:
   (a) Lecturer Certification (2009)
6. Current membership in professional organizations:
   (a) The Institution of Engineers Indonesia, Member, 2010-now
7. Honors and awards:
   (a) The 10-Year National Badge "Satya Lencana Karya Satya", 2017, from the President of the Republic of Indonesia
8. Service activities (within and outside of the institution): N/A
9. Briefly list the most important publications and presentations from the past five years:
   (a) Sri Mawar Said, Salama Manjang, M.Wihardi Tjaronge, Muh. Arsyad Thaha: "Arima Application as an Alternative Method of Rainfall Forecasts in Watershed of Hydro Power Plant", International Journal of Computational Engineering Research (IJCER), Vol. 3, Issue 3, pp.68-73, 2013.
   (b) Sri Mawar Said, Salama Manjang, M.Wihardi Tjaronge, Muh. Arsyad Thaha: "Electrical Energy Consumption Prediction in South–West Sulawesi Electrical Power System", International Journal of Computational Engineering Research (IJCER), Vol. 3, Issue 3, pp.74-78, 2013.
   (c) Sri Mawar Said, Salama Manjang, M. Wihardi Tjaronge, Muh. Arsyad Thaha: "Modelling of Water Resources in Bakaru Hydropower Plant in Anticipating Load Increment in Sulselbar Power System", International Journal of Computational Engineering Research (IJCER), Vol. 4, Issue 8, pp.1-5, 2014.
   (d) Yusri Syam Akil, Saiful Mangngenre, Sri Mawar Said, Kifayah Amar: "Preliminary Study of Perception and Consumer Behaviour Towards Energy Saving for Household Appliances: A Case of Makassar", Journal of Physics: Conference Se-ries, Vol. 979, pp. 1-6, 2018.
   (e) Andi Nurtrimarini Karim, Sri Mawar Said, Indar Chaerah Gunadin, Mustadir Darusman B.: "Impact of Penetration Wind Turbines on Transient Stability in Sulbagsel Electrical Interconnection System", Journal of Physics: Conference Series, Vol. 979, pp. 1-8, 2018.

(f) Syafaruddin, Muhammad Iqbal Abubakar, Hizkia Glorius Soma, Sri Mawar Said, Satriani Latief: "Determination of Sensorless Input Parameters of Solar Panel with Adaptive Neuro-Fuzzy Inference System (ANFIS) Method", International Journal of Innovative Computing, Information and Control (IJICIC) Vol.14, No.6, December 2018

10. Briefly list the most recent professional development activities: N/A

B.33 Syafaruddin

1. Name: Syafaruddin
2. Education:
    (a) Bachelor degree, Electrical Engineering, Universitas Hasanuddin,1996
    (b) Master degree, Electrical Engineering, University of Queensland, 2003
    (c) Doctor degree, Electrical Engineering, Kumamoto University, 2009
3. Academic experience:
    (a) Lecturer (1999-2002), Senior Lecturer (2003-2013), Associate Professor (2014-2016), Professor (2017-now)
4. Non-academic experience:
    (a) PT. Siemens Indonesia Site Planning Engineer Supervising and Network Testing
5. Certification or professional registration:
    (a) National Institute of Construction Services Development, Indonesia
6. Current membership in professional organization:
    (a) Member, Indonesian Association of Electricity Engineering Experts
    (b) Honorary Member, Scientific & Technical Research Association (STRA) of Eurasia Research Group
7. Honors and awards:
    (a) Dean's Commendation for High Achievement, Faculty of Engineering, Hasanuddin University, Indonesia, 1996
    (b) Australian Development Scholarship (ADS), Australia, 2003-2004
    (c) Dean's Commendation for High Achievement, Faculty of Engineering, Physics & Architecture, The University of Queensland, Australia, 2004
    (d) Monbukagakusho Scholarship, Japan, 2006-2009
    (e) Research Funding Program Supported by GRASIUS (Graduate School Action Scheme for Internationalization of University Students) of Kumamoto University, Japan, 2008
8. Service activities (within and outside of the institution):
    (a) Members, International Conference on Innovative Computing, Information and Control (ICICIC), 2017-2018
    (b) Technical Committee Chairs, International Conference on Green Energy (ICOGE), 2017
    (c) Technical Committee, International Conference on Power and Electrical Engineering (ICPEE), 2018
    (d) Conference Chairs, International Conference on Advanced Technologies in Energy and Electrical Engineering (AT3E), 2018
    (e) Conference Chairs, International Symposium on Green Energy and Smart Grid (SGESG), 2018
9. Briefly list the most important publications and presentations from past five years:

(a) Syafaruddin, Ranu Fauzan, Andika S. Amir, Hajime Miyauchi: "Microcontroller ATmega8535 Based Solar Tracker Design for PV System Applications in Equator Regio", International Journal of Control and Automation, Vol.7, No.4, pp.217-234, April 2014

(b) Syafaruddin, Dionisius Galla, Willy A.F.A Ajami: "Design of Boat Powered Photovoltaic Systems", Applied Solar Energy, Vol.50, No.4, pp.207-214, October 2014

(c) Syafaruddin, Nella Chintia Mendeng, Pilipus Master, Zaenab Muslimin: "Real-Time and Continuous Output Power Monitoring of Photovoltaic (PV) Systems", ICIC Express Letters: International Journal of Research and Surveys, Vol.9, No.1, pp.9-16, January 2015

(d) Syafaruddin, H. Narimatsu, Hajime Miyauchi: "Optimal Energy Utilization of Photovoltaic Systems Using the Non-Binary Genetic Algorithm", Energy Technology & Policy, Vol.2, No.1, pp. 10-18, February 2015

(e) Syafaruddin: "Interval Type Two Fuzzy Logic System (IT2FLS) based Short-Term Load Forecasting", ICIC Express Letters: International Journal of Research and Surveys, Vol.9, No.9, pp. 2445-2452, September 2015

(f) Syafaruddin, Faizal Arya Samman, Alfian, Muh. Aksa Idris, Siti Hamnah Ahsan and Satriani Latief: "Characteristics Approach of Thin-Film CIGS PV Cells with Conventional Mono-Crystalline Silicon Model", The International Journal of Innovative Computing, Information and Control (IJICIC), Vol.12, No.1, pp.171-180, February, 2016.

(g) Syafaruddin, Zaenab Muslimin, Fathul Razak, Arnita Tri Ananda, Satriani Latief: "Modeling and Simulation of Wind Power with Permanent Magnet Synchronous Generator (PMSG)", ICIC Express Letters: International Journal of Research and Surveys, Vol.10, No.9, pp. 2121-2127, September 2016.

(h) Syafaruddin, Satriani Latief, Wahyu H. Piarah: "Design of Photovoltaic-Thermal (PV/T) for Building Integrated Photovoltaic Systems", Journal of Clean Energy Technology, Vol.5, No.4, pp.304-309, July, 2017.

(i) Syafaruddin, Faizal Arya Samman, Zaenab Muslimin, Satriani Latief: "Design of Automatic Control for Surface Cleaning Systems of Photovoltaic Panel", ICIC Express Letters, Part B: Applications, Vol.8, No.11, pp. 1457-1464, November 2017

(j) Syafaruddin, Satriani Latief: "A Simple Method for Determination of Electrical Characteristics in Different Photovoltaic (PV) Modules Technologies", ICIC Express Letters, Vol.12, No.9, pp. 871-880, September 2018

(k) Syafaruddin, Muhammad Iqbal Abubakar, Hizkia Glorius Soma, Sri Mawar Said, Satriani Latief: "Determination of Sensorless Input Parameters of Solar Panel with Adaptive Neuro-Fuzzy Inference System (ANFIS) Method", International Journal of Innovative Computing, Information and Control (IJICIC) Vol.14, No.6, December 2018

10. Recent professional development activities:

(a) Visiting Professor at Northern Illinois University, September-December 2018, USA

(b) Visiting Researcher in Kumamoto University, July-September 2013, Japan

(c) Project Assistant Professor in Kumamoto University, October 2009-March 2011, Japan

