ABET

Self-Study Report

for the

Electrical Engineering Study Program

at

Universitas Hasanuddin

Makassar, Indonesia

July 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 part 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 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 divided 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: Competency-Based Curriculum (KBK - *Kurikulum Berbasis Kompetensi*).

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 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.

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 4666 Sarjana Teknik (S.T.), a degree equivalent to the BS in the US, as shown in Table 2.

Table 1: Summary of Major Changes in the History of Universitas Hasanuddin.

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

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

Academic Year	Number of Graduates
1975–2016	4409
2016–2017	83
2017–2018	107
2018–2019	67
Total	**4666**

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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 revisions.

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 (see Table 3). 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".

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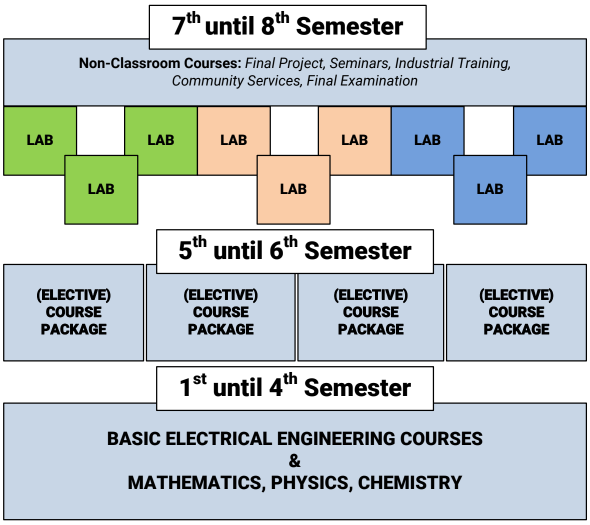

FIGURE 1: THE CURRICULUM STRUCTURE.

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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 namely1: (1) Electric Circuits, (2) Electromagnetics, (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 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.

Beginning in the fifth semester, a junior should make a decision to choose **at least one** of the following 5 (five) options by solicited 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. The list of available research laboratories and working groups in the academic year of 2018-2019 is shown in Table 3. 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. A group of instructors and students can propose capstone design projects in this final year for their laboratories or working groups.

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 graduating students 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.

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 145 credit hours of courses, a total of 28 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

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) 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 syllabii 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 three-story building as seen in FIGURE 7.2 in CRITERION 7 is functioned as the Classroom Building to house classrooms with the capacity of 20 to 100 students. Lecture theaters 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 Building can be used, as shown in FIGURE 2.

F Public Disclosure

The information regarding the PEOs, SOs, annual student enrollment 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 (Please 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 made arranged for initial ABET accreditation of the EESP. There is no deficiencies, weaknesses nor concerns from the previous evaluation of the

(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

Readiness Report submitted on October 28, 2018 as stated in ABET's response letter dated November 1, 2018.

CRITERION 1

STUDENTS

Contents

The Electrical Engimeering Study Program (EESP) is designed to accomodate 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 BSEE in the US. 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, Technolgy 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 Enrollment, Student Body and Graduates Fluctuation.

Academic Year	Enrollment	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-Lecturer 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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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), homeworks, quizes, a midterm and a final examination that will be summed up at the end of semester to produce the students' final grades according to

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
60$\leq$ N $<$ 65	C	2.00
60$\leq$ N $<$ 65	D	1.00
N $<$ 45	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 realated 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), total: 26 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

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.

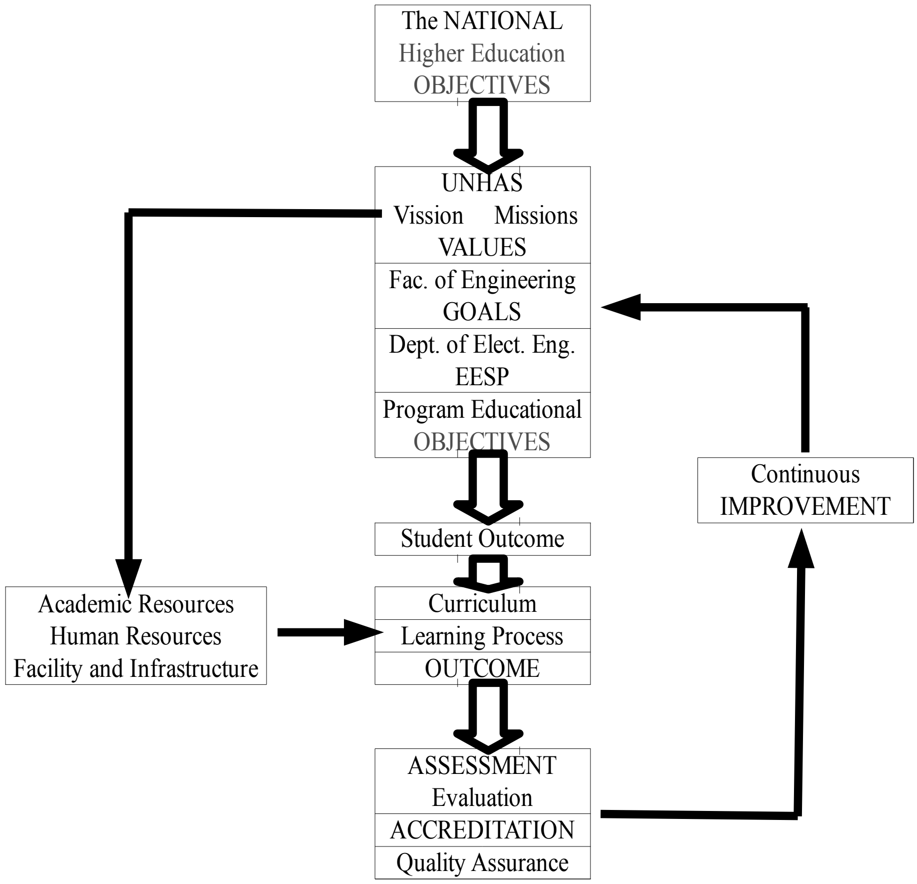


Figure 2.1: Systematic Derivation of National Higher Education Objectives into the EESP's PEOs.

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 infrastuctures, 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 Fig. 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.

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 visioned 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 visioned by the university as a “maritime-based” development, which is consistently translated intu 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 aplicable scientific creations with the national as well as the global insight, that are benefcial 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] 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 Adversory Board with the following members: 1. Muammar Muhayang, Apindo Makassar 2. Satriawan Ibrahim, PT EPFM 3. Iswan Nur Baso, PT EPFM 4. M. Sadiq, Zarindah Group 5. M. Nasir , PT Schneider 6. Hudly , PT Asia Nusantara Teknik 7. Rusdiyanto, PT Semen Tonasa 8. Hidayat, PT Kawan Baru 9. Husnul Mufida, PT Telkom 10. Bambang Yusuf, GM PT. PLN 11. Nurlina M, PT. Bank BNI

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

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

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.

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.

2.5.1 Tracer Study

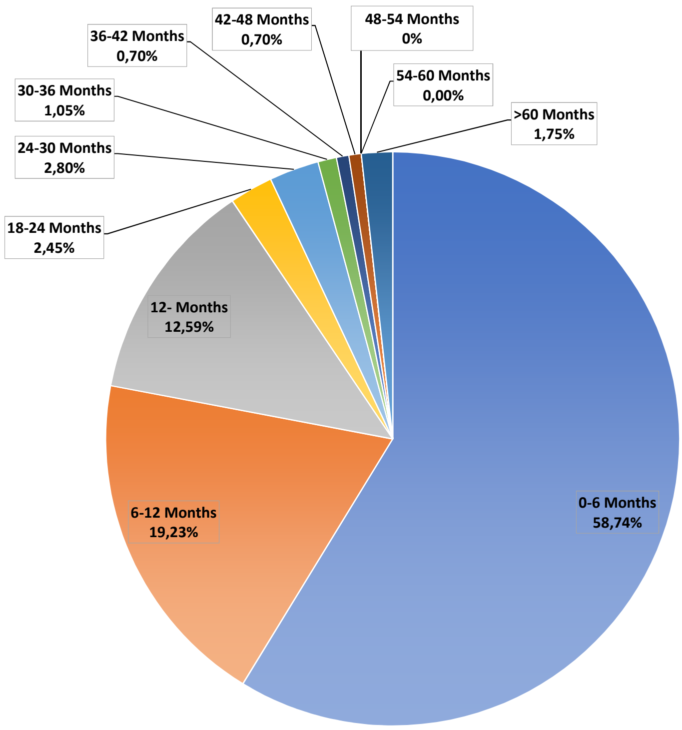


Figure 2.2: Pie Chart of Waiting Time for Alumni first job.

2.5.2 Questionnaire for Student/Senior Exit Survey

2.5.3 Questionnaire for Alumni Survey

2.5.4 Questionnaire for Employer Survey

2.5.5 Advisory Board

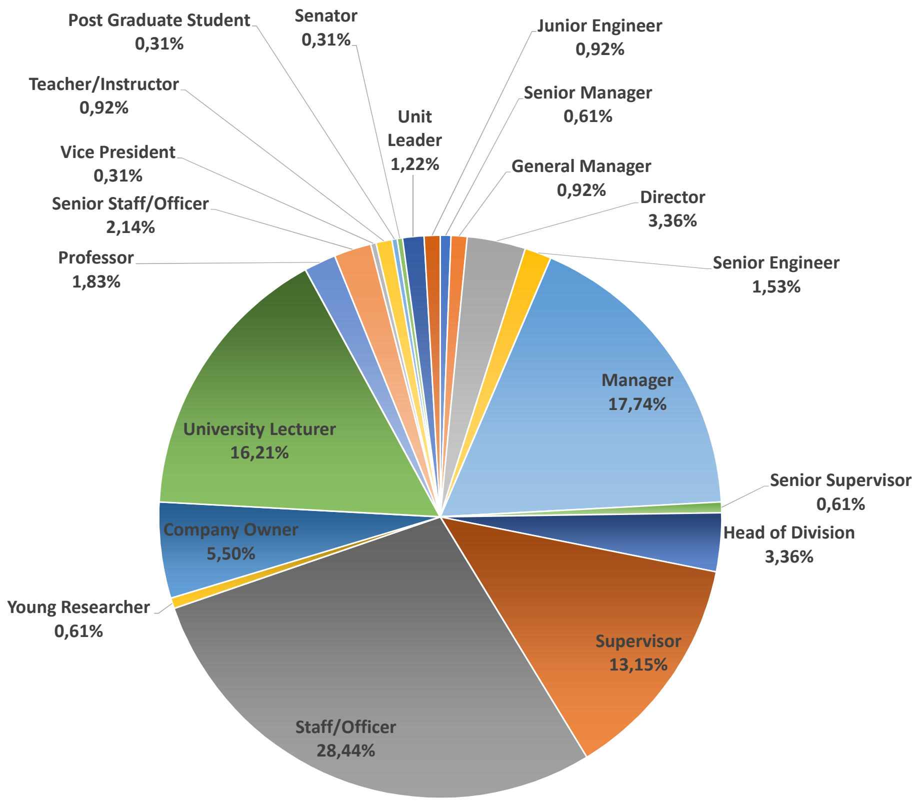


Figure 2.3: Pie Chart of Alumni Position in recent job place.

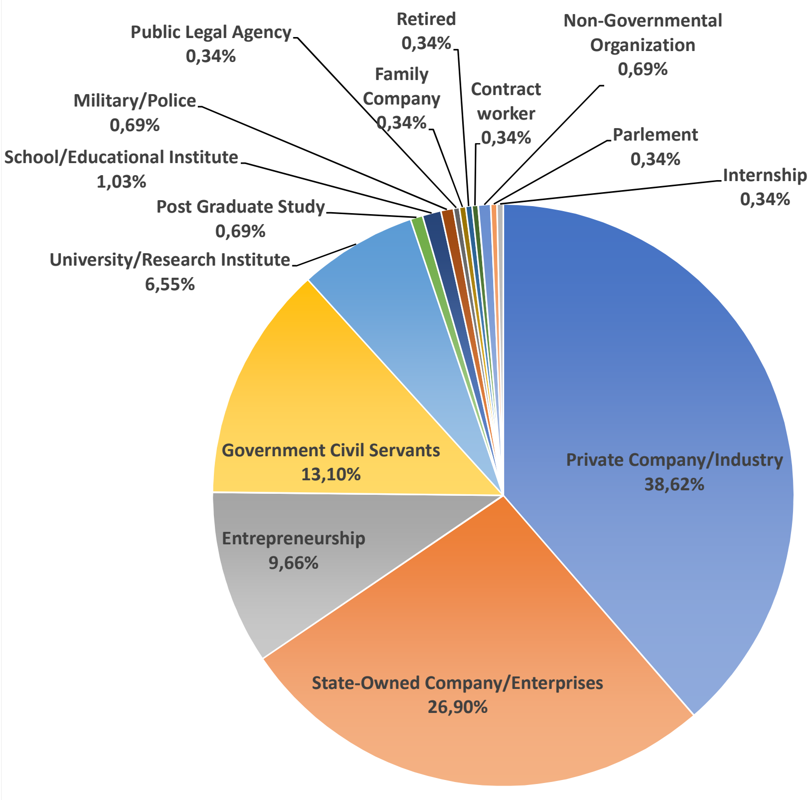


Figure 2.4: Pie Chart of Employer Category, where Alumni works.

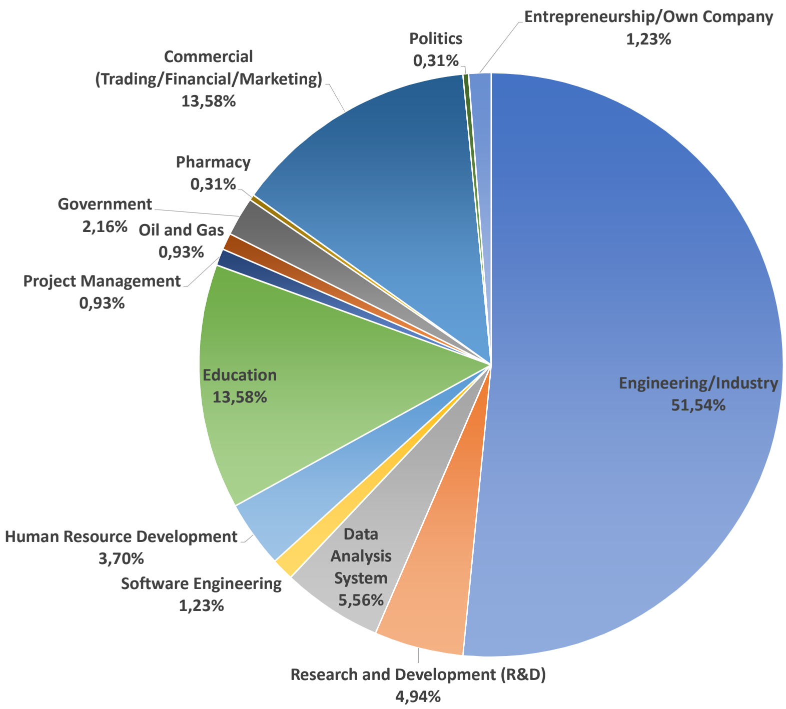


Figure 2.5: Pie Chart of Alumni's Field of Employment.

Table 2.2: 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

Table 2.3: 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 2.4: 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

CRITERION 3

STUDENT OUTCOMES

Contents

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 last time the Program Curriculum revised was in 2015. Hence, the next revision round will 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 Advisory Board meeting 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 (S0), 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, and

- **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; and

- **OP5(b)**: A mastery on the know-how to design integrated circuits or micro-electronics 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 ASO-a through ASO-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; and
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 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; and

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 is presented in TABLE 3.4

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

CRITERION 4

CONTINUOUS IMPROVEMENT

Contents

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 though 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

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 are defined.

In order to measure the performance indicator (PI) value of each course, a rubric is defined. Hence, 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, student achievement values or student grade point in each course are measured. Several courses are then selected for the performance indicator data assessment collections. The PI measurement data/values should be assessed, and should also 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.

Table 4.2 through Table 4.4 present courses that are selected for PI data measurement or collection. The EESP accumulates the total PI data, and computes its average value. In accordance with the rubric shown in Table 4.1, the PI data value should be in the range of 0.00 until 4.00.

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

TABLE 4.2: 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 ASSESSMENT	Student Exit Survey																								
2		Alumni Survey																								
3		Employer Survey																								
	DIRECT ASSESSMENT (RUBRIC-BASED ASSESSMENT METHOD)																									
1	011U0032	*Civic Education*	1	1														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								
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 4.3: 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									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 4.4: 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	1	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		

4.2.2 Indirect Assessment

In the indirect assessment process, five surveys are introduced, i.e. 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 graduate, alumni and employer. The capability level is categorized into 5 levels as follows:

Table 4.5: 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

Table 4.6: 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 QUESTIONARE**																						
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**						

Table 4.7: 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
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
Q	**AS**	**ALUMNI SURVEY QUESTIONARE**																						
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 knowledg*	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

Table 4.8: 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	ES	EMPLOYER SURVEY QUESTIONARE																							
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		

4.3 Assessment Schedule and Frequency

The direct assessment obtained from the student achievements reflected from their grade point

4.4 Evaluation

The EESP assesses regularly and evaluate the extent to which the program educational objective and student outcomes have been attained.

4.4.1 Student Outcome Evaluation

The assessment of the student outcome is generally divided into two methods, i.e. direct and indirect assessment method. The descriptions of the methods are given as follows. The student outcomes are the reflection of four program educational objectives 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.

4.4.2 Program Educational Objective Evaluation

4.4.3 Student Outcome Evaluation

4.5 Continuous Improvement

As inputs in the continuous improvement of the EESP student's outcomes, the EESP will collect data from the direct and indirect assessments explained in SECTION 4.2. The collected data are analyzed and used as the references to evaluate the EESP curriculum and to improve the achievements of the student outcomes (SOs) and program education objectives (PEOs).

4.6 Additional Information

CRITERION 5

CURRICULUM

Contents

5.1 Program Curriculum

The Program Curriculum of the EESP is designed to meet the program educational objectives. The EESP requires that all educational programs must have a freshman year that consists of mathematics and basic science, a set of general education, and engineering topics. With these constraints, the implementation of the EESP curriculum consists of three elements and with a total minimum of 145 credits hours as shown in the Figure 5.1.

Table 5.1 describes the plan of study for students in this program including information on course offerings in the form of a recommended schedule by year and term along with maximum section enrolments for all courses in the program.

The flowchart or worksheet that illustrates the prerequisite structure of the program's required courses is shown in Figure 5.2.

5.2 Course Syllabi

The Course Syllabi can be found in Appendix A of this Readiness Review Report.

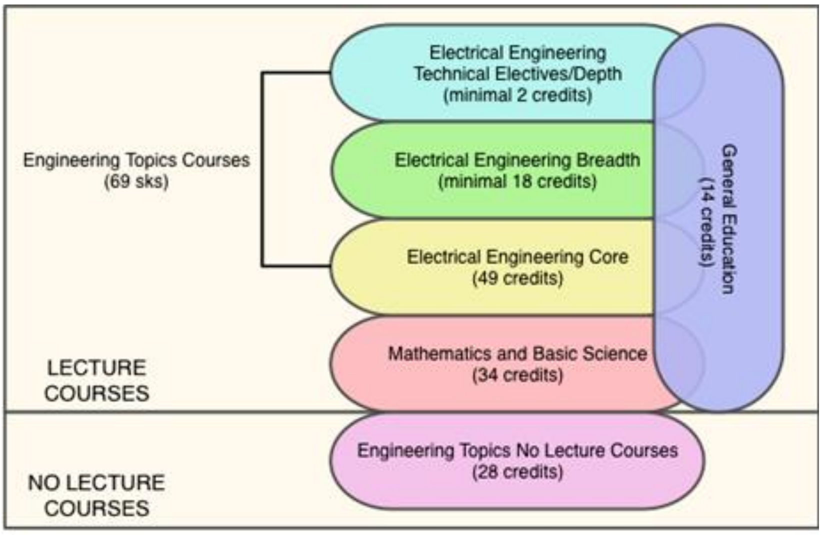


Figure 5.1: Overview of EESP curriculum.

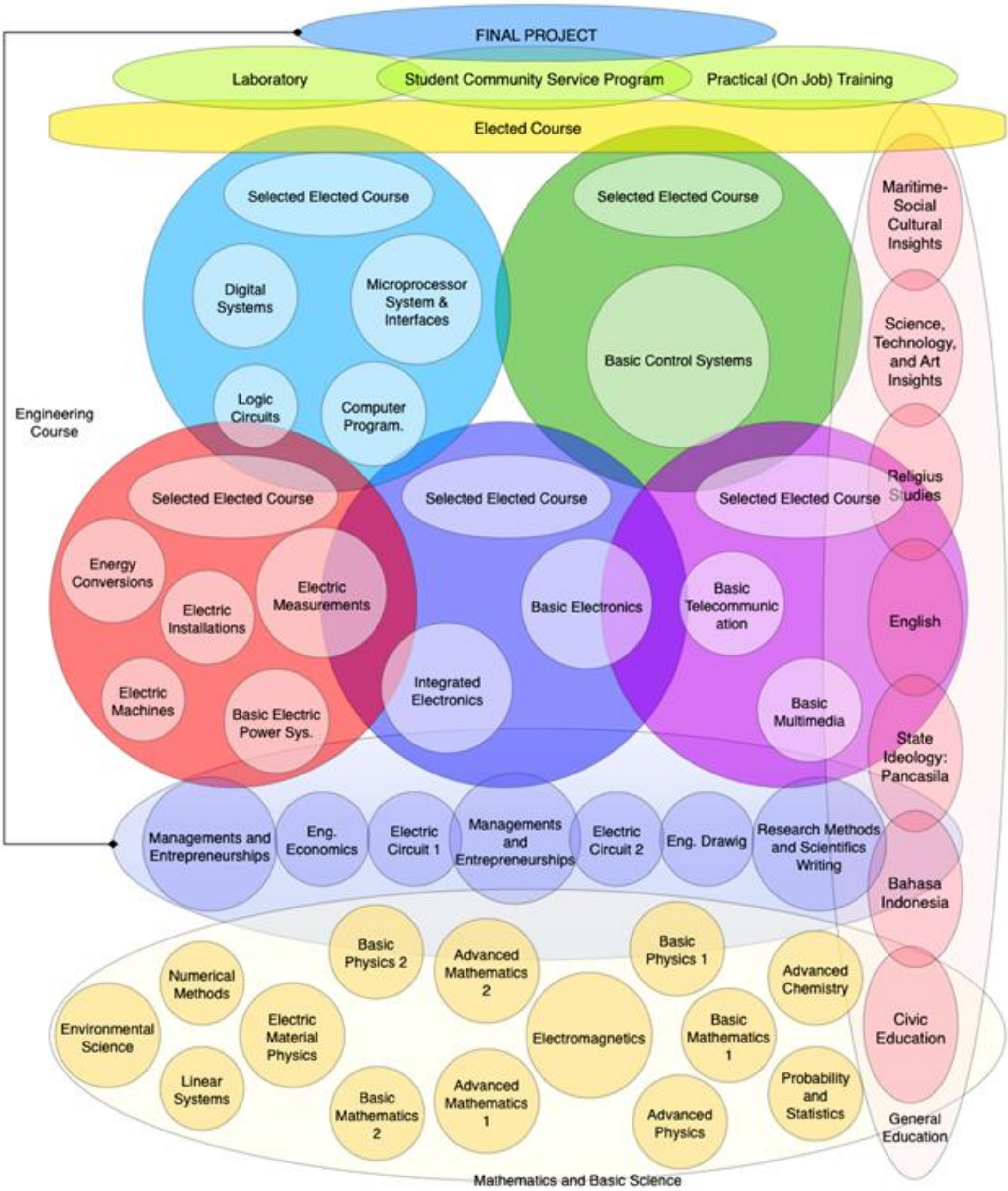


Figure 5.2: Flowchart or worksheet that illustrates the prerequisite structure of the program.

Table 5.1: 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	***Engineering Topics Check If Contains Significant Design ()***	***General Education***	***Other***		
Lecture Courses							
011U0032 Citizenship Education	R			2		I; 1	84
009U0032 Bahasa Indonesia	R			2		I; 1	84
016U0033 Basic Mathematics 1	R	3				I; 1	100
020U0033 Basic 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 Basic Mathematics 2	R	3				I; 2	100
022U0033 Basic 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 5.2: 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 5.3: 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 5.4: 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	
493D4122 Final Project Report	R		2			IV;8	
Total Credit Hours for Non-Lecture Courses	28						
Overall Minimum Total Credit Hours For Completion of The Program	145						

Table 5.5: Notes

Percentages of	Lecturer Course Only (117 credits)	Total Courses (145 credits)
Math & Basic Science	34 (29%)	34 (23.4%)
Engineering Topics	69 (59%)	93 (64.2%)
General Education	14 (12%)	18 (12.4%)

Table 5.6: General Education Component.

Code	General Education	Credit	Course (%)	Lab (%)	Other (%)
011U0032	Citizenship Education	2	100		
009U0032	Indonesian Language	2	100		
001U0032	Religion	2	100		
012U0032	State Ideology: Pancasila	2	100		
010U0032	English	2	100		
008U0032	Concept of Science and Technology	2	100		
007U0032	Social Science of Maritime Culture	2	100		

The proportion of Mathematics and Basic Sciences is only 23.4% of the total 145 credit hours minimum requirement for graduation. However, 28 credit hours out of those 145 credit hours are non-lecturer courses, such as Final Undergraduate Projects (Final Project, Seminars, and Laboratories) and Student Community Services, which may have Mathematics and Basic Sciences contents and are not comparable (“apple to apple”) to the regular lecture courses. Based on argument above, the non-lecture courses may be excluded so that the proportion of Mathematics and Basic Science is now 29.0% of the total of 117 credit hours of regular lecturer courses.

The following information provides the components of the EESP curriculum.

General Education

The general education consists of 7 courses (total 14 credit hours). The general educations are listed in Table 5.6 General Education Component below. These fourteen credit hours satisfy all the requirements of the Universitas Hasanuddingeneral education curriculum, which is design to accomplish the goals of Universitas Hasanuddinas defined by its mission statements.

Mathematics and Basic Science

The mathematics and basic science consist of 34 (thirty-four) credit hours. It divides to 18 (eighteen) credit hours of mathematics as shown in the Table 5.7 and 16 (sixteen) credit hours of basic science as shown in The Table 5.8.

Engineering Topics

The engineering topics component divides to 69 (minimum) credit hours of lecture course as shown in the Table 5.9 and 28 credit hours of no lecture course as shown in the Table 5.10.

The major design experience that prepares students for engineering prac-

Table 5.7: Mathematics Component.

Code	General Education	Credit	Course (%)	Lab (%)	Other (%)
016U0033	Basic Mathematics 1	3	100		
017U0033	Basic Mathematics 2	3	100		
201D4113	Advanced Mathematics 1	3	100		
210D4123	Advanced Mathematics 1	3	100		
211D4122	Linear Systems	2	100		
302D4112	Probability and Statistics	2	100		
342D4122	Numerical Methods	2	100		

Table 5.8: Basic Science Component.

Code	General Education	Credit	Course (%)	Lab (%)	Other (%)
020U0033	Basic Physics 1	3	75	25	
022U0033	Basic Physics 2	3	75	25	
206D4112	Advanced Physics	2	100		
104D4112	Advanced Chemistry	2	100		
205D4112	Electric Material Physics	2	100		
304D4112	Electromagnetics	2	100		
344D4122	Environmental Science	2	100		

tice.

In the EESP curriculum, there are some courses credits allocated to give students experience in project design. In the first semester, students take the Engineering Drawing course (103D4112), in which the students learn how to use CAD (Computer-Aided Design) software to design for example electric and electronic circuits.

In Digital Systems course (106D4122) and Digital Systems Lab (109D4121), the students learn to design logic circuits using a CAD Software Tools. In the last lab meeting, the students are divided into several groups and given a design project with any specifications. The students will then solve the problem given in the project, design digital circuit, implement it on a programmable logic device (in this case, we use Field Programmable Gate Array or FPGA device), and then test their functional and performance behaviours.

In Integrated Electronics Course (214D4122) and Integrated Electronics Lab (218D4121), the EESP students will learn how to design integrated circuits using educational CAD tools. The students learn how to design layout topographies of NMOS and PMOS transistors and CMOS logic circuits, simulate the circuit behaviours and analyse their performance.

In the Microprocessor Systems and Interfaces course (205D4121) and Microprocessor Systems and Interfaces Lab (205D4121), the students learn design techniques to implement a simple microcontroller-based project. The students learn Assembly and C/C++ Programming language and use them to interface the microcontroller with some I/O units such as sensors and actuators through standard interfaces.

The EESP cooperative education to satisfy curricular requirements

The EESP allows students to gather experience in industries and in society by taking the Practical (On Job) Training course (401D4112) and the Student Community Service course (491D4124) proposed in the last semester.

In the Practical (On Job) Training course, the students will work part-time in industries. Two supervisors are assigned to assess the students work, one from industry and one from the EESP faculty member. The student make a report and presents his/her work in a small meeting with his/her supervisor. Both supervisors give then the grade of the student work according the student performance in industry.

In the Student Community Service course, a groups of students from the EESP and other disciplines will work and learn in a village. A few groups could be sent to rural areas. In the village, the students will analyse any problem in the society and then they will try to find the solution. Student supervisors, normally faculty staff from university, are assigned to assess the student work and will evaluate them and give a grade according to student performance.

Final Examination and Scientific Writing

In the 7th semester, the EESP students take the course of Research Methods and Scientific Writing (402D4112). In first 8 course meetings, the students learn research methodology, and then in the second 8 course meetings, students learn to write a scientific article. This scientific article is also presented in the Final examination in the last semester.

Table 5.9: Lecture Courses.

Code	General Education	Credit	Course (%)	Lab (%)	Other (%)
101D4113	Electric Circuit 1	3	100		
102D4112	Logic Circuits	2	100		
103D4112	Engineering Drawing	2	100		
121D4123	Electric Circuit 2	3	100		
106D4122	Digital Systems	2	100		
107D4122	Computer Programming	2	50	50	
101D4121	Electric Circuit Laboratory	2		100	
109D4121	Digital Systems Laboratory	1		100	
202D4112	Basic Electrical Power (Systems)	2	100		
203D4112	Basic Telecommunication (Systems)	2	100		
233D4102	Basic Electronics	2	100		
207D4111	Basic Electric Power Laboratory	1		100	
208D4111	Basic Telecommunication Laboratory	1		100	
209D4112	Basic Electronics Laboratory	1		100	
212D4122	Electric Machines	2	100		
213D4122	Basic Multimedia	2	100		
214D4122	Integrated Electronics	2	100		
205D4121	Microprocessor Systems and Interfaces	2	100		
246D4102	Basic Control Systems	2	100		
217D4122	Electrical Installation Laboratory	2	75	25	
218D4121	Integrated Electronics Laboratory	1		100	
205D4121	Microprocessor Systems and Interface Laboratory	1		100	
301D4112	Engineering Economics	2	100		
303D4112	Electric Measurements	2	100		
343D4122	Energy Conversion	2	100		
345D4122	Management and Entrepreneurship	2	100		
402D4112	Research Methods and Scientific Writing	2	100		
	Selected Elective Course (2 package)	18			

Table 5.10: Non-Lecture Courses.

Code	General Education	Credit	Course (%)	Lab (%)	Other (%)
401D4112	Practical (On Job) Training	2			100
491D4124	Student Community Service Programs	4			100
	Laboratory 1	2	100		100
	Laboratory 2	3	100		100
403D4112	Final Project Proposal	2			100
492D4122	Final Project Results	2			100
493D4122	Final project Report	2			100

CRITERION 6

FACULTY

6.1 Faculty Qualifications

The EESP faculty member consists of 31 core members, 5 of them are professors. The faculties come from a wide variety of graduated domestic and overseas institutions. They are dedicated persons who have competence and expertise that support the achievement of learning in EESP. Their expertise includes Telecommunications and Information Engineering, Electric Power Engineering, and Computer, Control and Electronic Engineering.

In Telecommunication and Information Engineering, the EESP has 9 faculties. They have many years of experience in design and planning of telecommunication system related to wireless, satellite, fiber optic, antenna, traffic engineering, and switching. In Electric Power Engineering, the EESP has 17 faculty 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. In Computer, Control and Electronic Engineering, the EESP has 5 faculty, excluding a visiting lecture from Germany. The name of Faculty Members is presented in Table 6.1 until Table 6.5.

Table 6.1: 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		
		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	Control Eng.	Universitas Hasanuddin, Makassar	P		FT	0	31	31	PE, LC	M	H	L
4	Andini Dani Achmad	MT	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	Electronics and Control Eng.	Univ. of Dortmund, Germany	L		PT	0	9	12	NA	L	M	L
7	Ansar Suyuti	Dr	2013	Power Eng.	Universitas Hasanuddin, Makassar	P		FT	22	26	26	PE, LC, APEI, LPJK, IPU, PII	H	H	H
8	Ardiaty Arief	Dr	2012	Power Eng.	University of Queensland, Australia	SL		FT	1	12	17	LC	L	M	L

Table 6.2: 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		
		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	Power 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	Integrated Electronic	Technische Univ. Darmstadt, Germany	P		FT	2.8	11	16	LC, PE,	M	H	M
13	Fitriyanti Mayasari	MS	2012	Power Eng.	PhD in progress at Universitas Indonesia (UI)	SL		FT	0	4	12	-	L	L	L
14	Gassing	MS	1995	Power Eng.	Institut Teknologi Bandung (ITB)	AP		FT	0	30	32	PE, LC	M	M	H
15	Hasniaty A.	MS	2002	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	Power Eng.	Universitas Hasanuddin, Makassar	SL		FT	8	11	11	LC, PE	M	M	M

Table 6.3: 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		
		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	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	Robotics	University of Technology Sydney	SL		FT	2	7	14	LC	L	L	L
24	Muhammad Arief	Dr	1985	Power Eng.	l'Institute National Polytechnique de Toulouse, France	Em		PT	0	37	49	PE	H	H	H
25	Muh. Bachtiar Nappu	Dr	2013	Power Eng.	University of Queensland	AP		FT	0	10	16	LC	L	L	L
26	Muhammad Niswar	Dr	2010	Information Technologu	Information Science Nara Institute of Science and Technology	SL		FT	9	14	20	LC, CCNA, CDCP	M	H	H

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		
		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	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	Power Eng.	Institut Teknologi Bandung & TU Braunschweigh, Germany	P		FT	2	29	29	PE	M	H	H
31	Sonny Taniadji	Ir	1976	Power Eng.	Universitas Hasanuddin, Makassar	L		PT	50	43	43	NA	M	M	H
32	Sri Mawar Said	Dr	2014	Power Eng.	Universitas Hasanuddin, Makassar	AP		FT	0	33	33	LC, PE, TIEI	L	H	L
33	Syafaruddin	Dr	2009	Power Eng.	Kumamoto Univ., Japan	P		FT	2	15	20	LC, CSD,	H	H	L
34	Syafruddin Syarif	MS	2013	Computer Eng.	Universitas Hasanuddin, Makassar	P		FT	0	27	31	LC, PE, IEEE	M	H	L

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		
		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	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	Power Eng.	Universitas Gadjah Mada, Yogyakarta (UGM)	AP		FT	2	13	19	LC	M	M	L
38	Yusri Syam Akil	Dr	2013	Power Eng.	Kumamoto Univ., Japan	SL		FT	0	11	14	LC	M	H	L
39	Zaenab Muslimin	MS	2004	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
FT = Full-Time
PT = Part-Time
PE = Professional Engineer
LC = Professional Lecture Certificate

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

6.2 Faculty Workload

The EESP full-time faculty members requires 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 6.6 present the Faculty Workload Summary and describes this information in terms of workload expectations or requirements.