B.34 Tajuddin Waris

1. Name: Tajuddin Waris
2. Education:
   (a) Bachelor degree, Electrical Engineering, Universitas Hasanuddin , 1991
   (b) Master degree, Electrical Engineering, Universitas Hasanuddin , 2001
3. Academic experience:
   (a) Lecturer (1992-2000), Senior Lecturer (2001-2018)
4. Non-Academic experience: N/A
5. Certification or professional registration: N/A
6. Membership in professional organization:
   (a) Member of the Institution of Engineers Indonesia, (2010-now)
7. Honors and awards:
   (a) C-Best Scholarships, from JICA (Japan International Cooperation Agency) as Part of Universitas HasanuddinEngineering Faculty Development Project, Japan; Period October, 2017-now
8. Service activities (within and outside of the institution):
   (a) Local Organizing Committee, MICEEI (Makassar International Conference on Electrical Engineering and Informatics), 2014
9. Briefly list the most important publications and presentations from the past five years:
   (a) Faizal Arya Samman, Tajuddin Waris, Tiara Dwi Anugrah, Muhammad Nuralim Zain Mide, " Three phase inverter using microcontroller for speed control IEEE – MICEEI" Conferences, Makassar 2014
   (b) Yusri Syam Akil ; Syafaruddin ; Tajuddin Waris ; A. A. Halik Lateko, "The influence of meteorological parameters under tropical condition on electricity demand characteristic: Indonesia case study", Published in: 1st The International Conference on Information Technology, Computer, and Electrical Engineering, Semarang 2014
   (c) Yusri Syam Akil, Tajuddin Waris, Syafaruddin, Imran Taufik, "Meteorological Parameters and Daytime Maximum Electricity Demand in Makassar, Indonesia", IJMMM 2015 Vol.3(3): 197-200 ISSN: 1793-8198
   (d) S. Manjang, M. Arief, G. Duma, Syafaruddin, Tajuddin Waris , "Impact Of Water Absorptionon Dielectric Properties And Breakdown Voltage Of Polymer Epoxy And Xlpe", International Journal of Engineering and Science Applications ISSN: 2406-9833 @2016 PPs-UNHAS
   (e) Tajuddin Waris,Yoshinobu Murakami, Naohiro Hozumi, Tomohiro Kawashima, Salama Manjang, Ikhlas Kitta, "Improved Performance of Silicon Rubber Insulation with Coal Fly Ash Micro Filler", EPI International Journal of Engineering pISSN 2615-5109 Volume 1, Number 2, August 2018, pp. 81-86 eISSN 2621-0541 DOI: 10.25042/epi-ije.082018.13
10. Briefly list the most recent professional development activities:
    (a) Doctoral Program Course, Toyohasi University of Technology Japan, October 2017-now

B.35 Wardi Djuaeni

1. Name: Wardi Djuaeni
2. Education:
   (a) Bachelor degree, Electrical Engineering, Universitas Hasanuddin, 1997
   (b) Master degree, Telecommunication Engineering, University of South Australia, 2006
   (c) Doctor degree, Electrical Engineering and Computer Science, Ehime University, 2012
3. Academic experience:
   (a) Lecturer, (2007), Senior Lecturer (2007-now)
4. Non-academic experience:
   (a) Siemens Telecommunication, Junior Engineer, Network Planning and Implementation, 1997-1998.
   (b) Ehime University, Post-Doctoral, Short Term Research, July-October 2013.
5. Certifications or professional registrations:
   (a) MTCNA Mikrotik
6. Current membership in professional organization:
   (a) Indonesian Engineer Association
7. Honors and awards: N/A
8. Service activities (within and outside of the institution):
   (a) Internal Auditor of ISO 9001: 2015 for Universitas Hasanuddin, 2018-now
   (b) Head of Networking and Infrastructure Division in Directorate of System and Information Technology, Universitas Hasanuddin, 2015-now
   (c) Secretary for Student Affair of Electrical Engineering Department, Universitas Hasanuddin, (2003-2004)
9. Briefly list the most important publications and presentations from the past five years:
   (a) Elyas Palantei, Ashadi Amir, Wardi Djuaeni, Intan Sari Areni, Dewiani Djamaluddin, Sukriyah Buwarda, "High Gain CP Antenna for Mobile Satellite Communications Numerically Evaluated under Various Packaging Materials", Makassar International Conference on Electrical Engineering and Informatics (MICEEI), Makassar, Indonesia, November 2014
   (b) Intan Sari Areni, Wardi Djuaeni, Indrabayu, Zaenab Muslimin, Fitriyanti Mayasari, "Pembuatan Modul Perhitungan Control Cost Pembangkit Tenaga Uap", Seminar Nasional Teknik Energi dan Ketenaga Listrikan (SNTEK), Makassar, Indonesia, August 2014
   (c) Jalaluddin, Abdul Rasyid Jalil, Rustan Tarakka, Wardi Djuaeni, "Pemberdayaan Masyarakat dengan Pemanfaatan Sumber Energi Terbarukan pada Tambak Udang", Agrokreatif Jurnal Ilmiah Pengabdian Kepada Masyarakat, Vol.1(2), 2015
   (d) Khairunnisa Mansur, Zulfajri Basri Hasanuddin, Wardi Djuaeni, 'Implementation of NFC for Smart Gate Access Control in Campus Area", Proceedings of the International Conference on Science and Technology (ICOSAT 2017), Jakarta, Indonesia, August 2017.

(e) Syafruddin Syarif, Syafaruddin, Wardi Djuaeni, Shinya Kobayashi, “Quality Analysis and Illegal Logging Image Detection Using SYARITAR Method”, International Journal of Innovative Computing, Information and Control (IJICIC), Vol. 11(3), 2015

(f) Wardi Djuaeni, Andani Achmad, Zulfajri Basri Hasanuddin, Darmaji Asrun, Mohammad Syaiful Luthfi, “Portable IP-Based Communication System using Raspberry Pi as Exchange”, International Seminar on Application for Technology of Information and Communication, Semarang, Indonesia, October 2017

(g) Wardi Djuaeni, Dewiani Djamaluddin, Andini Dani Achmad, Rima Wahyuningsih, Pebrina Hardianti Tokanu, “Sistem Pengaman dan Pelacak Kendaraan Berbasis Arduino Mega2560”, Seminar Nasional Sains dan Teknologi, Makassar, Indonesia, September 2016

(h) Wardi Djuaeni, Indrabayu, Dewiani Djamaluddin, Sri Haryati B, Rida Ariyanti Z, “Performance Evaluation of Personal Computer on Mobile Cloud for Virtual Smartphone Based”, Journal Penelitian Enjinering (JPE), Vol. 8(1), 2013

(i) Wardi Djuaeni, Intan Sari Areni, Andani Achmad, Irma Pratiwi Sayuti, “Evaluasi Unjuk Kerja Jaringan Ad Hoc Berbasis Protokol AODV”, Seminar Nasional Aplikasi Teknologi Informasi 2014 (SNATi), Yogyakarta, Indonesia, June 2014

(j) Wardi Djuaeni, Zulkifli Tahir, Adnan, “Performance Evaluation OLSR Routing Protocol in a Testbed Environment”, International Workshop on Modern Research Methods in Electrical Engineering and Informatics (IWoRMEE), Makassar, Indonesia, September 2013

(k) Zahir Zainuddin, Wardi Djuaeni, Yurika Nantan, “Applying Maritime Wireless Communication to Support Vessel Monitoring”, The 4th International Conference on Information Technology, Computer and Electrical Engineering, Semarang, Indonesia, October 2017

10. Briefly list the most recent professional development activities:

(a) JICA Counterpart Training Course, Japan, September 2016

B.36 Yusran

1. Name: Yusran
2. Education:
   (a) Bachelor degree, Electrical Engineering, Universitas Hasanuddin, 1998
   (b) Master degree, Electrical Engineering, Universitas Gadjah Mada, 2002
   (c) Doctor degree, Electrical Engineering, Institut Teknologi Sepuluh November, 2013
3. Academic experience:
   (a) Assistant Lecturer (2002-2004), Lecturer (2004-2008)
   (b) Associate Professor, 2008-now
   (c) Head of Power Electronic Laboratory, 2015-now
   (d) Secretary of Student Affair, 2018-now
4. Non-academic experience:
   (a) Electrical Power Engineer in PT INCO, Sorowako (Co-Ops Program), (2004-2005)
5. Certifications or professional registrations:
   (a) Lecturer Certification (2014)
6. Current membership in professional organization:
   (a) IATKI (2016-now)
7. Honors and awards:
   (a) The 10-Year National Badge "Satya Lencana Karya Satya", 2014, from the President of the Republic of Indonesia
8. Service activities (within and outside of the institution): N/A
9. Briefly list the most important publications and presentations from the past five years:
   (a) Yusran, Ashari, M., and Soeprijanto, A., "Optimization Scheme of Distributed Generation Installation Growth Considering Network Power Quality", Journal of Theoretical and Applied Information (JATIT), Vol. 53, No.1, 2013, pp. 30-39, ISSN 1992-8645, E-ISSN 1817-3195
   (b) Yusran, "Electrical Network Power Quality Improvement Through Distributed Generation Optimum Placement Based on Breeder Genetic Algorithm Method", The 4th Makassar International Conference on Electrical Engineering and Informatics (MICEEI) 2014, ISBN 978-1-4799-6725-4
10. Briefly list the most recent professional development activities: N/A