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 between faculty and students. The faculty interacts closely with the students by face-to-face meeting in classroom or meeting in the faculty room. Interaction can also be done through online media such as e-mail, Learning Management System (LMS), social media, and special social media application groups. 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 members 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. Community service in the form of: Procurement and counseling on how to obtain clean water for people in areas that are difficult to get clean water. Engaged in electricity-saving education programs and the use of solar panels for locations that have not installed electricity services by the government.

Table 6.6: 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 Program5
				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	30	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	21	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 6.7: 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 Program5
				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	23	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	13	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	7	32	32	100%

Table 6.8: 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 Program5
				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	21	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	20	23	35	29	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 Program5*
				Teaching		*Research or Scholarship*		*Other*[4]		
				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	8	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	29	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	20	21	35	31	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 Program5
				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	46	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	45	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 6.11: 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]						% of Time Devoted to the to the Program5
				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	10	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	32	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 6.12: 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 Program5
				Teaching		Research or Scholarship		Other[4]		
				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	47	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 6.13: 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 Program5
				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	61	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	45	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	24	31	100%

1. FT = Full Time Faculty or PT = Part Time Faculty, at the institution

6.3 Faculty Size

The EESP employs 41 faculties to conduct the courses in the EESP. The qualifications of each faculty member is presented in Table 6.1 until Table 6.5.

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 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 others 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 member is presented in Table 6.14.

Table 6.14: Summary of Professional Development Activities for Faculty Members.

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 6.15: 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 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 us 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

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	

7.1.2 Meeting Room

7.1.3 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:

(a) Outdoor side view

(b) Entrance

(c) Indoor View

(d) Classroom Indoor view

Figure 7.2: Classroom Building.

7.1.4 Lecture Theatres

(a) Lecture Theatres 1 (b) Lecture Theatre 2

(c) Lecture Theatre 3 (d) Lecture Theatre 4

FIGURE 7.3: LECTURE THEATRE

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 XXX 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 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

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

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

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

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		333D4113– Electronic Instrumentation System + Laboratory
2	PLC-05		337D4112– Industrial Automation + Laboratory (PLC)
3	LabView National Instruments		333D4113– Electronic Instrumentation System + Laboratory
4	Room Temperature Regulatory Module		333D4113– Electronic Instrumentation System + Laboratory329D4113– Control Systems + Laboratory
5	Microcontroller-based Universal Digital Controllers		372D4123– Digital Control Systems + Laboratory
6	ED-4400B Servo Motor Experimental Modules		329D4113– Control Systems + Laboratory
7	Solid Material Process Control Mini-Plant		330D4112– Process Control Technology
8	Boiler Drum		
9	48 KVA 3-phase Silent Type AC Diesel Generator	For back-up power source	All courses
10	40 Mhz 2-channel Digital Storage Oscilloscopes		333D4113– Electronic Instrumentation System + Laboratory

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.

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 7.9 shows a list of equipment, quantity and function of each equipment.

Table 7.5: Equipment 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

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

Table 7.6: Equipment in the High Voltage Laboratory

No.	Software tools / Development kits	Function	Course Related
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
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

Table 7.7: Equipment in the High Voltage Laboratory

No.	Software tools / Development kits	Function	Course Related
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

Table 7.8: Equipment in the High Voltage Laboratory

No.	Software tools / Development kits	Function	Course Related
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
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

Table 7.9: Equipment in the High Voltage Laboratory

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

theory with laboratory activities as an effective means of developing the skills essential to the electrical trade. 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 7.10: Equipment in the Electrical Installation Laboratory

No.	Software tools / Development kits	Function	Course Related
1			
2			
3			
4			
5			

Figure 1 and Figure 2 present some equipment, their functionality and their related courses that use them. Beside the equipment presented in the figures, in the Electrical Installations Laboratory there are also Power Quality Meters, Solar Cell Modules, Air Conditioner Module, Modification Modified ATS / AMF module, Modified Motor Control Module, and Modified Motor Starting Module. The equipment are used for practicum and research on Smart Home.

7.1.5.6 Power System Laboratory

The Power Systems Laboratory has been set up mainly to teach the practical aspects of Power Systems Engineering to students.

At present it conducts parts of the laboratory classes in following subject areas:

- Introduction to Power Systems
- Generation & Transmission
- Distribution Power System
- Power System Protection
- Power Distribution & Utilization
- Power System Analysis

The Power Systems Laboratory is also used in carrying out research, consultancy and testing work.

Table 7.11: Equipment in the Power System Laboratory

No.	Software tools / Development kits	Function	Course Related
1			
2			
3			
4			
5			

7.1.5.7 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

Table C.7 presents some equipment, their functionality and their related courses that use them. 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 7.12

Table 7.12: Equipment 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

7.1.5.8 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.

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 modelling 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 7.13: Equipment 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

7.1.5.9 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 7.14 some laboratory equipment and their uses are shown.

In addition to the equipment contained in table 7.14 there are also other equipment that are often used to complement practical needs such as VSD (Variable Speed Drive), Microcontroller, Active and Passive Components.

Table 7.14: Equipment 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	
2	Electronics Demonstration System	To analyse electronics circuit	
3	Silicon Controlled Rectifier (SCR) Trainer	To analyse circuit using SCR	
4	Motor-Generator Trainer	To build and analyse circuit using motor/generator	
5	PC Oscilloscope, 2 Channels	To measure anlog and digital signals	
6	Analog Oscilloscope, 2 Channels	To measure analog signal	

7.1.5.10 Computer Hardware, Networking and Software Engineering Laboratory

Computer Hardware, Networking and Software Engineering Laboratoryhas 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.

7.1.5.11 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 BE courses related to the laboratory is Basic Telecommunications.

The available development kits in the Telematics Laboratory, their functionality and related courses and research that use them are summarized in Table 7.1.5.11

Table 7.15: Equipment in the Computer Hardware, Networking and Software Engineering Laboratory

No.	Software tools/ Development kits	Function	Course Related
1	Power Electronics Trainer	To analyse the power electronics circuits and applications	
2	Electronics Demonstration System	To analyse electronics circuit	
3	Silicon Controlled Rectifier (SCR) Trainer	To analyse circuit using SCR	
4	Motor-Generator Trainer	To build and analyse circuit using motor/generator	
5	PC Oscilloscope, 2 Channels	To measure anlog and digital signals	
6	Analog Oscilloscope, 2 Channels	To measure analog signal	

Table 7.16: Equipment in 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

7.1.5.12 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 7.17

Table 7.17: Equipment in Antenna and Propagation Laboratory

No.	Software tools / Development kits	Function	Course Related
1	3D-Electromagnetic Field Simulation Software (CST)	To design (modelling) antenna	311D4113–Antenna and Propagation + Laboratory
2	Vector Signal Generator (Rohde & Schwarz)	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 (GW Instek)	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 (AtenLab)	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 7.17 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.

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

7.1.5.13 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 within the Department of Electrical Engineering, Faculty of Engineering (FoE), Universitas Hasanuddin . As the common functionality of the most laboratories operated in FoE environment, TRML has two main important roles in order to gain the three pillars of UNHAS vision and mission (i.e. learning activity, research activity and public services). These roles 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 labo 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. TRML is currently equipped with various hardware and software tools including Vector Network Analyzer (Operation Frequency Band from 100 MHz up to 8.5 GHz); RF Signal Generator (Operation Frequency Band from 100 MHz up to 8 GHz); Handheld RF Power Meter/ Spectrum Analyzer (Operation Frequency Band from 100 MHz up to 8.5 GHz); Anechoic Chamber (Operation Frequency Band from 100 MHz up to 6 GHz); outdoor communication system testing facility (twin communication towers); and 3D computing software (e.g. CST, ADS, NEC Win Pro and EMPro). 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
- 311D4113–Antenna and Propagation + Laboratory
- 312D4112–Telecommunication Transmission Line
- 313D4113–High Frequency and Transmission System
- 315D4112–Telephone Telecommunication Network
- 314D4112–Satellite Communication Systems
- 352D4122–Cellular Communication
- 353D4122–Wireless Technology
- 357D4122–Telecommunication Electronics + Laboratory
- 359D4122–Digital Signal Processing
- 361D4123–Multimedia Signal Processing + Laboratory
- 360D4122–Analog and Digital Filter
- 365D4122–Telecommunication System Performance
- 424D4132–Special Telecommunication Network Topics
- 425D4132–Wireless Special Topic
- 427D4132–Special Antenna Topics
- 429D4132–Advanced Cellular Communication
- 432D4132–Telecommunication Network Optimization
- 442D4132–Modulation and Coding Techniques

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 7.18.

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.

7.3 Guidance

7.4 Maintenance and Upgrading of Facilities

7.5 Library Services

Library facility in Faculty of Engineering, Universitas Hasanuddinhas 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.

Table 7.18: Equipment in Antenna and Propagation 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 311D4113–Antenna and Propagation + Laboratory 312D4112–Telecommunication Transmission Line 313D4113–High Frequency and Transmission System 442D4132–Modulation and Coding Techniques
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	311D4113–Antenna and Propagation + Laboratory 312D4112–Telecommunication Transmission Line 313D4113–High Frequency and Transmission System 315D4112–Telephone Telecommunication Network 314D4112–Satellite Communication Systems 352D4122–Cellular Communication 353D4122–Wireless Technology 357D4122–Telecommunication Electronics + Laboratory 360D4122–Analog and Digital Filter 365D4122–Telecommunication System Performance 424D4132–Special Telecommunication Network Topics 425D4132–Wireless Special Topic 427D4132–Special Antenna Topics 429D4132–Advanced Cellular Communication
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	311D4113–Antenna and Propagation + Laboratory 312D4112–Telecommunication Transmission Line 313D4113–High Frequency and Transmission System 315D4112–Telephone Telecommunication Network 314D4112–Satellite Communication Systems 352D4122–Cellular Communication 353D4122–Wireless Technology 357D4122–Telecommunication Electronics + Laboratory 360D4122–Analog and Digital Filter 365D4122–Telecommunication System Performance 424D4132–Special Telecommunication Network Topics 425D4132–Wireless Special Topic 427D4132–Special Antenna Topics 429D4132–Advanced Cellular Communication
4	RF-anechoic Chamber (AtenLab)	To Used for performing measurements like Radiation pattern measurements, RCS measurements, Antenna parameters (gain, efficiency, pattern	311D4113–Antenna and Propagation + Laboratory313D4113–High Frequency and Transmission System

(a) CSA's Building

(b) Library

(c) Front View

(d) Back View

FIGURE 7.4: LIBRARY AND COMPUTER ROOMS

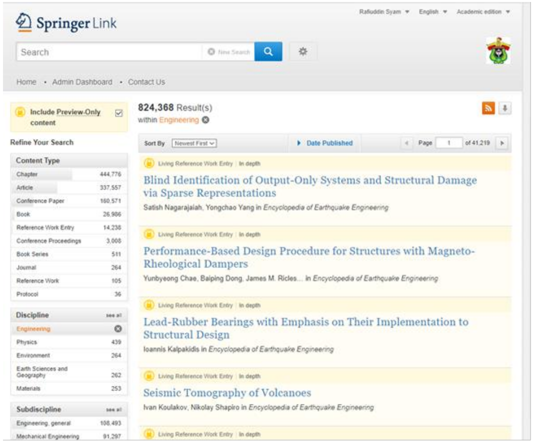
The journal article in Faculty of Engineering, Universitas Hasanuddincan be freely accessed without password through the link: https://cot.unhas.ac.id/library. Especially, the link of popular journal of Nature Springer publisher (Figure 7.5(a)) can be accessed through https://link.springer.com. In addition, 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.

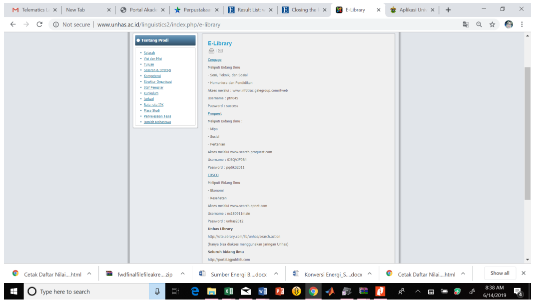
In general, the students may access the university library in the main campus of Universitas Hasanuddin through e-library which the main page appears in Figure 7.5(b) as follows.

If the students have registered as the National library member, they can access some publishers as listed in Table 7.19 as follows.

7.6 Overall Comments on Facilities



(a) Main Page of Journal Access through Springer Link



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

FIGURE 7.5: LIBRARY SERVICES

TABLE 7.19: 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

CRITERION 8

INSTITUTIONAL SUPPORT

PROGRAM CRITERIA

The EESP evaluates the aforementioned outcomes regularly using two types of student performance assessments, i.e. direct and indirect assessments. In the direct assessments, each student's is evaluated for certain performance criteria. These assessments are part of the grading of student works in the EESP courses. The direct assessment method includes also the student portfolios enrichment.

The indirect measurements are done through surveys. Upon completing their course, students are asked to take the surveys through the EESP and UNHAS webpages. Graduating students are also asked to take the senior exit survey which is a self-assessments for the student's outcomes. The indirect assessments are also made through Alumni and Employers Surveys.

Both the direct and indirect assessment methods have been described in Criterion 4 (Continuous Improvement), and is illustrated in Figure 8.1. The EESP collects data from the assessment methods and use them to evaluate the expected and the measured (real) student outcomes. The improvements are then made according to the evaluation results. The improvement actions can be made using the following:

1. Improve the quality of course materials

2. Invite international visiting lecturers

3. Organize staff's professional development and/or

4. Reform the curriculum structure

In general the direct assessment method is made during study period, which is divided into two main parts, i.e.:

1. Examinations, which are divided into:

    (a) Course exams. These exams are part of grading systems of student's works in each course.

    (b) Lab exams, These exams are part of grading systems of student's work in each lab work.

    (c) Final examination bundled in an Undergraduate Final project presentations.

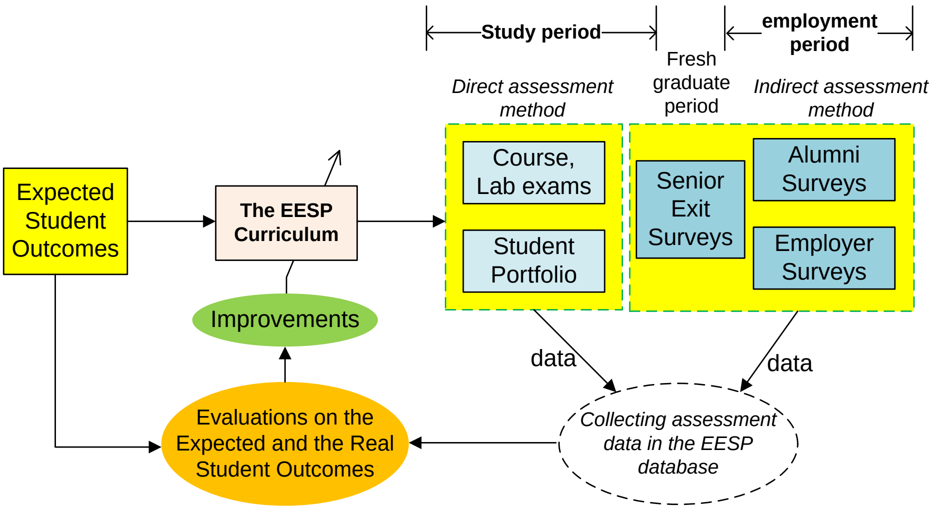


FIGURE 8.1: CONTINUOUS IMPROVEMENT DIAGRAM.

2. Student's Outcomes Portfolios. Besides the student's grades for all courses, which are presented in student's transcript after finishing their study, every student is also encourage to enrich his/her portfolio. The student's portfolio is described concretely in a single or multiple papers. Different with student's transcript that gives student performance in quantitative grading points, the student portfolio describes the student skills achievement qualitative description. The student portfolio states the student experiences in design contests or competitions, in national and/or international conferences as presenter or passive participant, including their achievements in those events, obtained awards or honours, etc.

In the first semester, each student is given a skill map (single paper), presenting some skills that the student wish or expect to master after completing his/her BSEE degree. Each student can select until 3-5 skills with a given priority number. The given skills are stated for example that "he/she will be able to design a component of an electric vehicle". It is not necessary that the given skills sound similar with the student outcomes, but they can implicitly represent or reflect at least one of the student outcomes. The EESP collects then the skill map signed by the student, and let the student keep a copy for his/her archive. In the last Semester, this skills map is opened again and the student expectations shown in the skills map are cross checked with the student portfolio that he/she will have made upon completing his/her BSEE study.

During their study-period, the student outcomes will be assessed. Four skills are given to students in accordance with the program educational objectives of the EESP (Criterion 3, i.e. basic science skills, professional skills, entrepreneur skills and research skills. The student outcomes related to their technical knowledge (professional skills) to solve an engineering problem can be achieved after Semester 6 (third year). Therefore, the professional skills can be measured after the third year. The research skills of a student can be assessed in the last semester (Semester 8) during completing his/her undergraduate final project. Extensive advising is given by the project supervisor including the scientific writing.

At least once a year or once per semester, the EESP opens a local student conference and exhibition (SCE). In the SCE, some students will have chance to demonstrate their communication or presentation skill, to show their scientific writing skill, and to expose their undergraduate projects. All students, teaching staff, government representatives and the parents and/or family members of the student will be invited to attend the SCE.

The EESP indirect assessment is divided into three methods, i.e.:

(a) Senior Exit Surveys

(b) Alumni Surveys using google form or an existing social media (LinkedIn as our preference)

(c) Employer Surveys through a purpose sampling industrial advisory committee meetings

The indirect method is made to know the extent to which: 1) a fresh graduate satisfies with the EESP curriculum, through the Senior Exit Surveys, 2) the employers satisfies with the performance of our alumni, through the purpose sampling industrial advisory committee meeting, and 3) the existences of our alumni that have established their own company. Point 2) above is related to both, the Alumni and Employer Surveys, while Point 3) is related to the Alumni Surveys.

To gather the data of our alumni, every fresh graduate is asked to register on a social media. In this case, we select LinkedIn as our preference. The fresh graduated alumni is asked to link his/her account to the EESP alumni account and continuously update their last employment status. The EESP will then collect the alumni data from the social media and put them in the EESP alumni database.

At least once a year, the EESP selects or samples an employer to host an industrial advisory committee meeting. The industrial advisory committee are the EESP staff and staff from industries or employers in which the EESP Alumni are employed. The committee will discuss about the industrial needs and how the EESP Alumni can meet the requirements.

APPENDIX A

COURSE SYLLABI

Contents

A.1 High Frequency and Transmission System

1. Course number: 313D4113
   Course name: High Frequency and Transmission System
2. Credits: 3
   Contact hours: 42 hours
3. Instructors:
   (a) Merna Baharuddin
   (b) Elyas Palantei
4. Text book, title, author, publisher and year:
   (a) Understanding Microwaves, Allan W. Scott, Publisher: Wiley-Inter Science (John-Wiley & Sons, Inc.), 2005.
   (b) High Frequency Techniques: An Introduction to RF and Microwave Engineering, Joseph F. White, Publisher:IEEE Press and Wiley-Inter Science (John-Wiley & Sons, Inc.), 2004.
   (c) Electromagnetic Waves and Radiating Systems, Edward C. Jordan and Keith G Balmain, Publisher: Prentice Hall, 1968.
   (d) Introduction to RF Equipment and System Design, Pekka Eskelinen, Publisher: Artech House, Inc., 2004. Handbook of Microwave Measurements, Moe Wind and Harold Rapaport, Publisher: Polytechnic Press, 1958.
   (e) Field and Wave Electromagnetics, David K. Cheng, Publisher: Addison-Wesley, 1989.
   (f) Electromagnetics for Engineers, Fawwaz T Ulaby, Publisher: Pearson Education, Inc., 2005.
5. Specific course information:
   (a) This course discusses about microwave concepts, performance parameters, and importance control components of microwave. Pre-requisites: N/A
   (b) Pre-requisite: Advanced Mathematics, Basic Telecommunication (Systems), Telecommunication Transmission System
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) The student will able to understand high frequency system concepts and the application in everyday life
   (b) The student will able to understand microwave wave field and performance parameters microwave
   (c) The student will able to understand importance part of microwave

(d) The student will able to understand importance components of signal control on microwave application

(e) The student will able to understand requirements and types of antennas for microwave applications

7. Brief list of topics to be covered:

   (a) High frequency line transmission fundamental
   (b) Microwave wave field
   (c) Microwave performance parameters
   (d) Line transmission microwave
   (e) Microwave signal control components
   (f) Microwave semiconductor amplifiers
   (g) Microwave oscillators
   (h) Low noise receiver
   (i) Microwave integrated circuit
   (j) Microwave tubes
   (k) Microwave antennas
   (l) Types of microwave communication systems

A.2 Electric Power Generation System

1. Course number: 309D4112
   Course name: 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-requisites: Basic Electric Power Systems, Energy Conversions
   (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.3 Protection System 1

1. Course number: 308D4112
   Course name: 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, Erlangen, 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) Prtective 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, overcurrent protection, differential protection, distance protection, pilot protection

   (b) Pre-requisite: Basic Electric Power Engineering, Electric Machines, Power System 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.4 Protection System 2 + Laboratory

1. Course number: 348D4122
   Course name: 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,GWA, Erlangen, 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 and Sons Inc, 1995.

   (i) Sistem Proteksi Tenaga Listrik 1st ed, Sonny Tanyadji, Sarma Thaha, Publisher: Uniceristas 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 Electric Power Engineering, Electric Machines, Power System Analysis, Electric Power 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:
      i. short circuit condition, stator and rotor winding fault protection
      ii. Non short circuit condition, loss of excitation, unbalance load, out of step, overloaded, over and under voltage and frequency, prim mover failure.
   (b) Transformer protection:
      i. Internal incipient fault:
      ii. Core fault, oil insulation failure, over-fluxing.
      iii. Internal active fault:
      iv. Winding shorted, inter-turn shorted, Phase to ground shorted.
      v. Electric parameter protection relays.
      vi. Non electric parameter protection relays.
   (c) Line Protection:
      i. Line phase fault and ground fault.
      ii. Non pilot current protection relay: Definite time overcurrent relay, time & current overcurrent relay, inverse combined with instantaneous overcurrent relay.
      iii. Non pilot distance protection relay:
      iv. Coordination system of un-event section length, Infeed factor due to line configuration.
      v. Distance relay with pilot system.
      vi. Base on communication medium:
      vii. Wire Pilot.
      viii. Power Line Carrier Pilot
      ix. Fiber Optic Pilot
      x. Radio Frequency Pilot (microwave pilot
      xi. Base on operation system:
      xii. Blocking Pilot, Permissive Under reaching Transfer Trip, Permissive Overreaching Transfer Trip.
      xiii. Line Differential Protection:
      xiv. Differential current detection method:
      xv. Magnitude comparison, phase comparison, phasor comparison.

xvi. Non directional and Directional overcurrent relay

(d) Bus Protection:

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

(e) Motor Protection

i. Phase and Ground Fault Protection.
ii. Unbalance Voltage Protection
iii. Overload Protection.

(f) Reactor Protection.

i. Phase and ground fault protection
ii. Unbalance voltage protection

(g) Capacitor Protection.

i. Phase and ground fault protection for grounded wye three phase system.
ii. Unbalance current protection for ungrounded wye three phase system

A.5 Electronic Instrumentation System + Laboratory

1. Course number: 333D4113
   Course name: 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 measurement, Integrated Electronic 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.6 Industrial Robotics

1. Course number: 331D4112
   Course name: 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 measurement, Integrated Electronic Laboratory, Electronics and Instrumentation System

   (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.7 Microprocessor Based System + Laboratory

1. Course number: 319D4113
   Course name: 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 System, Microprocessor Systems and Interface
   (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.8 Process Control Technology

1. Course number: 330D4112
   Course name: 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: Control Systems,
   (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.9 Wireless Technology

1. Course number: 353D4122
   Course name: 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 (Systems)
   (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.10 Telecommunication Software

1. Course number: 317D4112
   Course name: Telecommunication Software
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Syafruddin Syarif
4. Text book, title, author, publisher and year:
   (a) Tutorial on SDL-88. http://www.sdl-forum.org/sdl88tutorial/, Belina, H, Publisher: SDL Forum Society, 2007.
   (b) Languages for Telecommunication Application, Braek, R., Publisher: Teletronik. 2000.
   (c) SDL (Specification and Description Language), Doe, J., Publisher: Andrews University. 2007.
   (d) SDL: Formal Object-Oriented Language for Communicating Systems, Ellsberger, J. Hogrefe., D. Sarma, A., Publisher: Prentice Hall PTR. 1997.
   (e) The Formal Smeantics of SDL 2000: Status and Perspectives, Gotzhein, R., Publisher: Elsevier. 2003.
   (f) Net Theory and Applications, Braue, W., Publisher: Tokyo Computer Science. 1980.
5. Specific course information:
   (a) This course discuss specification and description language (SDL), various kinds of SDL, and Software Defined Radio.
   (b) Pre-requisites: Basic Telecommunication (Systems), Computer Programming
   (c) Course type: Elective (E)
6. Specific goals for the course:
   (a) Student will able to know and understand about specification and description language SDL and software defined radio (SDR).
7. Brief list of topics to be covered:
   (a) Specification and Description Language (SDL)
   (b) SDL 2000
   (c) SDL-PR
   (d) SDL-GR
   (e) Software Defined Radio (SDR): WiMAX IEEE
   (f) SDR

A.11 Optimal Control System

1. Course number: 373D4122
   Course name: 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-requisites: Basis Control systems, Control Systems
   (c) Course type: RElective (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 diskrit systems

A.12 Electric Machine Analysis 1 + Laboratory

1. Course number: 307D4112
   Course name: 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) Brief description of the content of the course (catalog description): To recognize the principles and analyzes the characteristic of DC Generator, DC Motor, and Transformer.
   (b) Pre-requisites: N/A
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) Course outcomes:
   (b) Students will understand the working principle of DC Generator
   (c) Students will know the types of DC Generator and their differences
   (d) Students will understand No Loaded, Loaded, and External characteristic of each DC Generator types
   (e) Students will understand why a type of DC generator is used
   (f) Students will understand the working principle of DC Motor
   (g) Students will know the types of DC Motor and their differences
   (h) Students will understand Torque, Speed, and Mechanic characteristic of each DC Motor types
   (i) Students will understand why a type of DC motor is used
   (j) Students will understand the working principle of Transformer
   (k) Students will know the types of Transformer and their differences
   (l) Students will be able to determine the ratio between primary winding with secondary winding on Single Phase Transformer
   (m) Students will know how to determine the polarity of Transformer

(n) Students will know the losses on Transformer and theirs cause
(o) Students will understand how to determine the connection of Three Phase Transformer
(p) Students will understand why a type of connection is used on Transformer.
(q) Student outcomes addressed by the course:
(r) Knowing the working principles and characteristics of DC Generator, DC Motor, and Transformer.
(s) Understanding the reasons why a type of DC Generator and DC Motor is used
(t) Understanding the reason 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:
(c) Working principle of DC Generator.
(d) Types of DC Generator (Self-excited, Series, Shunt, and Compund).
(e) Characteristics of DC Generator (No Loaded, Loaded, and External characteristic).
(f) Application of DC Generator.
(g) DC Motor:
(h) Working principle of DC Motor.
(i) Types of DC Motor (Self-excited, Series, Shunt, and Compund).
(j) Characteristics of DC Motor (Torque, Speed, and Mechanic characteristic).
(k) Application of DC Motor.
(l) Transformer:
(m) Working principle of Transformer.
(n) Construction of Transformer.
(o) Types of Transformer.
(p) Losses in Transformer.
(q) Transformer connection on Three Phase Transformer

A.13 Electric Machine Analysis 2 + Laboratory

1. Course number: 349D4122
   Course name: Electric Machine Analysis 2 + Laboratory
2. Credits: 2
   Contact hours: 1.8 contact 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 analyzes the characteristic of Induction Motor and Synchronous Generator.
   (b) Pre-requisites: 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 Capasitor and why a capasitor 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.14 Digital Signal Processing

1. Course number: 359D4122
   Course name: Digital Signal Processing
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) Fundamental of Signals and System, Edward W. Kamen and Bonnie S. Heck, Publisher: Prentice Hall, 1997.
   (b) Principle of Signal and System, Fred J. Taylor, Publisher: McGrawHill, 1997.
   (c) Pemrosesan Sinyal Digital, Prinsip Algoritma dan Aplikasi (Terjemahan), J.G. Proakis dan D.G. Manolakis, Publisher: PT. Prehelindo, 1997.
   (d) Fundamental of Digital Signal Processing, Lonnie C. Ludeman, Publisher: John Wiley & Sons Inc, 1987.
   (e) Digital Signal Processing: A Laboratory Approach using PC-DSP, Oktay Alkin, Publisher: Prentice Hall, 1994.
5. Specific course information:
   (a) This course discuss analog to digital converter, digital to analog converter, discrete time signals, Z transformation, Fourier transformation, and digital filter.
   (b) Pre-requisites: Advanced Mathematics, Linear Systems
   (c) Course type: Elective (E)
6. Specific goals for the course:
   (a) Student will able to know and understand discrete time system and analyze Z transformation and discrete Fourier transform.
   (b) Student will able to understand problems and solutions in time discrete linear system using convolution method
   (c) Student will able to utilize Z transformation and Fourier transformation as well as digital filter in digital signal processing
7. Brief list of topics to be covered:
   (a) Signal and system on digital signal processing
   (b) Analog to digital converter

(c) Digital to analog converter
(d) Discrete time signal classification
(e) Convolution concepts
(f) Causality and stability on discrete time linear system
(g) Time invariant linear system
(h) Z transformation and inverse
(i) Discrete Fourier series
(j) Finite impulse response
(k) Infinite impulse response

A.15 Advanced Chemistry

1. Course number: 104D4112
   Course name: 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.16 Alternating Current Transmission System

1. Course number: 305D4112
   Course name: 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, Electromagnetic, Electric Circuits
   (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.17 Antenna and Propagation + Laboratory

1. Course number: 311D4113
   Course name: 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, Basic Telecommunication (Systems), 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.18 Basic Electric Power Laboratory

1. Course number: 207D4111
   Course name: Basic Electric Power Laboratory

2. Credits: 1
   Contact hours: 150 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 Electric 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.19 Electrical Installation Laboratory

1. Course number: 217D4122
   Course name: 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 Circuits
   (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.20 Electric Machines

1. Course number: 212D4122
   Course name: 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 Circuits

   (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.21 Electric Measurements

1. Course number: 303D4112
   Course name: 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-requisites: Electric Circuits
   (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.22 Management and Entrepreneurship

1. Course number: 345D4122
   Course name: 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-requisites: 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.23 Fibre Optic Communication

1. Course number: 323D4112
   Course name: Fibre Optic Communication

2. Credits: 2
   Contact hours: 27 hours

3. Instructors:

   (a) Andani Achmad

   (b) Dewiani Djamaluddin

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

   (a) Optical Communications, 3rd Ed, Gerd Keiser, Publisher: McGraw-Hill, 2000.

   (b) Optical Fibre Communication Systems, Leonid Kazovsky, Sergio Beneditto, Allan Willner, Publisher: John Wiley & Sons Inc, 1996.

   (c) Optical Fibre Communications, Principle and Practice, 2nd Ed, John M. Senior, Publisher: Prentice Hall, 1992.

   (d) Fundamentals Of Photonics, Bahaa E.A.Saleh, Malvin Carl Teich, Publisher: John Wiley & Sons Inc, 1991.

   (e) Optical Fiber Telecommunications IVA, Ivan Kaminow, Tingye Li, Academic Pressl, 2000.