B.37 Yusri Syam Akil

1. Name: Yusri Syam Akil
2. Education:
   (a) Bachelor degree, Electrical Engineering, Universitas Hasanuddin, 2001
   (b) Master degree, Electrical Engineering, Universitas Hasanuddin, 2005
   (c) Doctor degree, Electrical Engineering, Kumamoto University, 2013
3. Academic experience:
   (a) Lecturer, 2005-now
4. Non-academic experience: N/A
5. Certifications or professional registrations:
   (a) Lecturer Certification (2014)
6. Current membership in professional organization:
   (a) International Association of Engineers, Member, 2013-now
7. Honors and awards:
   (a) Netherlands Fellowship Programmes (NFP), The Netherlands, 2015.
   (b) The 10-Year National Badge "Satya Lencana Karya Satya", 2018, from the President of the Republic of Indonesia
8. Service activities (within and outside of the institution):
   (a) International Journal on Advanced Science, Engineering and Information Technology (IJASEIT), Reviewer, 2017-now
   (b) Makara Journal of Technology, Reviewer, 2017-now
   (c) International Journal of Engineering and Technology Innovation (IJETI), Reviewer (2017)
   (d) International Conference on Science and Engineering (ICSE), Scientific Committee (2017)
   (e) International Conference on Electrical, Electronics and Information Engineering (ICEEIE), Technical Committee (2017)
   (f) International Seminar on Intelligent Technology and Its Applications (ISITIA), Reviewer (2015)
9. Briefly list the most important publications and presentations from the past five years:
   (a) Yusri Syam Akil, Saiful Mangngenre, Sri Mawar Said, Kifayah Amar, "Preliminary Study of Perception and Consumer Behaviour Towards Energy Saving for Household Appliances: A Case of Makassar", Journal of Physics: Conference Series, Vol. 979, pp. 1-6, 2018
   (b) Yusri Syam Akil, Yasunori Mitani, "Seasonal Short-Term Electricity Demand Forecasting under Tropical Condition using Fuzzy Approach Model", Journal of Telecommunication, Electronic, and Computer Engineering (JTEC) Special Issue, Vol. 9, No.1-3, pp. 77-82, 2017
   (c) Ansar Suyuti, Ikhlas Kitta, Yusri Syam Akil, "The Impact of the Operation Planning of Power Plants for Environmental Emissions in South Sulawesi", ARPN Journal of Engineering and Applied Sciences, Vol. 12, No.11, pp.3440-3444, 2017

(d) Faizal Arya Samman, Yusri Syam Akil, Nirwan A. Noor, "Design and Testing of Boost Type DC/DC Converter for DC Motor Control Applications", Proc. of the 2nd International Symposium on Smart Material and Mechatronics 2015, pp. 79-83, Gowa, Indonesia, 2015

(e) Salama Manjang, Rizki P. Putra, Yusri Syam Akil, Ikhlas Kitta, "Electrical and Mechanical Properties of Fly Ash Filled Silicone Rubber for High Voltage Insulator", ARPN Journal of Engineering and Applied Sciences, Vol. 10, No.17, pp.7320-7327, 2015

(f) Yusri Syam Akil, Hajime Miyauchi, "Seasonal Peak Characteristic Comparison Analysis by Hourly Electricity Demand Model", International Journal of Energy and Power Engineering, Vol. 3, No. 3, pp. 132–138, 2014

(g) Yusri Syam Akil, Syafaruddin, Tajuddin Waris, A. A. H. Lateko, "The Influence of Meteorological Parameters under Tropical Condition on Electricity Demand Characteristic: Indonesia Case Study", Proc. of the 1st International Conference on Information Technology, Computer, and Electrical Engineering, pp. 381-385, Semarang, Indonesia, 2014

(h) Yusri Syam Akil, Hajime Miyauchi, "Seasonal Regression Models for Electricity Consumption Characteristics Analysis", Engineering, Vol. 5, No. 1B, pp. 108–114, 2013

(i) Yusri Syam Akil, Hajime Miyauchi, "Seasonal Peak Electricity Demand Characteristics: Japan Case Study", International Journal of Energy and Power Engineering, Vol. 2, No. 3, pp. 136–142, 2013

10. Briefly list the most recent professional development activities:

(a) Course on "Competency Development Program and Professional Engineering Certification", The Institution of Engineers Indonesia, 2014, Indonesia

(b) Short Course Program on "Basic Analysis of Environmental Impact Assessment", Centre for Environmental Research and Development, Institute for Research and Community Service, Universitas Hasanuddin, 2015, Indonesia

(c) Short Course in UNESCO-IHE, Institute for Water Education, September 2015, The Netherlands.

(d) Visiting Researcher in Kyushu Institute of Technology, October – December 2015, Japan.

B.38 Zaenab Muslimin

1. Name: Zaenab Muslimin
2. Education:
   (a) Bachelor degree, Electrical Engineering, Universitas Hasanuddin, 1990
   (b) Master degree, Electrical Engineering, Universitas Hasanuddin, 2004
3. Academic experience:
   (a) Lecturer, 1992-now
   (b) Relay and Measurement Laboratory, Secretary, 2002-2012
   (c) Department of Electrical Engineering, Secretary, 2007-2011
4. Non-academic experience:
   (a) CV. Duta Teknik Utama, Person in Charge of Engineering, (1993-2014)
   (b) PT. Andira Jaya Raya, Person in Charge of Engineering, 2014-now
5. Certifications or professional registrations:
   (a) Lecturer Certification (2009)
6. Current membership in professional organization:
   (a) IEEE, Student Member, (2017-2018)
7. Honors and awards: N/A
8. Service activities (within and outside of the institution): N/A
9. Briefly list the most important publications and presentations from the past five years:
   (a) Zaenab Muslimin, Indar Chaerah Gunadin, Muhammad Anshar, "Comparative Study of the Effect of Temperature of Miniature Sun with Spotlights on Solar Pond", Proceedings of the National Seminar on Electrical and Informatics Engineering, SBN: 978-602-18168-2-6, pp 247 − 251, Makassar, Indonesia, November 2017
   (b) Indar Chaerah Gunadin, Zaenab Muslimin, Agus Siswanto, "Transient Stability Improvement Using Allocation Power Generation Methode Based on Momen Inertia", 2017 International Conference on Electrical Engineering and Informatics (ICELTICs) ISBN: 978-1-5386-2934-1, Banda Aceh, Indonesia, October 2017
   (c) Indar Chaerah Gunadin, Zaenab Muslimin, Yusran, "Steady State Stability Assesment Using Continous Power Flow Based on Load Tap Changer", International Journal of Applied Engineering Research (IJAER), ISSN 0973-4562 Volume 12, Number 24 (2017)
   (d) Syafaruddin, Zaenab Muslimin, Fathul Razak, Arnita Tri Ananda, Satriani Latief, "Modeling and Simulation of Wind Power with Permanent Magnet Synchronous Generator (PMSG)", ICIC Express Letters: International Journal of Research and Surveys, Vol.10, No.9, pp. 2121-2127, September 2016
   (e) Syafaruddin, Nella Chintia Mendeng, Pilipus Master, Zaenab Muslimin, "Real-Time and Continuous Output Power Monitoring of Photovoltaic (PV) Systems", ICIC Express Letters: International Journal of Research and Surveys, Vol.9, No.1, pp.9-16, January 2015
10. Briefly list the most recent professional development activities: N/A