5. Specific course information:

   (a) This course discusses about attenuation, absorption & scattering of fibre optics, dispersion and modifying disperse, PMD, multi-wavelength & non-linear effects, principle and type of laser, and modulation, principle of optical detectors and types of receivers and their performance, voltage repeater, regenerator and optical amplifier, principle and technology WDM, switching in fibre optic networks and its technology, the concept of fibre optic, multiplexing & fibre optic networks for jar. Optical fibre, non-linear effects, amplification & switching for jar. Optical fibre, the difference in application for regional, metro & local networks, planning of fibre optic communication systems

   (b) Pre-requisites: Advanced Mathematics, Basic Telecommunication (Systems), Digital Communication

   (c) Course type: Required (R)

6. Specific goals for the course:

   (a) The student will able to explain attenuation, absorption and scattering of optical fibre

   (b) The student will able to explain dispersion and modifying disperse

(c) The student will able to explain principle and type of laser and modulation
(d) The student will able to explain principle and technology WDM
(e) The student will able to explain concept of optical fibre network
(f) The student will able to plan fibre optic communication systems

7. Brief list of topics to be covered:

   (a) Optical fibre characteristic
   (b) PMD and multi-wavelength
   (c) Transmitter
   (d) Receiver
   (e) Repeater, regenerator, and optical amplifier
   (f) Wavelength division multiplexing
   (g) Switching in optical fibre network
   (h) Optical fibre network concept
   (i) Optical fibre network planning

A.24 Radar and Navigation

1. Course number: 366D4122
   Course name: Radar and Navigation
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Syafruddin Syarif
4. Text book, title, author, publisher and year:
   (a) Fourier Transforms in Radar and Signal Processing, David Brandwood, Publisher: Artech House, Inc., 2003.
   (b) Radar Systems Analysis and Design Using MATLAB, Bassem R. Mahafza, Publisher: CRC Press, 2000.
   (c) Air and Spaceborne Radar Systems: An Introduction, Philippe Lacomme, Jean-Philippe Hardange, Jean-Claude Marchais, Eric Normant, Publisher: William Andrew Publishing, 2007.
   (d) Introduction to Radar System, 2nd Ed, Merrill I. Skolnik, Publisher: McGraw-Hill, 2008.
   (e) Radar: Priciples, Technologies, Applications, B. Edde, Publisher: Prentice Hall, 1995. ISBN 0137523467
5. Specific course information:
   (a) This course discuss concepts and theories related to the detection and location of objects with radio waves and satellite-based positioning systems. The course structure is divided into three main parts, namely radar, conventional navigation, and satellite-based navigation
   (b) Pre-requisites: Electromagnetic Wave, Antenna and Propagation + Laboratory
   (c) Course type: Elective Courses
6. Specific goals for the course:
   (a) The student will able to understand and explain concept, history, and architecture of radar, navigation radar, radar infrastructure hardware
7. Brief list of topics to be covered:
   (a) Basic principle of radar
   (b) Radar performance
   (c) External factors that affect radar
   (d) Factors that cause incorrect reading

(e) Standardization
(f) Pulse-radar, continuous-wave-radar, pulse-Doppler-radar
(g) Radar signal processing, radar signal theory
(h) Synthetic Aperture Radar (SAR) and remote sensing applications
(i) Direction finding methods
(j) Omnidirectional radio (VOR, DVOR)
(k) Instrument landing system (ILS, MLS)
(l) LORAN, DECCA, OMEGA
(m) Satellite navigation (GS, GLONASS)

A.25 Satellite Communication Systems

1. Course number: 314D4112
   Course name: Satellite Communication Systems
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Zulfajri Basri Hasanuddin
   (b) Dewiani Djamaluddin
4. Text book, title, author, publisher and year:
   (a) Satellite Communications, Prat, Timothy & Bostian Charles W, Publisher: John Wiley & Sons, 1986.
   (b) Satellite Communication Systems Engineering, Pritchard Wilbur L & Co, Publisher: Prentice Hall, 1993.
   (c) Digital Satellite Communications, Tri T. Ha, Publisher: McGraw-Hill, 1990.
5. Specific course information:
   (a) This course discusses about satellite communication system, satellite orbit, satellite modulation, satellite multiplexing, analog and digital transmission, multiple access
   (b) Pre-requisites: Basic Telecommunication (Systems), Probability and Statistics
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) The student will able to understand satellite communication system
   (b) The student will able to understand basic law and orbit mechanics, and types of orbits
   (c) The student will able to understand orbit geometry, geostationary, non-geostationary, and eclipse geometry
   (d) The student will able to understand types of satellite modulations and multiplexing
   (e) The student will able to understand satellite analog ad digital transmission system, and multiple access
7. Brief list of topics to be covered:
   (a) Preliminary
   (b) Orbit
   (c) LEO & MEO

(d) Satellite earth geometry

(e) Modulation

(f) Multiplexing

(g) Analog transmission system

(h) Digital transmission system

(i) Multiple access

A.26 Telecommunications System Performance

1. Course number: 365D4122
   Course name: Telecommunications System Performance
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Syafruddin Syarif
4. Text book, title, author, publisher and year:
   (a) Information Transmission Modulatio and Noise, M. Schwart, Publisher: McGraw Hill, 1990.
   (b) Modern Digital and Analog Communication Systems, BP Lathi, Publisher: Oxford University Press, 2009.
   (c) Analog and Digital Communication, Hwei Hsu, Publisher: McGraw-Hill-Schaum's Outline Series, 2003.
5. Specific course information:
   (a) This course discuss demodulation with the influence of noise and interference, correlation, autocorrelation, PSD, ESD, and performance of digital modulation
   (b) Pre-requisites: Basic Telecommunication (Systems), Probability and Statistics
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) The student will able to know and understand types of wave forms
   (b) The student will able to know and understand types of noises
   (c) The student will able to understand demodulation process with influence of noise and interference
   (d) The student will able to understand about correlation, autocorrelation, PSD, and ESD
   (e) The student will able to know and understand how to calculate digital modulation performance
7. Brief list of topics to be covered:
   (a) Signal
   (b) Noise
   (c) Demodulation process with influence of noise and interference
   (d) Correlation, autocorrelation, PSD, and ESD

(e) Probability theory and optimal detection
(f) Digital modulation
(g) Digital modulation performance

A.27 Telecommunication Transmission Line

1. Course number: 312D4112
   Course name: 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-requisites: Basic of Telecommunication, Electromagnetic Field

   (c) Course type: Elective Course

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.28 Multimedia Signal Processing + Laboratory

1. Course number: 361D4123
   Course name: Multimedia Signal Processing + Laboratory
2. Credits: 3
   Contact hours: 42 hours
3. Instructors:
   (a) Indrabayu
   (b) Intan Sari Areni
4. Text book, title, author, publisher and year:
   (a) Digital Signal Processing-A Hands on Approach, Charles Schuler, Mahesh Chugani, Publisher: Mc Graw Hill, 2005.
   (b) Multimedia Signal Processing: Theory and Applications in Speech, Music and Communications, Saeed V. Vashegi, Publisher: John Wiley, 2007.
5. Specific course information:
   (a) This courses discusses about signal acquisition, sampling and interpolation for signals in 1, 2 and 3 dimensions. Digital representation of multimedia signals. Fourier transforms, power spectra and convolution in multiple dimensions
   (b) Pre-requisites: Advanced Mathematics, Basic Telecommunication (Systems), Probability and Statistics , Computer Programming
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) The student will able to understand the basic of digital and multimedia signal and its application in various fields
   (b) The student will able to analyse analog filter design process
   (c) The student will able to analyse digital filter design process
   (d) The student will able to understand and design adaptive filter
   (e) The student will able to understand speech processing
7. Brief list of topics to be covered:
   (a) Basic of digital and multimedia signal processing as well as signal processing application in various fields
   (b) Analog filter
   (c) Digital filter
   (d) Adaptive filter
   (e) Speech processing

A.29 Engineering Economics

1. Course number: 301D4112
   Course name: 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-requisites: 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.30 Electrical Engineering Materials

1. Course number: 205D4112
   Course name: 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.31 Digital Communication

1. Course number: 324D4112
   Course name: Digital Communication

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) Communication Systems : An Introduction to Signals and Noise in Electrical Communication, A.B. Carlson , Publisher: Mc-Graw Hill Book Company, 1986.

   (b) Cellular Mobile System Engineering, Saleh Faruque, Publisher: Artech House, 1996.

   (c) Digital Communications, J.G. Proakis, Publisher: McGraw Hill International Edition, 1995.

   (d) Wireless Communications: Principles and Practices, Theodore S. Rappaport, Publisher: Prentice Hall, 2002.

5. Specific course information:

   (a) This course is designed to introduce to the student the fundamentals of the theory of digital communications and coding. The course will provide in-depth knowledge of communication fundamentals, which include Digital transmission of information across discrete and analog channels. Sampling; quantization; noiseless source codes for data compression: Huffman's algorithm and entropy; block and convolutional channel codes for error correction; channel capacity; digital modulation methods: PSK, MSK, FSK, QAM; matched filter receivers. Signal Design for bandlimited channels. Performance analysis: power, bandwidth, data rate and error probability.

   (b) Pre-requisites: Advanced Mathematics 1 , Advanced Mathematics 2 , Basic Telecommunication

   (c) Course type: Required (R)

6. Specific goals for the course:

   (a) Student will be able to explain the basic concept of digital communication

   (b) Student will able to explain information source coding

   (c) Student will able to explain signal characteristics and digital communication system

(d) Student will able to explain various of digital modulations and its application in telecommunication area

7. Brief list of topics to be covered:

   (a) Basic theory of digital communication
   (b) Source information coding
   (c) Signal characteristic and communication system
   (d) Various of digital modulation and application

A.32 Basic Multimedia

1. Course number: 213D4122
   Course name: 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-requisites: 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 Advanced Mathematics 2

1. Course number: 210D4123
   Course name: 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 edition, Kreyszig Erwin, Publisher: John Wiley & Sons, Inc, 2011.
   (b) Advanced Modern Engineering Mathematics, 1st edition, 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-requisites: 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.34 Pancasila

1. Course number: 012U0032
   Course name: 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.35 Social Science of Maritime Culture

1. Course number: 007U0032
   Course name: 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.36 Religion

1. Course number: 001U0032
   Course name: Religion
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Nur Asiah
   (b) Khaeriyah
4. Text book, title, author, publisher and year:
   (a) Al-Qur'an dan Terjemahnya, Publisher: Departemen Agama RI, 1990.
   (b) Islam untuk Disiplin Ilmu Filsafat, Publisher: Departemen Agama RI, 1997.
   (c) Islam untuk Disiplin Ilmu Bahasa, Publisher: Departemen Agama RI, 1997.
   (d) Islam untuk Disiplin Ilmu Hukum, Sosial dan Politik, Publisher: Departemen Agama RI, 1997.
   (e) Islam untuk Disiplin Ilmu Kedokteran dan Kesehatan I, Publisher: Departemen Agama RI, 1999.
   (f) Islam untuk Disiplin Ilmu Pengetahuan Alam dan Teknologi, Publisher: Departemen Agama RI, 1995.
   (g) Islam untuk Disiplin Ilmu Pendidikan, Publisher: Departemen Agama RI, 2000.
   (h) Islam untuk Disiplin Ilmu Ekonomi, Publisher: Departemen Agama RI, 2000.
   (i) Post Modernisme dalam Islam, Ahmeed, A. Akbar S, Publisher: Mizan, 1995.
   (j) Hak Asasi Manusia dalam Islam, Al-Maududi, Abu Ala, Publisher: Pustaka Firdaus, 1987.
   (k) Al-Ahkam Assulthaniyyah, Imam Al-Mawardi, Publisher: Darul Falah, 2000.
   (l) Hukum Islam: Pengantar Ilmu Hukum dan Tata Hukum Islam Indonesia, Muh. Daud Ali, Publisher: PT Raja Grafindo, 1996.
   (m) Mukjizat Al-Qur'an dan As-Sunnah Tentang IPTEK, Ahmad As-Showy, Publisher: Gema Insani Press, 1995.
   (n) Negara Hukum: Suatu Studi tentang Prinsip-Prinsipnya Dilihat dari Segi Hukum Islam, Implementasinya pada Periode Negara Madinah dan Masa Kini, Tahir Azhary, Publisher: Gema Insani Press, 1995.
   (o) Perkembangan Modern dalam Islam, Azra, Azyumardi, Harun Nasution, Publisher: Yayasan Obor Indonesia, 1985.
   (p) Sistem Etika Islami (akhlak mulia), Rahmat Djatmika, Publisher: Pustaka Islam, 1985.
   (q) Masjid Pusat Ibadah dan Kebudayaan Islam, Sidi Gazalba, Publisher: Pustaka Antara, 1983.
5. Specific course information:
   (a) This course discusses about Islamic values to actualized in all aspects of everyday life
   (b) Pre-requisite: N/A
   (c) Course type: Required (R)
6. Specific goals for the course:

(a) Student will able to explain the basic framework of teaching comprehensively
(b) Student will able to explain the source of Islamic teachings in a hierarchical and systematically
(c) Student will able to behave as a Muslim, a member of the community and good citizen
(d) Student will able to understand the purpose and function of life in Islam
(e) Student will able to actualize Islamic values in everyday life
(f) Student will able to actualize Islamic values in the field of study for the development of their respective professions
(g) Student will able to responds all issues of life rationally and based on Islamic teachings
(h) Student will able to find solutions to various life problems based on Islamic values

7. Brief list of topics to be covered:

(a) Divinity concept in Islam
(b) Human concept in Islam
(c) Islam
(d) Law and human rights in Islam
(e) Ethics, moral, and akhlak
(f) Science and technology in Islam
(g) Islam and plurality
(h) Civil society and people's welfare
(i) Islamic culture
(j) Islamic political system and democracy
(k) Islam for scientific disciplines

A.37 Bahasa Indonesia

1. Course number: 009U0032
   Course name: Bahasa Indonesia
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.38 English

1. Course number: 010U0032
   Course name: 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.39 Concept of Science and Technology

1. Course number: 008U0032
   Course name: 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.40 Civic Education

1. Course number: 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.41 Calculus 1

1. Course number: 016U0033
   Course name: 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, Varberg, Dale., Purcell, Edwin., Ridgon, Steve. 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.42 Calculus 2

1. Course number: 017U0033
   Course name: 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, Varberg, Dale., Purcell, Edwin., Ridgon, Steve. 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.43 Electric Circuit 1

1. Course number: 101D4113
   Course name: 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 edition, Robert L. Boylestad, Publisher: Prentice Hall, Pearson Education International, 2014.
   (b) Principles of Electrical Circuits Electron Flow Version, Thomas L. Floyd, 6th edition, Publisher: Prentice Hall, Pearson Education International, 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 I, Calculus II, Basic Physics I, Basic Physics II
   (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.44 Logic Circuits

1. Course number: 102D4112
   Course name: 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-requisites: 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.45 Electric Circuit 2

1. Course number: 121D4123
   Course name: 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 Edition, Publisher: Prentice Hall, Pearson Education International, 2014.
   (b) Principles of Electrical Circuits Electron Flow Version, Thomas L. Floyd, 6th Edition, Publisher: Prentice Hall, Pearson Education International, 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-requisites: Calculus I, Calculus II, Basic Physics I, Basic Physics II, Electric Circuit I
   (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.46 Advanced Mathematics 1

1. Course number: 201D4113
   Course name: 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 edition, Kreyszig Erwin, Publisher: John Wiley & Sons, Inc, 2011.
   (b) Matematika Teknik, 5th edition, 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 I, Calculus II
   (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.47 Basic Electrical Power

1. Course number: 202D4112
   Course name: 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: -
   (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.48 Basic Electronics

1. Course number: 233D4102
   Course name: 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 edition, Robert C. Boylestad, Publisher: Pearson Education, 2013.
   (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 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.49 Basic Electronics Laboratory

1. Course number: 209D4112
   Course name: 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 edition, Robert C. Boylestad, Publisher: Pearson Education, 2013.
   (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.
   (d) SPICE for Power Electronics and Electric Power, 2nd edition, 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.50 Basic Telecommunication

1. Course number: 203D4112
   Course name: 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: -
   (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.51 Electric Circuit Laboratory

1. Course number: 101D4121
   Course name: 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 edition, Publisher: Prentice Hall, Pearson Education International, 2014.
   (b) Principles of Electrical Circuits Electron Flow Version, Thomas L. Floyd, 6th edition, Publisher: Prentice Hall, Pearson Education International, 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.52 Advanced Physics

1. Course number: 206D4112
   Course name: 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.53 Basic Control Systems

1. Course number: 246D4102
   Course name: Basic Control Systems
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Nadjamuddin Harun (Course Coordinator)
   (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
   (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.54 Integrated Electronics

1. Course number: 214D4122
   Course name: Integrated Electronics
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Faizal Arya Samman(Course Coordinator)
   (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.55 Linear Systems

1. Course number: 241D4102
   Course name: 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, Oppenheim, Willsky with Young, 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, Basic Mathematics
   (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.56 Microprocessor Systems and Interfaces

1. Course number: 205D4121
   Course name: Microprocessor Systems and Interfaces
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Muhammad Anshar(Course Coordinator)
   (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 System
   (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.57 Access Network Technology

1. Course number: 322D4112
   Course name: 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.58 Probability and Statistics

1. Course number: 302D4112
   Course name: Probability and Statistics
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Andani Achmad(Course Coordinator)
   (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-requisites: 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.59 Energy Conversion

1. Course number: 343D4122
   Course name: Energy Conversion
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Syafaruddin(Course Coordinator)
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 Electric Power, C-minimum grade
   (c) Co-requisite: Electric Machines, C-minimum grade
   (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.60 Numerical Methods

1. Course number:342D4122
   Course name: 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.61 Analog and Digital Filter

1. Course number: 360D4122
   Course name: Analog and Digital Filter
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Intan Sari Areni
   (b) Merna Baharuddin
4. Text book, title, author, publisher and year:
   (a) Passive and Active Filters: Theory and Implementation, Wai Kai Chen, Publisher: Wiley and Sons, 1986.
   (b) Analog and Digital Filter Design, 2nd edition, Steve Winder, Publisher: Elsevier Science, 2002.
5. Specific course information:
   (a) This course discusses about examples of filter applications, explanation the importance of filter design, a description of the limitations of filter types (active, passive, and digital), terminology of basic filter, overview design process, description of the frequency response characteristics of filters, both ideal and practical, descriptions on how to design active or passive lowpass, high-pass, bandpass, and band stop filters to meet most desired specifications. Explanation the basic concept of digital filter, FIR and IIR filters. Description on how to design FIR and IIR filters
   (b) Prerequisites: Basic Telecommunication, Advanced Mathematics, Electric Circuit
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) The student will able to understand the examples of filter applications
   (b) The student will able to learn the importance of filter design
   (c) The student will able to describe the limitations of filter types (active, passive, and digital), terminology of basic filter, overview design process
   (d) The student will able to explain frequency response characteristics of filters, both ideal and practical
   (e) The student will able to design active or passive lowpass, high pass bandpass, and band stop filters to meet most desired specifications
   (f) The student will able to understand the basic concept of digital filter
   (g) The student will able to design FIR filter
   (h) The student will able to design IIR filter
   (i) The student will able to have an ability to apply knowledge of mathematics, science, and engineering
7. Brief list of topics to be covered:
   (a) Filter type and specification
   (b) Filter Transfer Function
   (c) Butterworth and Chebyschef Filters
   (d) Active and Passive Filter Design

(e) Basic concept of digital filter

(f) FIR filter

(g) IIR filter

A.62 Power Line Carrier for Communication Transmission

1. Course number: 318D4112
   Course name: Power Line Carrier for Communication Transmission
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Intan Sari Areni
   (b) Syafruddin Syarif
4. Text book, title, author, publisher and year:
   (a) J. Anatory & N. Theethayi, “Broadband Power-line Communication Systems: Theory and Applications”, WITPress, 2010.
   (b) H. Hrasnica, A. Haidine, R. Lehnert, “Broadband Power-line Communications: Network”, Wiley, 2004.
5. Specific course information:
   (a) This course discusses about the communication system through power lines (PLC), PLC standardization, characteristics of power line channels and PLC applications
   (b) Pre-requisites: Basic Telecommunication
   (c) Course type: Required (R)
6. Specific goals for the course:
   (a) The student will be able to understand about the communication system through power lines (PLC)
   (b) The student will be able to explain PLC standardization
   (c) The student will be able to understand the characteristics of power line channels
   (d) The student will be able to describe the applications of PLC system
7. Brief list of topics to be covered:
   (a) Introduction of power line communication system
   (b) PLC standardization
   (c) Characteristics of power line channel: attenuation and noise
   (d) PLC system architecture
   (e) Types of electric power transmission lines
   (f) PLC applications

A.63 Power Systems Analysis

1. Course number: 306D4112
   Course name: Power Systems Analysis
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Ardiaty Arief(Course Coordinator)
4. 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
   (c) Co-requisite: Engineering Mathematics, Basic of Electric Systems, Electric Circuits
   (d) Course type: Required (R)
5. 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
6. 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
      (a) Gauss Elimination
      (b) Jacobi and Gauss–Seidel
      (c) Newton–Raphson
   (e) Power flow analysis
      (a) Power flow solution by Gauss–Seidel
      (b) Power flow solution by Newton–Raphson
      (c) Fast Decoupled Power Flow
   (f) Symmetrical faults
   (g) Symmetrical components
   (h) Asymmetrical faults
      (a) Single line-to-ground fault
      (b) Line-to-line fault
      (c) Double line-to-ground fault
      (d) Sequence bus impedance matrices

A.64 Electric Power Operation

1. Course number: 350D4122
   Course name: Electric Power Operation

2. Credits: 2
   Contact hours: 27 hours

3. Instructors:

   (a) Muhammad Bachtiar Nappu(Course Coordinator)

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

   (a) Allen J. Wood and Bruce F. Wollenberg and Gerald B. Sheble "Power Generation Operation and Control", 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: Engineering mathematics, Basic of Electric Systems, Electric Circuits, Alternating Current transmission

   (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

      (a) Economic dispatch by neglecting network losses and generations constraints
      (b) Economic dispatch by considering generations constraints
      (c) 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.65 Digital Systems

1. Course number: 106D4122
   Course name: 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 edition, Stephen Brown and Zvonko Vranesic, Publisher: McGraw-Hill Higher Education, 2009.
   (c) Digital Design and Computer Architecture, 2nd edition, David Money Harris and 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.66 Digital Systems Laboratory

1. Course number: 109D4121
   Course name: 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 edition, Stephen Brown and Zvonko Vranesic, Publisher: McGraw-Hill Higher Education, 2009.
   (c) Digital Design and Computer Architecture, 2nd edition, 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, modeling and simulation
   (e) Flip-flop design, modeling 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, modeling and simulation
   (i) Second project in group: Digital Timer (Watch) design and testing

A.67 Integrated Electronics Laboratory

1. Course number: 218D4121
   Course name: Integrated Electronics Laboratory
2. Credits: 2
   Contact hours: 27 hours
3. Instructors:
   (a) Faizal Arya Samman (Course Coordinator)
   (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

APPENDIX B

FACULTY VITAE

Contents

B.1 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.2 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.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) Satyalancana Karya Satya Award of 20 Years
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) "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) "Client Server Based of Channel Cable Distribution Information System Case Study of PT. Telkom, Tbk (Persero) Witel NTT", Prosiding Seminar Nasional Teknik ketenagalistrikan dan Teknologi Informasi (SNTKTI), Agustus 2015.
   (c) "Arduino Uno Microcontroller Based of Housing Security System", Journal Techno Entrepreneur Acta, Vol. 1 No. 1 Maret 2016, ISSN:2503-1767.
   (d) "Design of Microstrip Antennas for 4G Network Repaters Operating on 1800 MHz Frequency", Prosiding Smeinar Nasional Teknik Elektro dan Informatika (SNTEI), 2016.
   (e) "Design and Implementation of Outdoor Hotspot Network Using M2 nanostation 2.4GHz Frequency with Voucher System on RT/RW-Net Microtic Network", Journal Techno Entrepreneur Acta, Vol. 2 No. 2, 2017, ISSN:2503-1767
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) "Client Server Based of Channel Cable Distribution Information System Case Study of PT. Telkom, Tbk (Persero) Witel NTT", Prosiding Seminar Nasional Teknik ketenagalistrikan dan Teknologi Informasi (SNTKTI), Agustus 2015.
   (b) "Arduino Uno Microcontroller Based of Housing Security System", Journal Techno Entrepreneur Acta, Vol. 1 No. 1 Maret 2016, ISSN:2503-1767.
   (c) "Design of Microstrip Antennas for 4G Network Repaters Operating on 1800 MHz Frequency", Prosiding Smeinar Nasional Teknik Elektro dan Informatika (SNTEI), 2016.
   (d) "Design and Implementation of Outdoor Hotspot Network Using M2 nanostation 2.4GHz Frequency with Voucher System on RT/RW-Net Microtic Network", Journal Techno Entrepreneur Acta, Vol. 2 No. 2, 2017, ISSN:2503-1767
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), Assistant Professor (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, Japan

B.6 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) Distribution and Electrical Installation Laboratory, Head, 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) Satyalancana Karya satya X Tahun,
   (c) Satyalancana Karya satya XX Tahun
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, Muh. 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 G, 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.7 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.8 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.9 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), Assistant Professor, 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, 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) The 10-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.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), Assistant Professor (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 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), Lecturer/Senior Lecturer (2002-2019), 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 Regencydemi

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.12 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
   (c) International Publication Capacity Enhancement Committee, Chairman, 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.13 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.14 Ikhlas Kitta

1. Name: Ikhlas Kitta
2. Education:
   (a) Bachelor degree, Electrical Engineering, Universitas Hasanuddin , 1999
   (b) Master degree, Electrical Engineering, Institut Teknologi Bandung, 2003
   (c) Doctor degree, Civil Engineering, Universitas Hasanuddin , 2016
3. Academic experience:
   (a) Assistant (2008-2013), Lecturer, 2013-now
4. Non-Academic experience:
   (a) PT Eleska IATKI, Bandung, Electrical Engineering Assessor (2011-now)
5. Certification or professional registration: Lecturer Certification (2012)
6. Membership in professional organization:
   (a) Member of Indonesian Power Engineers Association (IATKI), (2011-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.15 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.16 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 Night 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.17 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) IEEE Engineering in Medicine and Biology Society, Member (2016-now)
   (c) IAENG, Member (2011-now)
   (d) APTIKOM (Assosiasi Perguruan Tinggi Komputer), (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
   (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: N/A
10. Briefly list the most recent professional development activities: N/A

B.18 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) Assistant Professor, 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.19 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), Assistant Professor, 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.20 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.21 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.22 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) Assistant Lecturer (1999-2003), Lecturer (2005-2009), Assistant Professor (2010-2011), Lecturer (2012-2016), 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.23 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.24 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.25 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.26 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), Assistant Professor (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.27 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), Assistant Professor, (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 Mandjang, Ikhlas Kita, "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.28 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), Assistant Professor, 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.29 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.30 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.31 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.32 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

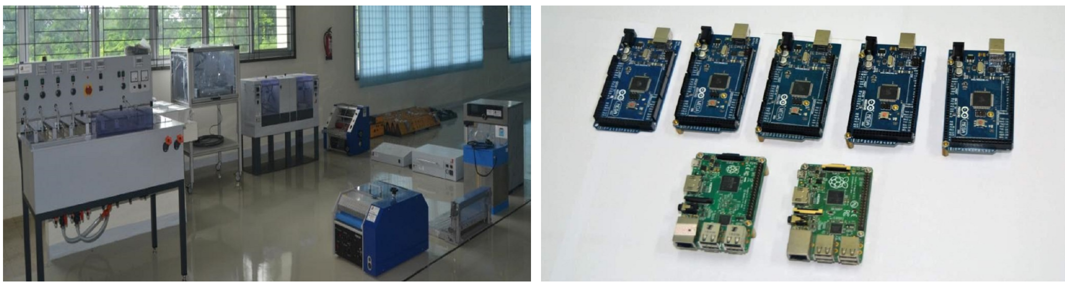
Contents

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.

Table C.1: 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.1.1 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 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.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)

TABLE C.3: EQUIPMENT IN CONTROL AND INSTRUMENTATION SYSTEM LABORATORY

E3-11	Control and Instrumentation System Laboratory		
Code	Item	Qty	Manufacturer
E3-11.01	Instrumentation System Module Experiment	12	
E3-11.02	PLC-05	1	
E3-11.03	LabView National Instruments	12	
E3-11.04	Room Temperature Regulatory Module	2	
E3-11.05	Microcontroller-based Universal Digital Controllers	4	
E3-11.06	ED-4400B Servo Motor Experimental Modules	2	
E3-11.07	Solid Material Process Control Mini-Plant	1	
E3-11.08	Boiler Drum	1	
	48 KVA 3-phase Silent Type AC Diesel Generator	1	
	40 Mhz 2-channel Digital Storage Oscilloscopes	2	

C.1.2 Electric Machines Laboratory

C.1.3 Control Systems and Instrumentation Laboratory

Our laboratory equipment, as seen in Figure 1, are of 2 (two) types: large- scale equipment and small-scale equipment, both are mostly models or miniatures of control plants, or experimental modules. There are equipment completely purchased and imported from overseas manufacturers, and also equipment designed, developed and built in the laboratory by former students for their undergraduate projects, master's thesis or doctoral dissertations.

Measurement equipment such as AVO-meters and digital storage oscilloscopes are also available. In addition to that, we also have supporting equipment such as a diesel generator for back up electric power supply, and multimedia equipment for presentation and lecturing.

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 and presentation are also available.

C.1.4 High Voltage Laboratory

C.1.5 Electrical Installation Laboratory

C.1.6 Power System Laboratory

khdff lhfjsdahf lhsdfjlhsdf h dkfhjas hsdh hf slhsdslfh fhsdf lsd f sfhsd fls jfksdhf ljf hl dalh l flads slhfs dsfsdfhl s lsdhl sladfhl sdfh sldflhsdf lh sddfh khdff lhfjsdahf lhsdfjlhsdf h dkfhjas hsdh hf slhsdslfh fhsdf lsd f sfhsd fls jfksdhf ljf hl dalh l flads slhfs dsfsdfhl s lsdhl sladfhl sdfh sldflhsdf lh sddfh khdff lhfjsdahf lhsdfjlhsdf h dkfhjas hsdh hf slhsdslfh fhsdf lsd f sfhsd fls jfksdhf ljf hl dalh l flads slhfs dsfsdfhl s lsdhl sladfhl sdfh sldflhsdf lh sddfh

khdff lhfjsdahf lhsdfjlhsdf h dkfhjas hsdh hf slhsdslfh fhsdf lsd f sfhsd fls jfksdhf ljf hl dalh l flads slhfs dsfsdfhl s lsdhl sladfhl sdfh sldflhsdf lh sddfh khdff lhfjsdahf lhsdfjlhsdf h dkfhjas hsdh hf slhsdslfh fhsdf lsd f sfhsd fls jfksdhf ljf hl dalh l flads slhfs dsfsdfhl s lsdhl sladfhl sdfh sldflhsdf lh sddfh khdff lhfjsdahf lhsdfjlhsdf h dkfhjas hsdh hf slhsdslfh fhsdf lsd f sfhsd fls jfksdhf ljf hl dalh l flads slhfs dsfsdfhl s lsdhl sladfhl sdfh sldflhsdf lh sddfh

khdff lhfjsdahf lhsdfjlhsdf h dkfhjas hsdh hf slhsdslfh fhsdf lsd f sfhsd fls jfksdhf ljf hl dalh l flads slhfs dsfsdfhl s lsdhl sladfhl sdfh sldflhsdf lh sddfh khdff lhfjsdahf lhsdfjlhsdf h dkfhjas hsdh hf slhsdslfh fhsdf lsd f sfhsd fls jfksdhf ljf hl dalh l flads slhfs dsfsdfhl s lsdhl sladfhl sdfh sldflhsdf lh sddfh khdff lhfjsdahf lhsdfjlhsdf h dkfhjas hsdh hf slhsdslfh fhsdf lsd f sfhsd fls jfksdhf ljf hl dalh l flads slhfs dsfsdfhl s lsdhl sladfhl sdfh sldflhsdf lh sddfh

khdff lhfjsdahf lhsdfjlhsdf h dkfhjas hsdh hf slhsdslfh fhsdf lsd f sfhsd fls jfksdhf ljf hl dalh l flads slhfs dsfsdfhl s lsdhl sladfhl sdfh sldflhsdf lh sddfh khdff lhfjsdahf lhsdfjlhsdf h dkfhjas hsdh hf slhsdslfh fhsdf lsd f sfhsd fls jfksdhf ljf hl dalh l flads slhfs dsfsdfhl s lsdhl sladfhl sdfh sldflhsdf lh sddfh khdff lhfjsdahf lhsdfjlhsdf h dkfhjas hsdh hf slhsdslfh fhsdf lsd f sfhsd fls jfksdhf ljf hl dalh l flads slhfs dsfsdfhl s lsdhl sladfhl sdfh sldflhsdf lh sddfh

C.1.7 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, wattmeter, 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.5).

C.1.8 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.8 presents

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)
	Control Desk	2	Terco (Sweden)
	Test Transformator 100 kV	3	Terco (Sweden)
	High Voltage Connection	2	Terco (Sweden)
	Cascade Connection Set	1	Terco (Sweden)
	Discharge Rod	1	Terco (Sweden)
	Connecting Rod	7	Terco (Sweden)
	Connecting Cup	21	Terco (Sweden)
	Floor Pedestal	8	Terco (Sweden)
	HV Rectifier	6	Terco (Sweden)
	Smoothing Capacitor/ Impulse Capacitor	5	Terco (Sweden)
	Measuring Resistor	3	Terco (Sweden)
	Load Resistor	1	Terco (Sweden)
	Earthing Switch	1	Terco (Sweden)
	Spacer Tube	9	Terco (Sweden)
	Load Capacitor	3	Terco (Sweden)
	Charging Resistor	3	Terco (Sweden)
	Wave Front Resistor	3	Terco (Sweden)
	Wave Tail Resistor	3	Terco (Sweden)
	Insulating Rod	12	Terco (Sweden)
	Sphere Gap	3	Terco (Sweden)
	Drive for Sphere Gap	1	Terco (Sweden)
	Top Electrode	17	Terco (Sweden)
	Electrode 200	1	Terco (Sweden)
	Electrode 300	1	Terco (Sweden)
	Measuring Capacitor/100	1	Terco (Sweden)
	Measuring Capacitor/200	1	Terco (Sweden)
	Measuring Capacitor/300	1	Terco (Sweden)
	Low Voltage Divider	3	Terco (Sweden)
	Triggering Device	1	Terco (Sweden)
	Electronic Trigger Sphere	2	Terco (Sweden)
	AC Peak Voltmeter	1	Terco (Sweden)
	DC Voltmeter	1	Terco (Sweden)
	Impulse Volt Meter	1	Terco (Sweden)
	Space Bar (for HV9133)	1	Terco (Sweden)
	Measuring Spark Gap	1	Terco (Sweden)
	Vessel for Vacuum/ and Pressure	1	Terco (Sweden)
	Vacuum Pump	1	Terco (Sweden)
	Compressor	1	Terco (Sweden)
	Corona Cage	1	Terco (Sweden)
	Oil Testing Cup	1	Terco (Sweden)
	Capacitor Coupling	1	Terco (Sweden)
	High Voltage safety Cage/safety Net	1	Terco (Sweden)
	Partial discharge meter (DTM) (to Computer & Oscilloscope)	1	Terco (Sweden)

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)

Table C.6: Equipment in Power System Laboratory

E3-6	Power System Laboratory		
Code	Item	Qty	Manufacturer
E3-06.01	Power System Simulator	1	Edibon(Spain)
E3-06.02	Thermal Imager	1	Ideal(USA)
E3-06.03	Power Quality Analyser	1	Fluke(USA)
E3-06.04	Flex Clamp	1	Fluke(USA)
E3-06.05	Megohmmeter	1	Fluke(USA)
E3-06.06	Insulating Tester	1	Metler (Slovenia)
E3-06.07	Scopemeter	1	GW INSTEK (Taiwan)

Table C.7: Basic Electric Laboratory

E3-13	Basic Electric Laboratory		
Code	Item	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)
	Wattmeter AEG 1KW	4	
DW-6060	Wattmeter	22	Lutron (United States)

Table C.8: Equipment in Relay and Measurement Laboratory

E3-5	Relay and Measurement Laboratory			
Code	Item	Qty	Manufacturer	Figure
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)	

Table C.9: Equipment in Power Electronics Laboratory

E3-1	Power Electronics Laboratory			
Code	Equipment	Qty	Manufacturer	Figure
E3-01.02	Power Electronics Trainer	1	DeLorenzo (Italia)	C.7(e)
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)	
	Analog Oscilloscope, 2 Channels	1		

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.

C.1.9 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 C.9 some laboratory equipment and their uses are shown.

In addition to the equipment contained in table C.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.

C.1.10 Computer Hardware, Networking and Software Engineering Laboratory

Computer Hardware, Networking and Software Engineering 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.