B.39 Zahir Zainuddin

1. Name: Zahir Zainuddin
2. Education:
   (a) Bachelor degree, Electrical Engineering, Universitas Hasanuddin , 1988
   (b) Master degree, Computer Engineering, Florida Institute of Technology, 1995
   (c) Doctor degree, Electrical Engineering, Institut Teknologi Bandung, 2005
3. Academic experience:
   (a) Assistant Lecturer (1991-1993), Lecturer (1993-1996), Senior Lecturer (1996-2003), Associate Professor (2008-now)
4. Non-academic experience:
   (a) Head of Electrical Engineering Dept, Engineering Faculty, Universitas Hasanuddin , 2007-2011
   (b) Head of Electrical Engineering Master Study Program, Engineering Faculty, Universitas Hasanuddin , 2013-2017
   (c) Head of Computer System Master Study Program, STMIK Handayani, 2013-now
5. Certifications or professional registrations: N/A
6. Current membership in professional organization:
   (a) Member, The Institute of Electrical and Electronics Engineer (IEEE)
   (b) Member, Asosiasi Pendidikan Tinggi Informatika dan Komputer (Association of Higher Education for Informatics and Computer Study)
7. Honors and awards:
   (a) Master Degree BAPPENAS Scholarship 1993-1995
   (b) InSiNAS Research Grant from Ministry of Research and Technology, Indonesia (2012-2014)
8. Service activities (within and outside of the institution):
   (a) Head of PIU Technical Assistance JICA- Engineering Faculty UNHAS
   (b) IT Expert staff, Government of Makassar City, 2011-2013
   (c) Expert Staff, Government of Sulawesi Selatan Province 2012
9. Briefly list the most important publications and presentations from the past five years:
   (a) Masjono, Salama Manjang, Zahir Zainuddin, Arsyad T, "Modelling and numerical simulation of multiple one way gearswave energy converter to generate electricity", International Conference on Smart Green Technology in Electrical and Information Systems (ICSGTEIS) 2014
   (b) Yustunus Upa, Zahir Zainuddin, Indrajaya, "Performance analysis of interconnection sistem of SulselBarTeng using unified power flow controller (UPFC)", Makassar International Conference on Electrical Engineering and Informatics (MICEEI) 2014
   (c) Ahyar M, Suryani, Merna Baharuddin, Zahir Zainuddin, "Online Mobile Mapping application development for monitoring fruit tree plantation", ARPN Journal of Engineering and Applied Sciences 2014

(d) Aksan Surya W, Zahir Zainuddin , Muhammad Niswar , “Design a Smart Waste Bin for Smart Waste Management”, 5th International Conference on Instrumentation, Control, and Automation (ICA) 2017

(e) Yurika N, Wardi Djuaeni, Zahir Zainuddin, “Applying Maritime Wireless Communication to Support Vessel Monitoring”, 4th International Conference on Information Technology, Computer, and Electrical Engineering (ICITACEE) Implementation of the LDA Algorithm for Online Validation Based on Face Recognition 2017

(f) Muh. Fathur R, Salama Manjang, Zahir Zainuddin, “Water Level Monitoring using Ultrasonic-Pipe in Open Channel”, 15th International Conference on Quality in Research (QiR): International Symposium on Electrical and Computer Engineering 2017

(g) Zagita M, Zahir Zainuddin, Muhammad Niswar, Yushinta, “An Automated Feeding System for Soft Shell Crab”, Indonesian Journal of Electrical Engineering and Computer Science, Vol 5, Issue 3, 564-568

(h) Ali Akbar V, Armin Lawi, Zahir Zainuddin, “On Identifying Potential Direct Marketing Consumers using Adaptive Boosted Support Vector Machine”

(i) Imran H, Andani Achmad, Zahir Zainuddin, “Fault Detection and Replacement of a Temperature Sensor in Wheat Flour Short Term Storage”, Proceedings of the 2017 5th International Conference on Instrumentation, Control, and Automation (ICA) 2017

(j) Sonny Tanyadji, Zahir Zainuddin, Amil Ahmad Ilham, Muhammad Niswar, “IoT-based Water Quality Monitoring System for Soft-Shell Crab Farming”, IEEE International Conference on Internet of Things and Intelligence System (IOTAIS), 6-9, 2018

(k) Walukow, Stephy B, Salama Manjang, Zahir Zainuddin, Faizal Arya Samman, “Design Analysis of Ceramic and Polymer 150 kV Insulators for Tropical Condition using Quickfield Software”, 5th International Conference on Instrumentation, Control, and Automation (ICA) 2017

(l) Febriansyah, Zahir Zainuddin, Muhammad Bachtiar Nappu, “Voice Based City Panic Button System”, Journal of Physics: Conference Series, 2018

10. Briefly list the most recent professional development activities: N/A

B.40 Zulfajri Basri Hasanuddin

1. Name: Zulfajri Basri Hasanuddin
2. Education:
   (a) Bachelor degree, Electrical Engineering, Universitas Hasanuddin, 1992
   (b) Master degree, Computer Science and Communication Engineering, Kyushu University, 1999
   (c) Doctor degree, Computer Science and Communication Engineering, Kyushu University, 2003
3. Academic experience:
   (a) Lecturer, 1993-now
   (b) Telematic Laboratory, Head, 2012-now
   (c) Satellite Communication Laboratory, Head, 2016-now
   (d) ICT Innovation Center, Head, 2018-now
4. Non-academic experience: N/A
5. Certifications or professional registrations:
   (a) Lecturer Certification (2009)
6. Current membership in professional organization:
   (a) The Institution of Engineers Indonesia, Member, 2010-now
   (b) Member of the National Research Council of the Republic of Indonesia, 2012-now
   (c) Persada Jepang, 2012-now
   (d) The Observer in APEC-MMC Think Tank, 2017-now
7. Honors and awards:
   (a) Letter of Appointment as The Observer in APEC-MMC Think Tank in one year from November 1, 2007 to October 31, 2018
   (b) Certificate of Appreciation as Invited Speaker from various Institution
8. Service activities:
   (a) Dean of the Faculty of Engineering, West Sulawesi University, 2017-now
9. Briefly list the most important publications and presentations from the past five years:
   (a) A. E. Multazam, Z. B. Hasanuddin, "Sistem Monitoring Kualitas Air Tambak Udang Vaname", JURNAL IT: Media Informasi STMIK Handayani Makassar 8 (2), 2018
   (b) M. R. Hidayat, A. Charisma, M. Arif, Z. B. Hasanuddin, S. Sambasri, "Empirical Study of Mobile Satellite Channel Characteristics in Indonesian Region", Wireless and Telematics (ICWT), 2017 3rd International Conference on, 191-194
   (c) K. Mansur, Z. B. Hasanuddin, W. Wardi, "Sistem Keamanan Informasi Pada Smart Gate Menggunakan Visual Basic", Jurnal Penelitian Enjiniring (JPE) 21 (1), 48-53
   (d) M. Amin, N. Harun, S. Pallu and Z. B. Hasanuddin, "Sustainable Water Resources Management for Makassar City Using Fuzzy Logic-Based Micro Controller (A Case Study in Jeneberang River)", Asian Academic Research Journal of Multidisciplinary, Vol. 4, Issue 7 (July 2017), ISSN: 2319-2801, pp. 128-136.

(e) L. M. Ambia, F. R. Djumingin, F. A. Samman, Z. B. Hasanuddin, "Design and Built Underwater Vehicle with Wireless Controlling Based on Arduino Microcontroller", MICEEI, Makassar, Indonesia, 26-30 November 2017.

(f) Z. B. Hasanuddin, S. Syarif and D. Inal, "Zakah Management System Using Approach Classification", TELKOMNIKA, Vol. 15, No. 4, December 2017

(g) A Noer, Z. B. Hasanuddin, D Djamaluddin, "Implementation of RFID based Raspberry Pi for User Authentication and Offline Intelligent Payment System", Quality in Research (QiR): International Symposium on Electrical and Computer Engineering, 2017, 15th International Conference

(h) Y.U. Sombolayuk, N. Harun, H. Parung, Z.B. Hasanuddin, "Early Detection System of Fire Hazard in High-Rise Buildings as a Result of Electrical Installation Failure", Asian Academic Research Journal of Multidisciplinary, Vol. 4, Issue 7 (July 2017), - ISSN: 2319-2801, pp. 112-119.

(i) Z. B. Hasanuddin, "Design of Ka-band Satellite Links in Indonesia", The International Conference on Satellite and Space Communication in Paris on August 2014.

(j) A. F. Himawan, Z. B. Hasanuddin, F. A. Samman, "Perancangan Sistem Sensor dan Akuator Nirkabel Untuk Sistem SCADA Berbasis PLC", Jurnal Nasional Teknik Elektro dan Teknologi Informasi, Vol. 3, No. 3, 2014.

(k) Keynote Speaker in "The International Conference on Satellite and Space Communication", Paris, France, 2014 with title *Design of Ka-band Satellite Links in Indonesia*, 2014.

(l) Keynote Speaker in "Makassar International Conference on Electrical Engineering and Informatics (MIICEI) 2014", The Trends of ICT Research in Indonesia, Makassar Golden Hotel, 26 November 2014.

(m) Speaker in "Focal Point SCMIT pada ASEAN COST 72", ICT Programs in Indonesia, Press Conference Hall, ICC, Bandar Seri Begawan, Brunei Darussalam, 22-25, Mey 2017.

(n) Keynote Speaker in "The 10th China-ASEAN Education Cooperation Week" on second panel: The Present Situation and Trend of ICT Industry-Education Integration in Developing Countries, ICT Research and Innovation Activities in Indonesia, Hall Center, Guiyang, Guizhou, China, 29 July 2017.