Table C.10: Computer Hardware, Networking and Software Engineering Laboratory

E3-10	Computer Hardware, Networking and Software Engineering Laboratory			
Code	Item	Qty	Manufacturer	Figure
E3-10.01	80C51 Microcontroller Trainer	1	DeLorenzo (Italia)	
E3-10.03	PIC Development & Training System	1	DeLorenzo (Italia)	
	Computer	30		
	LAN Tester	10		
	Crimping tools	10		
	Oscilloscope	2		

Table C.11: Equipment in Telematics Laboratory

E3-8	Telematics Laboratory			
Code	Item	Qty	Manufacturer	Figure
E3-08.04	Bit Error Rate Testers	1	Fetest(Japan)	
E3-08.09	Communication Technology for Fibre Optics Training	1	Lucas Nuelle (Germany)	
	Raspberry Pi	4		
	Nano Station Antenna	2		

C.1.11 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.11 shows the Telematics Laboratory equipment.

C.1.12 Antenna and Propagation Laboratory

C.1.13 Telecommunication, Radio, and Microwave Laboratory

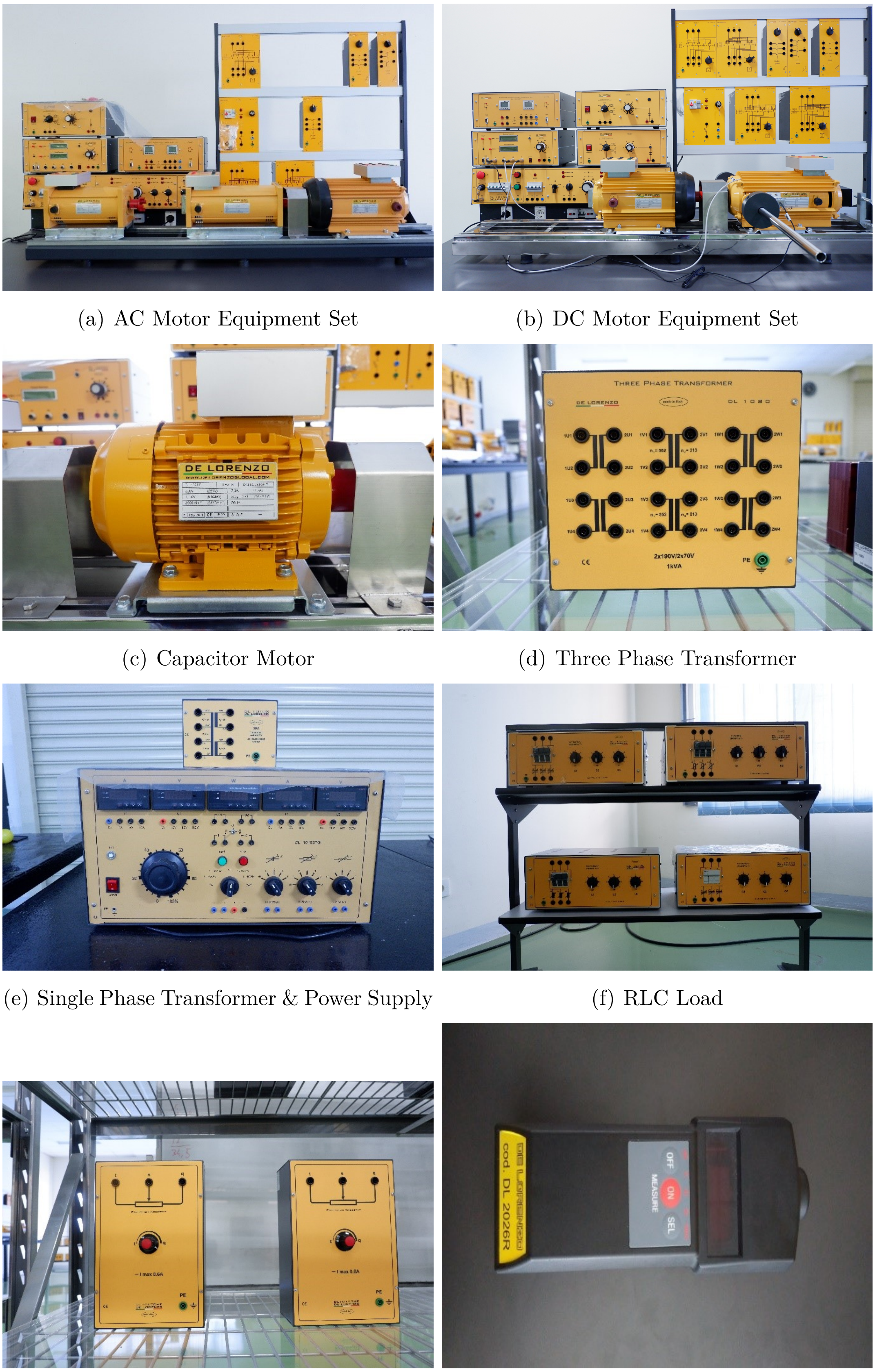
C.2 Other Supporting Equipment

Table C.12: Equipment in Antenna and Propagation Laboratory

E3-9	Antenna and Propagation Laboratory			
Code	Item	Qty	Manufacturer	Figure
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)	

Table C.13: Equipment in Telecommunication Radio and Microwave Laboratory

E3-7	Telecommunication Radio and Microwave Laboratory			
Code	Item	Qty	Manufacturer	Figure
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)	



(a) AC Motor Equipment Set

(b) DC Motor Equipment Set

(c) Capacitor Motor

(d) Three Phase Transformer

(e) Single Phase Transformer & Power Supply

(f) RLC Load

(g) Starting Rheostat

(h) Tachometer

FIGURE C.2: EQUIPMENT IN ELECTRIC MACHINES LABORATORY

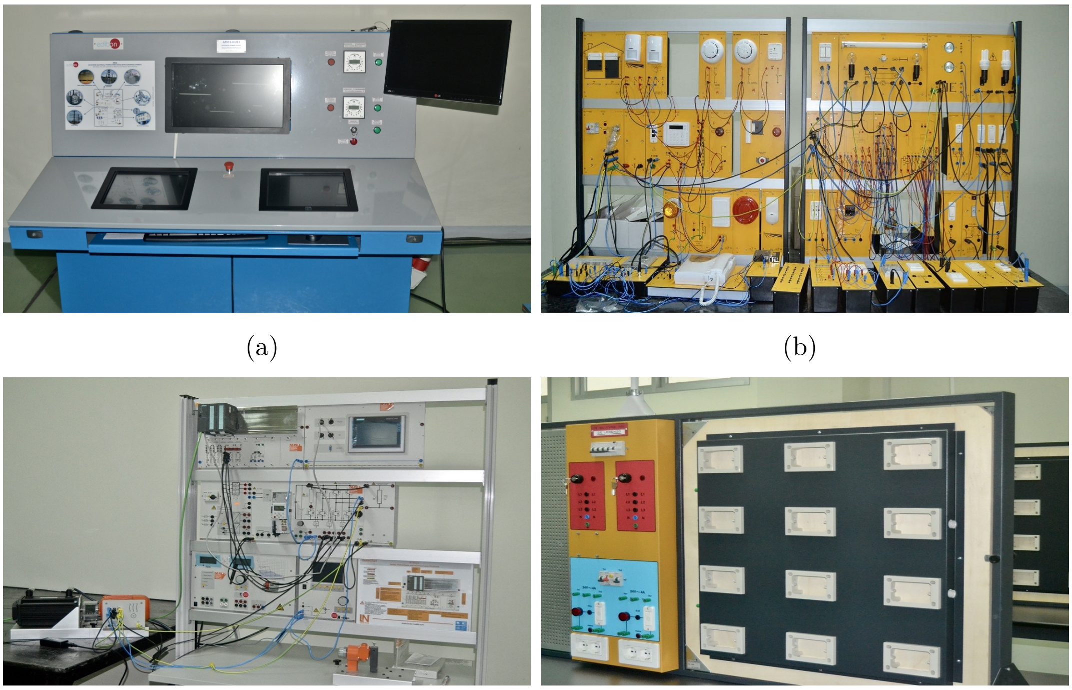
(a) ED-4400B Servo Motor Experimental Modules

(b) Broiler Drum

(c) Microcontroller-based Universal Digital Controllers

(d)

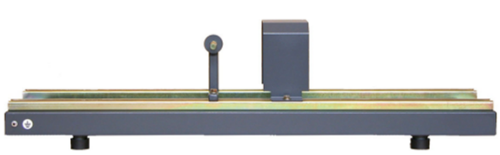
Figure C.3: Equipment in Control and Instrumentation System Laboratory



(a) (b) (c) (d)

Figure C.4: Equipment in Power System Laboratory

Figure C.5: Equipment Set in Basic Electric Laboratory



(a) Universal Base

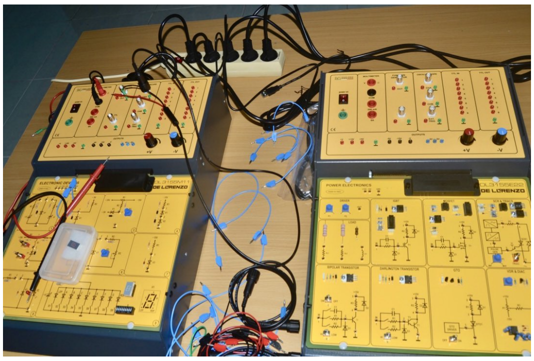
(b) DC Power Supply

(c) Capacitive Load

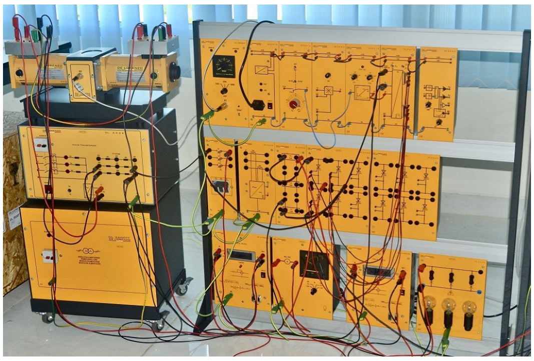
(d) Inductive Load

(e) Differential Relay Trainer

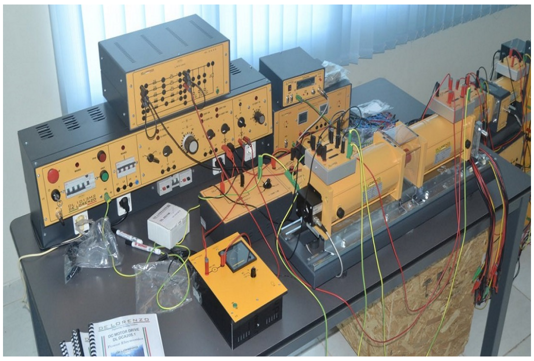
Figure C.6: Equipment in Relay and Measurement Laboratory



(a)



(b)

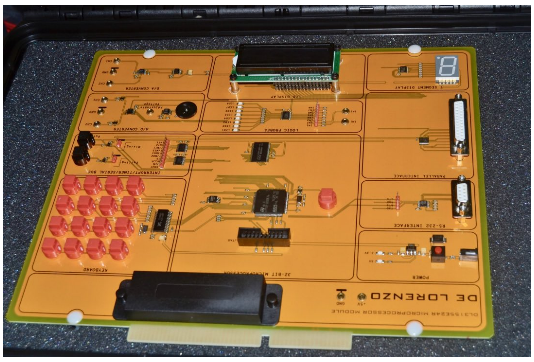


(c)

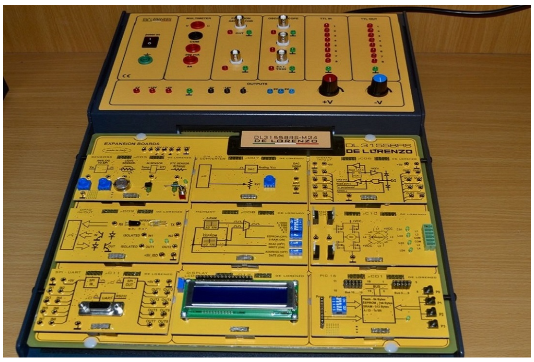
(d)

(e) Power Electronics Trainer

Figure C.7: Equipment in Power Electronics Laboratory

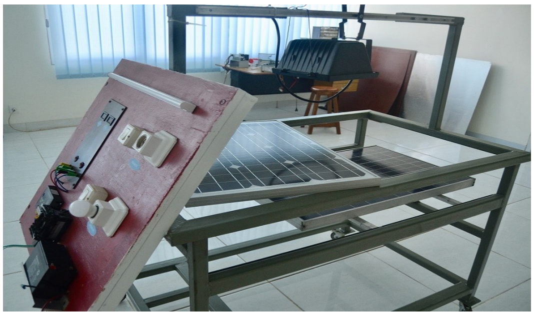


(a)



(b)

Figure C.8: Equipment in Computer Hardware & Networking and Software Engineering Laboratory



(a)

(b)

(c)

(d)

Figure C.9: Equipment in Antenna and Propagation Laboratory

(a)

(b)

Figure C.10: Equipment in Telecommunication, Radio, and Microwave Laboratory

APPENDIX D

INSTITUTIONAL SUMMARY

D.1 The Institution

(a) Universitas Hasanuddin
Jl. Perintis Kemerdekaan Km. 10 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.

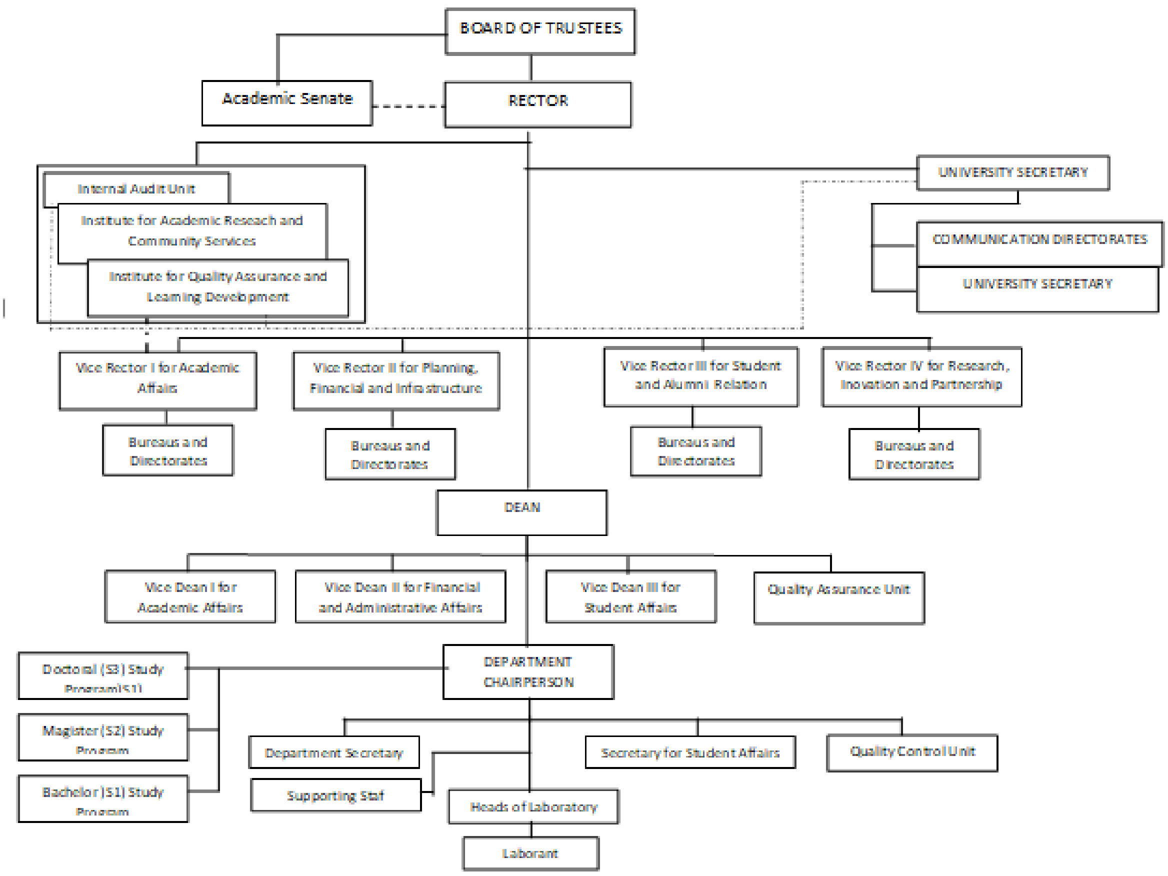


Figure D.1: Organization Chart of Universitas Hasanuddin

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.M.Si	Citizenship Education
5	Abdur Rahman arif S.Si.,M.Si	Advanced Chemistry
6	Dr. Syahruddin Kasim, SSi, MSi	Advanced Chemistry
7	Dr.Paulus Lobo G M.Sc	Basic Physics
8	Prof.Dr.Syamsir Dewang MS	Basic Physics
9	Dr Munira Hasyim S.S.M.Hun	Bahasa Indonesia
10	Dr.Asriani Abbas m.Hum	Bahasa Indonesia
11	Dr.Firman, S.Si.,M.Si	Basic Mathematics
12	Andi Galsan Mahie, S.Si.,M.Si	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	Junaid	Head of Administrative Staff
2	Salmiati	Administrative Staff
3	Aris	Administrative Staff
4	Budi	Laborant
5	Mustakim, ST	Laborant
6	Amsal Salim, ST	Laborant
7	Nompo	Laborant
8	Rimba	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 students' 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

APPENDIX E

INDIRECT ASSESSMENT SHEETS

The following tables present the indirect assessment sheets that show the performance indicator measurements of the survey questionnaires.

There are three questionnaire surveys that have been made, i.e.:

1. Student/Senior Exit Survey
2. Alumni Survey
3. Employer Survey

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
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
Q	AS	**Alumni Survey Questionare**																						
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 knowledg*	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			

Table E.1: The Indirect Assessment Sheets.