(o) Keynote Speaker in "The 4th APEC Internet of Vehicles Symposium", IoT for ITS Research Project in Indonesia, Shanghai Automobile Exhibition Center, Shanghai, China, 14-16 September, 2017.

10. Briefly list the most recent professional development activities:

(a) Local Point of ASEAN Sub Committee for Microelectronics and Information Technology, Indonesian Representative, 2016-now

(b) The Observer in APEC-MMS Think Tank, for 2017-2018

APPENDIX C

EQUIPMENT

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C.1 Laboratory Equipment

In the EE Department, there are many equipment, which are available in the laboratories. The available equipment are deployed in each laboratory as follows.

C.1.1 Electronics and Devices Laboratory

The Electronics and Devices Laboratory houses some manufacture and measurement equipment. The equipment are used in some courses and practical courses, and to support design projects from some course assignment including the final bachelor project. Table C.1 presents some equipment, their functionality and their related courses that use them. In the Electronics and Devices Laboratory, there is a set of PCB manufacture equipment (See Figure FIGURE C.1(A)).

Beside the equipment presented in TABLE C.1, in the Electronics and Devices Laboratory there are also electronic breadboards, multimeters, soldering tools, electronic development kits/boards, such as FPGA, microcontroller and embedded microprocessor development kits, passive and active electric/electronic components/devices to complete laboratory assignments.

TABLE C.1: EQUIPMENT IN ELECTRONICS AND DEVICES LABORATORY

E3-12	Electronics and Devices Laboratory		
Code	Item	Qty	Manufacturer
E3-12.01	Multipurpose Electronic Trainer	1	DeLorenzo (Italia)
E3-12.02	Basic Electronic Trainer	1	DeLorenzo (Italia)
E3-12.04	Digital Multimeter	1	GW INSTEK (Taiwan)
E3-12.05	Logic Circuit Tester	1	GW INSTEK (Taiwan)
E3-12.06	Function Generator	1	GW INSTEK (Taiwan)
E3-12.07	RF Generator	1	BK Prescision (USA)
E3-12.08	Digital Storage Oscilloscope	1	GW INSTEK (Taiwan)
E3-12.09	PC Oscilloscope	1	Neurotech (Picotech) (Singapore)
E3-12.10	Analog Oscilloscope	2	GW INSTEK (Taiwan)
E3-12.11	Spectrum Analyser	1	GW INSTEK (Taiwan)
E3-12.12	Power Supply	1	GW INSTEK (Taiwan)
E3-12.14	PCB Processing Equipment	1	Walter Lemmen (Germany)

(a) PCB Manufacture Equipment

(b) Electronic Development Kit

FIGURE C.1: EQUIPMENT IN ELECTRONICS AND DEVICES LABORATORY

C.1.2 Electric Machines Laboratory

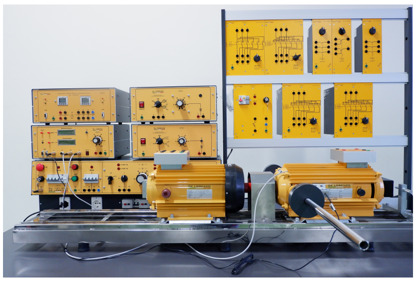
The Electrical Machinery Laboratory provides a variety of equipment to be used primarily for Electric Circuit Laboratorycourses, such as the use of DC and AC motors, the use of generators and principles of work, step-up, and step-down transformator working principles, and the Solar panel working principle.

Besides that it is used to work on the final project for students, both bachelor, master and doctor degree.

Table C.2: Equipment in Electric Machines Laboratory

E3-2	Electrical Machine Laboratory		
Code	Item	Qty	Manufacturer
E3-02.01	Electric Motor	1	DeLorenzo (Italia)
E3-02.02	Instruments Set for Electric Motor	1	DeLorenzo (Italia)
E3-02.03	Controller for Electric Motor	1	DeLorenzo (Italia)
E3-02.04	Power Source for Electric Motor	1	DeLorenzo (Italia)
E3-02.05	Load Set for Electric Motor	1	DeLorenzo (Italia)
E3-02.07	Workbench	1	DeLorenzo (Italia)
E3-02.08	Data Processing	1	DeLorenzo (Italia)

(a) AC Motor Equipment Set



(b) DC Motor Equipment Set

(c) Capacitor Motor

(d) Three Phase Transformer

Figure C.2: Equipment in Electric Machines Laboratory

C.1.3 Control Systems and Instrumentation Laboratory

Control Systems and Instrumentation Laboratory is one of the core laboratory in the field of Electrical Engineering. This laboratory is used by students in experiment and project tasks, so as to improve competency skills in the field of control engineering. Some subjects which include experiment such as Courses for Instrumentation and Electronics System, Digital Control System, Control System Design, Control System, Microprocessor Based System, Process Control System, Industrial Automation as well as several research and development activities including those funded by BOPTN. Student activities such as participation in regional level competitions Celebes Robot Contest and national level (KRI and KRCI), are managed in LSKI by the Cyber-Tech Community (CRC). Though, all tools can function properly, but there are some that still need improvement, because the components of the tools must be repaired or replaced.

In the laboratory section for robotics, many equipment and components are available for the members of the "Cyber Tech Community" to prepare their participation in regional and national robotic contests and other events. Supporting equipment such as desktop personal computers (one of these desktops is used for the boiler drum's remote control) and laptops, LCD projectors and a large screen monitor for lecturing

Table C.3: Equipment in Control Systems and Instrumentation Laboratory

E3-11	Control and Instrumentation System Laboratory		
Code	Item	Qty	Manufacturer
E3-11.01	Instrumentation System Module Experiment	12	
E3-11.04	Room Temperature Regulatory Module	2	Self-Made
E3-11.05	Microcontroller-based Universal Digital Controllers	4	Universitas Muhammadiyah Pare-Pare (Indonesia)
E3-11.06	ED-4400B Servo Motor Experimental Modules	2	ED (South Korea)
E3-11.07	Solid Material Process Control Mini-Plant	1	LEN (Bandung)
E3-11.08	Boiler Drum	1	SOLTEQ (Malaysia)
E.LSKI.01	48 KVA 3-phase Silent Type AC Diesel Generator	1	
E.LSKI.02.1-2	40 Mhz 2-channel Digital Storage Oscilloscopes	2	
E.LSKI.03	3D Printer CR 20	1	Shenzhen Creality (China)
E.LSKI.04	CNC Machine 3018	1	SainSmart (USA)

(a) ED-4400B Servo Motor Experimental Modules

(b) Broiler Drum

(c) Microcontroller-based Universal Digital Controllers

(d) Solid Material Process Control Mini-Plant

Figure C.3: Equipment in Control and Instrumentation System Laboratory and presentation are also available.

C.1.4 High Voltage Laboratory

High Voltage Laboratory is used to support high voltage engineering courses and insulation material lectures. High voltage equipment can also be used for research in the field of Insulation materials (solid, liquid, and gas), besides that it is used in this laboratory to test materials that experience aging and the influence of electromagnetic fields on humans and equipment. In this laboratory there is also equipment to measure the release of load in the material (partial discharge), so that students can observe the phenomenon of isolation failure. With this equipment can also be simulated lightning voltage and impulse voltage/switching.

Table C.4: Equipment in High Voltage Laboratory

E3-4	High Voltage Laboratory		
Code	Equipment	Qty	Manufacturer
E3-02.01	High Voltage Trainer	1	Terco (Sweden)
E.LTT.01.1-2	Control Desk	2	Terco (Sweden)
E.LTT.02.1-3	Test Transformator 100 kV	3	Terco (Sweden)
E.LTT.03.1-2	High Voltage Connection	2	Terco (Sweden)
E.LTT.04	Cascade Connection Set	1	Terco (Sweden)
E.LTT.05	Discharge Rod	1	Terco (Sweden)
E.LTT.06.1-7	Connecting Rod	7	Terco (Sweden)
E.LTT.07.1-21	Connecting Cup	21	Terco (Sweden)
E.LTT.08.1-8	Floor Pedestal	8	Terco (Sweden)
E.LTT.09.1-6	HV Rectifier	6	Terco (Sweden)
E.LTT.10.1-5	Smoothing Capacitor/ Impulse Capacitor	5	Terco (Sweden)
E.LTT.11.1-3	Measuring Resistor	3	Terco (Sweden)
E.LTT.12	Load Resistor	1	Terco (Sweden)
E.LTT.13	Earthing Switch	1	Terco (Sweden)
E.LTT.14.1-9	Spacer Tube	9	Terco (Sweden)
E.LTT.15.1-3	Load Capacitor	3	Terco (Sweden)
E.LTT.16.1-3	Charging Resistor	3	Terco (Sweden)
E.LTT.17.1-3	Wave Front Resistor	3	Terco (Sweden)
E.LTT.18.1-3	Wave Tail Resistor	3	Terco (Sweden)
E.LTT.19.1-12	Insulating Rod	12	Terco (Sweden)
E.LTT.20.1-3	Sphere Gap	3	Terco (Sweden)
E.LTT.21	Drive for Sphere Gap	1	Terco (Sweden)
E.LTT.22.1-17	Top Electrode	17	Terco (Sweden)
E.LTT.23	Electrode 200	1	Terco (Sweden)
E.LTT.24	Electrode 300	1	Terco (Sweden)
E.LTT.25	Measuring Capacitor/100	1	Terco (Sweden)
E.LTT.26	Measuring Capacitor/200	1	Terco (Sweden)
E.LTT.27	Measuring Capacitor/300	1	Terco (Sweden)
E.LTT.28.1-3	Low Voltage Divider	3	Terco (Sweden)
E.LTT.29	Triggering Device	1	Terco (Sweden)
E.LTT.30.1-2	Electronic Trigger Sphere	2	Terco (Sweden)
E.LTT.31	AC Peak Voltmeter	1	Terco (Sweden)
E.LTT.32	DC Voltmeter	1	Terco (Sweden)
E.LTT.33	Impulse Volt Meter	1	Terco (Sweden)
E.LTT.34	Space Bar (for HV9133)	1	Terco (Sweden)
E.LTT.35	Measuring Spark Gap	1	Terco (Sweden)
E.LTT.36	Vessel for Vacuum/ and Pressure	1	Terco (Sweden)
E.LTT.37	Vacuum Pump	1	Terco (Sweden)
E.LTT.38	Compressor	1	Terco (Sweden)
E.LTT.39	Corona Cage	1	Terco (Sweden)
E.LTT.40	Oil Testing Cup	1	Terco (Sweden)
E.LTT.41	Capacitor Coupling	1	Terco (Sweden)
E.LTT.42	High Voltage safety Cage/safety Net	1	Terco (Sweden)
E.LTT.43	Partial discharge meter (DTM) (to Computer & Oscilloscope)	1	Terco (Sweden)

(a) Vessel for Vacuum and Pressure

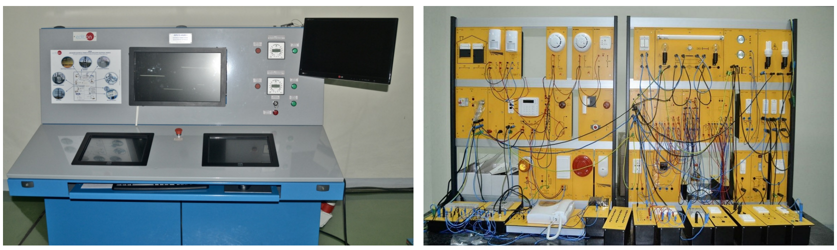
(b) Control Desk

(c) Measurement of Flashover

FIGURE C.4: EQUIPMENT IN HIGH VOLTAGE LABORATORY

C.1.5 Electrical Installation Laboratory

Electrical Installation Laboratory is a laboratory that is very important for electrical engineering students (either bachelor, master, and doctor) because this lab is a place for students to establish the wiring or installation of electrical equipment that is often used by electricity consumers. This installation lab is supported by practical equipment and research in the form of the latest modules in the world of electrical intrusion, namely the module of household installations made by De-Lorenzo, hospital installation modules, installation modules utilizing electric motors, electric motor control installation modules and monitor equipment and measure electricity quality. In the Basic Electronic Laboratory, there is a set of practicum equipment (See FIGURE C.5).



(a) Advances Electrical Power System Simulator

(b) Hospital Installation Modules

(c) Hospital Installation Modules

(d) Basic Installation Module (De Larenzo Module)

FIGURE C.5: EQUIPMENT IN ELECTRICAL INSTALLATION LABORATORY

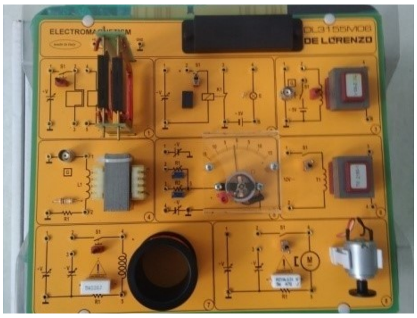
Table C.5: Equipment in Electrical Installation Laboratory

E3-3	Electrical Installation Laboratory		
Code	Equipment	Qty	Manufacturer
E3-03.01	Cubicle For Fault Finding	1	Lucas Nuelle (Germany)
E3-03.02	Electrical Installation Trainer	1	DeLorenzo (Italia)
E3-03.03	Motor Control System	1	Lucas Nuelle (Germany)
E3-03.05	Motor Control System	1	Lucas Nuelle (Germany)

C.1.6 Basic Electric Laboratory

The Basic Electric Laboratory houses equipment, electronic development kits and to support analog and digital measure electrical parameters. In the Basic Electric Laboratory, there some electronic equipment such as analog, digital and mixed-signal oscilloscopes, watt-meter, function generators, multimeter, power supplies, electronic circuit boards, electronic breadboards, active and passive electronic components, and logic circuit trainer which are utilized to complete laboratory assignments. In the Basic Electronic Laboratory, there is a set of practicum equipment (See Figure C.6).

(a) Function Generator



(b) Electro Magnetism

(c) Multimeter

(d) Oscilloscope Semi Digital

Figure C.6: Equipment in Basic Electric Laboratory

TABLE C.6: EQUIPMENT IN BASIC ELECTRIC LABORATORY

E3-13	Basic Electric Laboratory		
Code	Equipment	Qty	Manufacturer
E3-13.02	Logic Digital Circuit Trainer	5	DeLorenzo (Italia)
E3-13.03	Electromagnetism Trainer	1	DeLorenzo (Italia)
E3-13.05	Oscilloscope	10	GW INSTEK (Taiwan)
E3-13.06	Digital Multimeter	22	GW INSTEK (Taiwan)
E3-13.07	Function Generator	2	GW INSTEK (Taiwan)
E3-13.11	Function Transfer Analysis	1	DeLorenzo (Italia)
FG-800	Function Generator 10 MHZ	5	DeLorenzo (Italia)
DL3155M	AD/DA Logic Trainer	5	DeLorenzo (Italia)
E.LLD.1.1-4	Wattmeter 1KW	4	AEG (German)
DW-6060	Wattmeter	22	Lutron (United States)

C.1.7 Relay and Measurement Laboratory

The Relay and Measurement Laboratory houses some module experiment. The equipment are used in some courses and practical courses, and to support design projects from some course assignment including the final bachelor project. TABLE C.7 presents some equipment, their functionality and their related courses that use them.

In the Relay and Measurement Laboratory, the static relay module trainer consists of 12 types of experiment. Also, the frequency relay module trainer consists of 15 types of experiments and the module of percentage Bias of Differential Relay includes 4 types of experiments.

(a) Capacitive Load

(b) Inductive Load

(c) Differential Relay Trainer

FIGURE C.7: EQUIPMENT IN RELAY AND MEASUREMENT LABORATORY

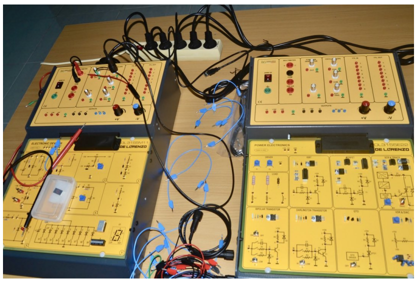
Table C.7: Equipment in Relay and Measurement Laboratory

E3-5	Relay and Measurement Laboratory		
Code	Equipment	Qty	Manufacturer
E3-05.01	Static Relay Trainer	1	DeLorenzo(Italia)
E3-05.02	Differential Relay Trainer	1	Anshuman Tech(India)
E3-05.03	Frequency Relay Trainer	1	DeLorenzo(Italia)
E3-05.04	Relay Testing Unit	1	Megger(Sweden)

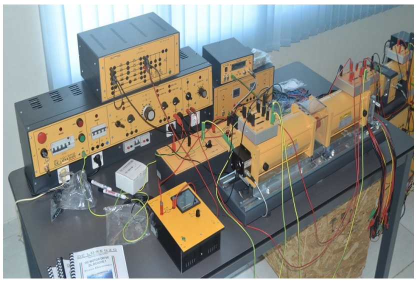
C.1.8 Power Electronics Laboratory

There are several equipment in the power electronics laboratory. This equipment is used to assist students in practical and research activities. Practical activities carried out in accordance with the theories that have been obtained in the classroom. Whereas, for research activities, it is usually used to analyse the relationship between theory and practice. InTable C.8 some laboratory equipment and their uses are shown.

In addition to the equipment contained in Table C.8 there are also other equipment that are often used to complement practical needs such as VSD (Variable Speed Drive), Microcontroller, Active and Passive Components.



(a) Power Electronics Experiment Module



(b) Motor-Generator Training Kit

(c) AC Motor

Figure C.8: Equipment in Power Electronics Laboratory

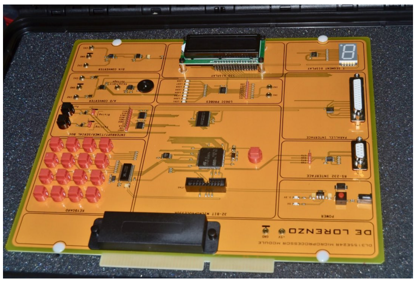
Table C.8: Equipment in Power Electronics Laboratory

E3-1	Power Electronics Laboratory		
Code	Equipment	Qty	Manufacturer
E3-01.02	Power Electronics Trainer	1	DeLorenzo (Italia)
E3-01.03	Electronics Demonstration System	1	DeLorenzo (Italia)
E3-01.04	Silicon Controlled Rectifier Trainer	1	DeLorenzo (Italia)
E3-01.06	Motor/Generator Trainer	1	DeLorenzo (Italia)
E3-01.09	PC Oscilloscope, 2 Channels	1	Neurotech (Picotech) (Singapore)
E.LELD.1	Analog Oscilloscope, 2 Channels	1	GW INSTEK (Taiwan)

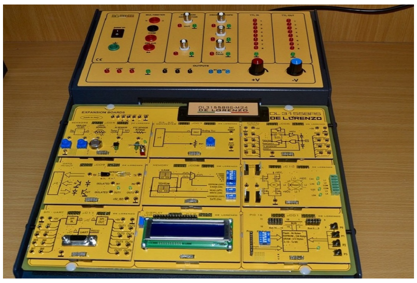
C.1.9 Computer and Networking Laboratory and Software Engineering Laboratory

Computer and Networking Laboratory and Software Engineering Laboratory has some computers and measurement equipment. Both of this laboratory is in one room. The equipment are used in some courses and practical courses, and to support design projects from some course assignment including the final bachelor project. There are some electronic equipment such as computer, networking equipment (LAN tester, crimping tool, twisted pair cable), and mixed-signal oscilloscopes, which are utilized to complete laboratory assignments and courses.

Figure C.9: Equipment in Computer and Networking Laboratory and Software Engineering Laboratory



(a) Microprocessor Module



(b) Expansion Boards

Table C.9: Equipment in Computer and Networking Laboratory and Software Engineering Laboratory

E3-10	Computer Hardware, Networking and Software Engineering Laboratory		
Code	Equipment	Qty	Manufacturer
E3-10.01	80C51 Microcontroller Trainer	1	DeLorenzo (Italia)
E3-10.03	PIC Development & Training System	1	DeLorenzo (Italia)
E.LKJ.01.1-30	Computer	30	Lenovo (China)
E.LKJ.02.1-10	LAN Tester	10	
E.LKJ.03.1-10	Crimping tools	10	
E.LKJ.04.1-2	Oscilloscope	2	Ronde& Schwarz (Germany)

C.1.10 Telematics Laboratory

There are several equipment in the Telematics Laboratory. The equipment is used to conduct practical activities for the Basic Telecommunications course of BE Students. The equipment also are used by researchers to support their research. TABLE C.10 shows the Telematics Laboratory equipment.

(c) Bit Error Rate Testers

(d) Communication Technology for Fibre Optics Training Course

FIGURE C.10: EQUIPMENT IN TELEMATICS LABORATORY

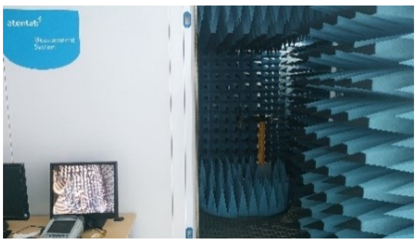
TABLE C.10: EQUIPMENT IN TELEMATICS LABORATORY

E3-8	Telematics Laboratory		
Code	Equipment	Qty	Manufacturer
E3-08.04	Bit Error Rate Testers	1	Fetest(Japan)
E3-08.09	Communication Technology for Fibre Optics Training	1	Lucas Nuelle (Germany)
E.LTL.01.1-4	Raspberry Pi	4	Raspberry Pi Foundation (UK)
E.LTL.02.1-2	Nano Station Antenna	2	

C.1.11 Antenna and Propagation Laboratory

In the Antenna and Propagation Laboratory there are some equipment such as 3D Electromagnetic Field Simulation Software (CST), Vector Signal Generator, Logic Analyzer-32 Channel and RF-anechoic Chamber (AtenLab). In the Antenna and Propagation Laboratory, there are also software tools used to support teaching methodology and to improve student's capabilities to design (modelling) antenna.

(a) Vector Signal Generator



(b) RF-anechoic Chamber

FIGURE C.11: EQUIPMENT IN ANTENNA AND PROPAGATION LABORATORY

Table C.11: Equipment in Antenna and Propagation Laboratory

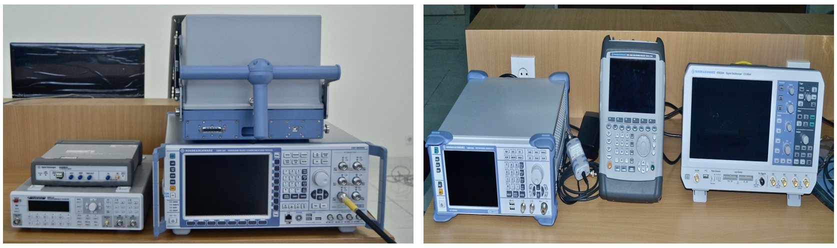
E3-9	Antenna and Propagation Laboratory		
Code	Equipment	Qty	Manufacturer
E3-09.01	3D-Electromagnetic Field Simulation Software	1	CST (Germany)
E3-09.03	Vector Signal Generator	1	Rohde & Schwarz (Germany)
E3-09.08	Logic Analyser - 32 Channel	1	GW Instek (Taiwan)
E3-09.10	RF-anechoic Chamber	1	Atenlab (Taiwan)

C.1.12 Telecommunication, Radio, and Microwave Laboratory

The Telecommunication, Radio and Microwave Laboratory (preferred to mention later on as TRML) has been equipped by several numbers of both hardware and software tools to support various numbers of regular academic and scientific activities.

In TRML, the equipped hardware and software tools are mutually used to support teaching and research methodology and to improve student's capabilities to comprehend the teaching materials and to boost the research quality.

In the TRML, there are some measurement tools to perform the quality of network such us radiation pattern, VSWR, Gain, Axial ratio, signal amplitude, noise, delay time, RF signal generator, S-parameter. Beside the measurement tools, there are also communication towers and transceiver module which is located on the 4th Floor (Rooftop) of Electrical Engineering Building.



(a) Universal Radio Communication Test set with GSM and CDMA

(b) Upgradeable Oscilloscope

Figure C.12: Equipment in Telecommunication, Radio, and Microwave Laboratory

Table C.12: Equipment in Telecommunication Radio and Microwave Laboratory

E3-7	Telecommunication Radio and Microwave Laboratory		
Code	Equipment	Qty	Manufacturer
E3-07.01	RF and Electromagnetic Simulation Engines	1	Keysight(USA)
E3-07.02	Universal Radio Communication Test set with GSM	1	Rohde & Schwarz(Germany)
E3-07.08	Upgradeable Oscilloscope	1	GW INSTEK(Taiwan)

APPENDIX D

INSTITUTIONAL SUMMARY

D.1 The Institution

(a) Universitas Hasanuddin
Jl. Perintis Kemerdekaan Km. 10, Makassar, 90245
Sulawesi Selatan, Indonesia

(b) The name of Chief Executive Office of the Institution (Rector):
Prof. Dr. Dwia Aries Tina Pulubuhu, MA.

(c) Name and title of the person submitting the Report:
Prastawa Budi, PhD.

(d) Universitas Hasanuddin is accredited by National Accreditation Agency for Higher Education (NAAHE), 2017

The Electrical Engineering Study Program (EESP) is accredited by National Accreditation Agency for Higher Education (NAAHE), 2017.

D.2 Type of Control

The Universitas Hasanuddin is a state university with special status as Autonomous Public University under the Ministry of Research, Technology, and Higher Education (MORTHE or *PTNBH – Perguruan Tinggi Negeri Berbadan Hukum*).

D.3 Educational Unit

The EESP is under the Department of Electrical Engineering (EE Department). The EE Department is under the Faculty of Engineering, and consist of Bachelor, Master and Doctoral study program, The EESP is the Bachelor study program, which is the educational unit that prepares this ABET Readiness Report. The ESSP is led by a chair of study program. The organizational chart of Universitas Hasanuddin showing the departmental educational unit is presented in Figure D.1.

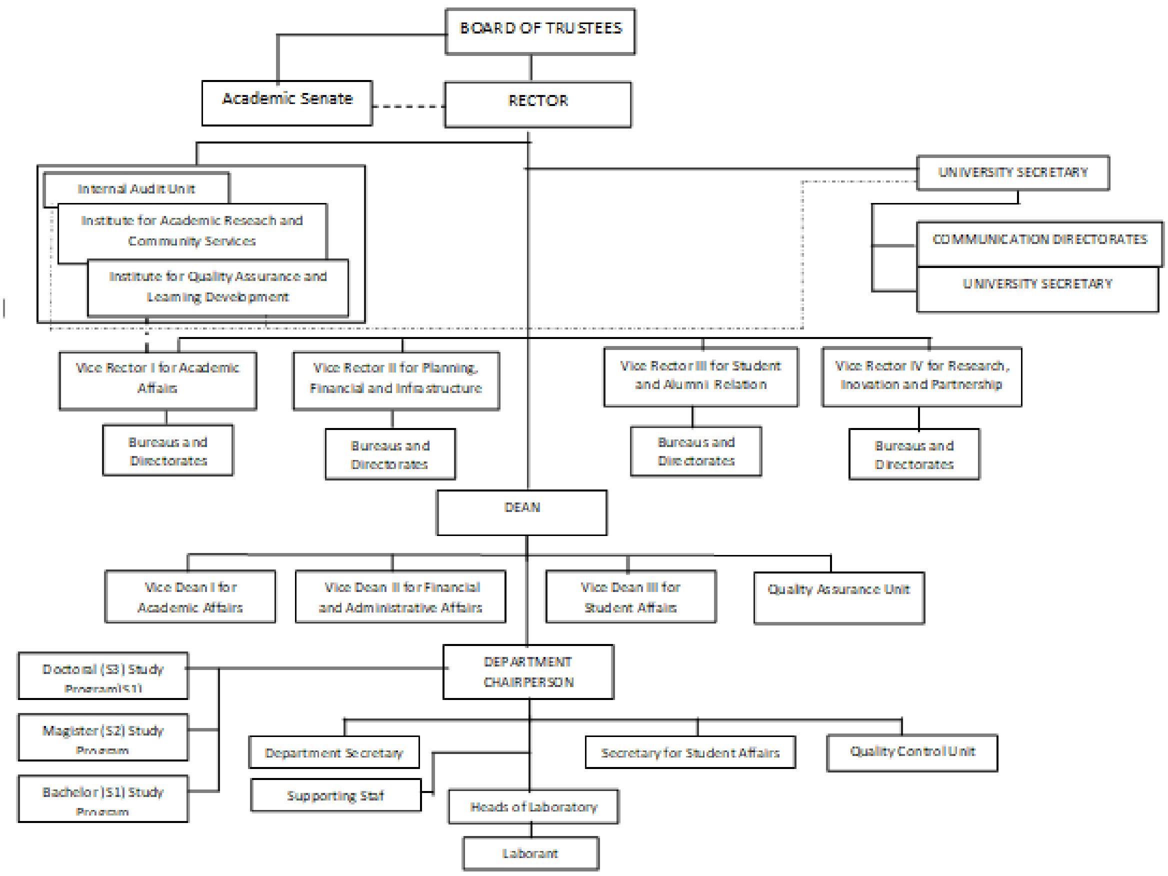


Figure D.1: Organization Chart of Universitas Hasanuddin

D.4 Academic Support Units

The following table lists the names and titles of the individuals responsible for each of the units that teach courses required by the program being evaluated for readiness, e.g., mathematics, physics, etc.

No.	Name of academic staff	Academic Support Courses
1	Dr. Syahruddin Kasim, SSi, MSi	Concept of Science and Technology
2	Dr. Ir. Muhammad Agung, MP	Concept of Science and Technology
3	Dr. A. Baharuddin, SH	Citizenship Education
4	Abdul Azis, STP, MSi	Citizenship Education
5	Abdur Rahman Arif, SSi, MSi	Advanced Chemistry
6	Dr. Syahruddin Kasim, SSi, MSi	Advanced Chemistry
7	Dr. Paulus Lobo G., MSc	Basic Physics
8	Prof. Dr. Syamsir Dewang, MS	Basic Physics
9	Dr. Munira Hasyim, SS, MHum	Bahasa Indonesia
10	Dr. Asriani Abbas, MHum	Bahasa Indonesia
11	Dr. Firman, SSi, MSi	Basic Mathematics
12	Andi Galsan Mahie, SSi, MSi	Basic Mathematics

D.5 Non-academic Support Units

The names and titles of the individuals responsible for each of the units that provide non-academic support to the program, e.g. library, computing facilities, placement, tutoring are listed below.

No.	Name of Non-academic Staff	Non-academic Support Units
1	Rhisma Hidayani	Head of Administrative Staff
2	Salmiati, Hartika, Syamsiah	Administrative Staff
3	Aris	Administrative Staff
4	Budi	Laborant
5	Mustakim	Laborant
6	Amsal Salim	Laborant
7	Nompo	Laborant
8	Ayu, Tia, Ikhsan	Office Boy

D.6 Credit Unit

Using the 16-week semester, the semester credit hour, and the 50-minute class hour, Universitas Hasanuddin course offerings are measured under the following guidelines.

Credit Guidelines One semester credit hour is assigned in the following ratio of component hours per week devoted to the course of study:

Non-Laboratory Instruction *Lecture, Recitation* – Normally, one credit hour is associated with a class meeting for 50 minutes per week for an entire semester (or the equivalent 750 semester-minutes, excluding final exams). Another widely repeated standard states that each in-class hour of college work should require two hours of preparation or other outside work.

Presentation – 1/2 credit hour is associated with a class meeting for 50 minutes per week for an entire semester (or the equivalent 750 semester-minutes, excluding final exam).

Laboratory Class Instruction ***Laboratory*** – Normally, one credit hour is associated with a class meeting for 180 minutes per week for an entire semester (or the equivalent 2700 semester-minutes, excluding final exam, in other meeting formats).

Lab Prep – One semester credit hour is associated with a class meeting 180 minutes per week over the semester.

Studio – One semester credit hour is associated with a class meeting 180 minutes per week over the semester.

Independent Study ***Experiential, Research, Individual Study*** – Credit hours associated with this type of instruction will be assigned credit depending upon the amount of activity associated with the course, faculty supervision, and students outside work activity.

Non-Directed Study *Practice/Study/Observation* – No credit hours or staff effort are directly associated with these learning situations.

Types of Credit Awarded in the Universitas Hasanuddin System

Regular Credit: Credit earned for regularly offered collegiate courses of instruction that meet the requirements of a degree program.

It is assumed that one semester or quarter credit normally represents one class hour or three laboratory hours per week. One academic year normally represents at least 28 weeks of classes, exclusive of final examinations. If other standards are used for this program, the differences should be indicated.

Thesis Credit: Credit awarded to students for research toward completion of a research project, or a degree thesis or dissertation. This credit allows measure of the expected amount of work and the resources used, while the student actually earns zero-degree credit hours. The benefit obtained is primarily to account for the resources provided, to use in reporting to governments, and in maintaining the students' financial aid position. Example: Senior Research Project, Master's Thesis, Doctoral Dissertation.

Equivalent Credit: Hours are assigned to courses to reflect the value of resources used to provide the class, such as rooms, instructors, equipment, etc. Equivalent hours are used in the registration process but revert to zero when posted to the student's academic history.

Example: A seminar with a visiting professor, over and above existing degree requirements. The benefit obtained is primarily to account for the resources provided, to use in reporting to governments, and in maintaining the student's financial aid position.

Procedure for Exceptions Many situations and new developments may cause a given department or faculty member to vary from the guidelines listed above in the assigning of credit.

D.7 Signature Attesting to Compliance

By signing below, I attest to the following:
That Electrical Engineering Study Program (EESP) has conducted an honest assessment of compliance and has provided a complete and accurate disclosure of timely information regarding compliance with ABET's Criteria for Accrediting Engineering Programs to include the General Criteria and any applicable Program Criteria, and the ABET Accreditation Policy and Procedure Manual.