NO	KODE	COURSE	STUDENT OUTCOMES																
			SO-1				SO-2			SO-3			SO-4			SO-5			S
			1K	1C	1A	1D	2A	2D	2I	3A	3D	3I	4K	4C	4I	5C	5D	5I	6A
1	INDIRECT ASSESS-MENT	***Student Exit Survey***	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
3		***Employer Survey***	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Q	SES	**Student Exit Survey Questionare**																	
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	

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
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 Questionare**																						
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		

APPENDIX F

DIRECT ASSESSMENT SHEETS

The following tables present the direct assessment sheets that show the performance indicator measurements of each selected course.

The assessments are made in every semester for 4 years, the selected semesters of academic year are as follows:

1. Academic Year 2015/2015, Semester 1
2. Academic Year 2015/2015, Semester 2
3. Academic Year 2016/2017, Semester 1
4. Academic Year 2016/2017, Semester 2
5. Academic Year 2017/2018, Semester 1
6. Academic Year 2017/2018, Semester 2
7. Academic Year 2018/2019, Semester 1
8. Academic Year 2018/2019, Semester 2

Table F.1: The Direct Assessment Sheets 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	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
1	011U0032	*Civic Education*														3,32								
2	009U0032	*Bahasa Indonesia*										3,55												
3	016U0033	*Calculus 1*			1,96																			
4	020U0033	*Physics 1*			3,26																			
5	101D4113	*Electrical Circuits 1*			x																			
6	102D4112	*Logic Circuits*				x																		
7	103D4112	*Engineering Drawing*				3,74																		
8	104D4112	*Advanced Chemistry*	3,41																					
9	012U0032	*State Ideology: Pancasila*														x								
10	010U0032	*English*								x														
11	017U0033	*Calculus 2*			x																		x	
12	022U0033	*Physics 2*			x																		x	
13	105D4123	*Electric Circuits 2*			2,50																			
14	106D4122	*Digital Systems*				x			x															
15	107D4122	*Computer Programming*																						
16	108D4121	*Electric Circuits Laboratory*																		3,30				
17	109D4121	*Digital Systems Laboratory*						x												x				
18	008U0032	*Concept of Science and Technology*													3,82									
19	201D4113	*Advanced Mathematics 1*			2,42																		2,42	
20	202D4112	*Basic Electric Power (Systems)*		x																				
21	203D4112	*Basic Telecommunication (Systems)*		x																				

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
22	204D4112	*Basic Electronics*			x																			
23	205D4112	*Electric Material Physics*	x																					
24	206D4112	*Advanced Physics*			3,68																		3,68	
25	207D4111	*Basic Electric Power Laboratory*																	x					
26	208D4111	*Basic Telecommunication Laboratory*																	0,13					
27	209D4111	*Basic Electronics Laboratory*																	x					
28	007U0032	*Social Science of Maritime Culture*												x										
29	210D4123	*Advanced Mathematics 2*			x																		x	
30	211D4122	*Linear Systems*			x																		x	
31	212D4122	*Electric Machines*		x			x																	
32	213D4122	*Basic Multimedia*		x			x																	
33	214D4122	*Integrated Electronics*				x			x															
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															x			
37	218D4121	*Integrated Electronics Laboratory*																x		x				
38	219D4121	*Microprocessor Systems and Interfaces Laboratory*				2,31															x			
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																	
42	304D4112	*Electromagnetics*		x																		x		
43	342D4122	*Numerical Methods*						x														x		
44	343D4122	*Energy Conversion*		x																		x		
45	344D4122	*Environmental Science*	x											x										

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
46	345D4122	*Management and Entrepreneurship*													1,14		1,14							
47	402D4112	*Research Methods and Scientific Writing*											2,87									2,87		
48	305D4112	*Alternating Current Transmission Systems*			x																			
49	306D4112	*Electric Power System Analysis*			1,93																			
50	307D4112	*Electric Machines Analysis 1 + Laboratory*			x														1,93					
51	308D4112	*Electric Power Protection System 1*			x																			
52	309D4112	*Electric Power Generation Systems*			x																			
53	310D4112	*Power System Control and Stability*			3,08																			
54	348D4122	*Electric Power Distribution Systems + Laboratory*			x														x					
55	349D4122	*Electric Power Protection System 2 + Laboratory*			x														x					
56	350D4122	*Electric Machines Analysis 2 + Laboratory*			x														x					
57	351D4122	*Power Systems Operations*			x																			
58	352D4122	*High Voltage Engineering + Laboratory*			3,01														3,01					
59	311D4113	*Antenna and Propagation + Laboratory*				x			x											x				
60	312D4112	*Telecommunication Transmission Systems*			x																			
61	353D4122	*Cellular Communication*				x		x																
62	354D4122	*Wireless Technology*		x			x																	
63	322D4113	*Access Network Technology*		x																				
64	321D4112	*Data Communications*		x			x																	
65	329D4113	*Control Systems + Laboratory*			x														x					
66	330D4112	*Process Control Technology*			2,23														2,23			2,23		
67	373D4122	*Optimal Control Systems*			x														x					
68	372D4123	*Digital Control Systems + Laboratory*																		x				x
69	375D4122	*Control Systems Design*				1,28															1,28			

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
70	331D4112	*Industrial Robotics*				x														x				
71	333D4113	*Electronic Instrumentation Systems + Laboratory*				x														x				
72	319D4113	*Microprocessor-based Systems + Laboratory*				x														x				
73	335D4113	*Digital System Design + Laboratory*				x															x			
74	380D4123	*Embedded Systems Design + Laboratory*				x															x			x
75	336D4113	*Computer Architecture 1 + Laboratory*				x														x				
76	379D4123	*Power Electronics + Laboratory*				x															x			x
77	334D4112	*Computer Network-based SCADA*				x														x			x	
78	337D4112	*Industrial Automation + Laboratory (PLC)*				x														x		x		

Number of Courses where Assessment Data (per PI) are collected:	1	0	11	5	3	2	1	0	0	1	1	0	3	1	1	0	4	1	1	2	2	0
Total Assessment Value for each PI:	3,41	0,00	28,92	12,42	7,56	5,81	1,42	0,00	0,00	3,55	2,87	0,00	7,39	3,32	1,14	0,00	7,30	3,30	1,28	5,10	6,10	0,00
Average Measured Assessment Value for each PI:	3,41	2,50	2,63	2,48	2,52	2,91	1,42	2,50	2,50	3,55	2,87	2,50	2,46	3,32	1,14	2,50	1,83	3,30	1,28	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	0,37	0,52	0,48	0,09	1,58	0,50	0,50	-0,55	0,13	0,50	0,54	-0,32	1,86	0,50	1,18	-0,30	1,72	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	117,00	0,00	161,00	66,00	28,00	0,00	173,00	116,00	18,00	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:	2,62				2,09			3,03			2,56			2,26			2,00			2,68		
Student Outcomes Code:	SO-1				SO-2			SO-3			SO-4			SO-5			SO-6			SO-7		

Table F.2: The Direct Assessment Sheets 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
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
1	011U0032	*Civic Education*														x								
2	009U0032	*Bahasa Indonesia*										x												
3	016U0033	*Calculus 1*			x																			
4	020U0033	*Physics 1*			x																			
5	101D4113	*Electrical Circuits 1*			2,51																			
6	102D4112	*Logic Circuits*				2,35																		
7	103D4112	*Engineering Drawing*				x																		
8	104D4112	*Advanced Chemistry*	x																					
9	012U0032	*State Ideology: Pancasila*														x								
10	010U0032	*English*								x														
11	017U0033	*Calculus 2*			2,43																		2,43	
12	022U0033	*Physics 2*			x																		x	
13	105D4123	*Electric Circuits 2*			x																			
14	106D4122	*Digital Systems*				x			x															
15	107D4122	*Computer Programming*						1,00																
16	108D4121	*Electric Circuits Laboratory*																		x				
17	109D4121	*Digital Systems Laboratory*						x												x				
18	008U0032	*Concept of Science and Technology*													x									
19	201D4113	*Advanced Mathematics 1*			x																		x	
20	202D4112	*Basic Electric Power (Systems)*		x																				
21	203D4112	*Basic Telecommunication (Systems)*		x																				

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
22	204D4112	*Basic Electronics*			x																			
23	205D4112	*Electric Material Physics*	x																					
24	206D4112	*Advanced Physics*			x																		x	
25	207D4111	*Basic Electric Power Laboratory*																	3,32					
26	208D4111	*Basic Telecommunication Laboratory*																	x					
27	209D4111	*Basic Electronics Laboratory*																	x					
28	007U0032	*Social Science of Maritime Culture*												x										
29	210D4123	*Advanced Mathematics 2*			2,30																		2,30	
30	211D4122	*Linear Systems*			1,83																		1,83	
31	212D4122	*Electric Machines*		x			x																	
32	213D4122	*Basic Multimedia*		x			x																	
33	214D4122	*Integrated Electronics*				x			x															
34	215D4122	*Microprocessor Systems and Interfaces*			x				x															
35	216D4122	*Basic Control Systems*			x			x																
36	217D4122	*Electric Installation + Laboratory*				x															x			
37	218D4121	*Integrated Electronics Laboratory*																x		x				
38	219D4121	*Microprocessor Systems and Interfaces Laboratory*				x															x			
39	301D4112	*Engineering Economics*					x								x									
40	302D4112	*Probability and Statistics*					x	x																
41	303D4112	*Electric Measurement*				x	x																	
42	304D4112	*Electromagnetics*		x																		x		
43	342D4122	*Numerical Methods*						2,97														2,97		
44	343D4122	*Energy Conversion*		2,86																		x		
45	344D4122	*Environmental Science*	3,07											3,07										

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
46	345D4122	*Management and Entrepreneurship*													x		x							
47	402D4112	*Research Methods and Scientific Writing*											x									x		
48	305D4112	*Alternating Current Transmission Systems*			2,26																			
49	306D4112	*Electric Power System Analysis*			x																			
50	307D4112	*Electric Machines Analysis 1 + Laboratory*			x														x					
51	308D4112	*Electric Power Protection System 1*			x																			
52	309D4112	*Electric Power Generation Systems*			x																			
53	310D4112	*Power System Control and Stability*			x																			
54	348D4122	*Electric Power Distribution Systems + Laboratory*			x														x					
55	349D4122	*Electric Power Protection System 2 + Laboratory*			x														x					
56	350D4122	*Electric Machines Analysis 2 + Laboratory*			x														x					
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				
60	312D4112	*Telecommunication Transmission Systems*			x																			
61	353D4122	*Cellular Communication*				2,66		2,66																
62	354D4122	*Wireless Technology*		x			x																	
63	322D4113	*Access Network Technology*		3,32																				
64	321D4112	*Data Communications*		x			x																	
65	329D4113	*Control Systems + Laboratory*			x														x					
66	330D4112	*Process Control Technology*			x														x			x		
67	373D4122	*Optimal Control Systems*			x														x					
68	372D4123	*Digital Control Systems + Laboratory*																		2,61				2,61
69	375D4122	*Control Systems Design*				x															x			

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
70	331D4112	*Industrial Robotics*				x														1,41				
71	333D4113	*Electronic Instrumentation Systems + Laboratory*				x														3,35				
72	319D4113	*Microprocessor-based Systems + Laboratory*				x														x				
73	335D4113	*Digital System Design + Laboratory*				x															x			
74	380D4123	*Embedded Systems Design + Laboratory*				x															x			x
75	336D4113	*Computer Architecture 1 + Laboratory*				2,06														2,06				
76	379D4123	*Power Electronics + Laboratory*				x															x			x
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**	**6**	**0**	**3**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**2**	**7**	**0**	**2**	**4**	**1**
Total Assessment Value for each PI:	**3,07**	**6,18**	**17,31**	**15,07**	**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**	**5,97**	**10,56**	**2,61**
Average Measured Assessment Value for each PI:	**3,07**	**3,09**	**2,47**	**2,51**	**2,50**	**2,21**	**1,00**	**2,50**	**2,50**	**3,55**	**2,87**	**3,07**	**2,46**	**3,32**	**1,14**	**2,50**	**2,87**	**2,49**	**1,28**	**2,99**	**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**	**0,49**	**0,50**	**0,79**	**2,00**	**0,50**	**0,50**	**-0,55**	**0,13**	**-0,07**	**0,54**	**-0,32**	**1,86**	**0,50**	**0,14**	**0,51**	**1,72**	**0,01**	**0,36**	**0,39**
Number of Students Assessed:	**17,00**	**119,00**	**547,00**	**197,00**	**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**	**63,00**	**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:	**2,67**				**1,66**			**3,03**			**2,73**			**2,26**			**1,96**			**2,69**		
Student Outcomes Code:	**SO-1**				**SO-2**			**SO-3**			**SO-4**			**SO-5**			**SO-6**			**SO-7**		

Table F.3: The Direct Assessment Sheets 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	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
1	011U0032	*Civic Education*														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																					
9	012U0032	*State Ideology: Pancasila*														x								
10	010U0032	*English*								x														
11	017U0033	*Calculus 2*			x																		x	
12	022U0033	*Physics 2*			x																		x	
13	105D4123	*Electric Circuits 2*			x																			
14	106D4122	*Digital Systems*				x			x															
15	107D4122	*Computer Programming*						x																
16	108D4121	*Electric Circuits Laboratory*																		x				
17	109D4121	*Digital Systems Laboratory*						x												x				
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																				

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
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					
28	007U0032	*Social Science of Maritime Culture*												x										
29	210D4123	*Advanced Mathematics 2*			x																		x	
30	211D4122	*Linear Systems*			x																		x	
31	212D4122	*Electric Machines*		3,06			3,06																	
32	213D4122	*Basic Multimedia*		3,68			3,68																	
33	214D4122	*Integrated Electronics*				x			x															
34	215D4122	*Microprocessor Systems and Interfaces*			x				x															
35	216D4122	*Basic Control Systems*			x			x																
36	217D4122	*Electric Installation + Laboratory*				x															x			
37	218D4121	*Integrated Electronics Laboratory*																x		x				
38	219D4121	*Microprocessor Systems and Interfaces Laboratory*				x															x			
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		
44	343D4122	*Energy Conversion*		x																		x		
45	344D4122	*Environmental Science*	2,00											2,00										

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
46	345D4122	*Management and Entrepreneurship*													x		x							
47	402D4112	*Research Methods and Scientific Writing*											3,49									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																			
54	348D4122	*Electric Power Distribution Systems + Laboratory*			x														x					
55	349D4122	*Electric Power Protection System 2 + Laboratory*			x														x					
56	350D4122	*Electric Machines Analysis 2 + Laboratory*			x														x					
57	351D4122	*Power Systems Operations*			x																			
58	352D4122	*High Voltage Engineering + Laboratory*			x														x					
59	311D4113	*Antenna and Propagation + Laboratory*				1,30			1,30											1,30				
60	312D4112	*Telecommunication Transmission Systems*			x																			
61	353D4122	*Cellular Communication*				x		x																
62	354D4122	*Wireless Technology*		x			x																	
63	322D4113	*Access Network Technology*		x																				
64	321D4112	*Data Communications*		x			x																	
65	329D4113	*Control Systems + Laboratory*			x														x					
66	330D4112	*Process Control Technology*			x														x			x		
67	373D4122	*Optimal Control Systems*			x														x					
68	372D4123	*Digital Control Systems + Laboratory*																		x				x
69	375D4122	*Control Systems Design*				4,00															4,00			

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
70	331D4112	*Industrial Robotics*				3,58														3,58				
71	333D4113	*Electronic Instrumentation Systems + Laboratory*				x														x				
72	319D4113	*Microprocessor-based Systems + Laboratory*				x														x				
73	335D4113	*Digital System Design + Laboratory*				1,50															1,50			
74	380D4123	*Embedded Systems Design + Laboratory*				3,37															3,37			3,37
75	336D4113	*Computer Architecture 1 + Laboratory*				x														x				
76	379D4123	*Power Electronics + Laboratory*				3,50															3,50			3,50
77	334D4112	*Computer Network-based SCADA*				x														x			x	
78	337D4112	*Industrial Automation + Laboratory (PLC)*				x														x		x		

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	3,49	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	3,49	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	-0,49	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	135,00	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			2,88			2,31			2,92			3,31		
Student Outcomes Code:	SO-1				SO-2			SO-3			SO-4			SO-5			SO-6			SO-7		

TABLE F.4: THE DIRECT ASSESSMENT SHEETS 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
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
1	011U0032	*Civic Education*														x								
2	009U0032	*Bahasa Indonesia*										x												
3	016U0033	*Calculus 1*			x																			
4	020U0033	*Physics 1*			x																			
5	101D4113	*Electrical Circuits 1*			x																			
6	102D4112	*Logic Circuits*				x																		
7	103D4112	*Engineering Drawing*				x																		
8	104D4112	*Advanced Chemistry*	x																					
9	012U0032	*State Ideology: Pancasila*														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				
18	008U0032	*Concept of Science and Technology*													x									
19	201D4113	*Advanced Mathematics 1*			x																		x	
20	202D4112	*Basic Electric Power (Systems)*		x																				
21	203D4112	*Basic Telecommunication (Systems)*		x																				

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
22	204D4112	*Basic Electronics*			x																			
23	205D4112	*Electric Material Physics*	x																					
24	206D4112	*Advanced Physics*			x																		x	
25	207D4111	*Basic Electric Power Laboratory*																	x					
26	208D4111	*Basic Telecommunication Laboratory*																	x					
27	209D4111	*Basic Electronics Laboratory*																	x					
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																
36	217D4122	*Electric Installation + Laboratory*				x															x			
37	218D4121	*Integrated Electronics Laboratory*																2,62		2,62				
38	219D4121	*Microprocessor Systems and Interfaces Laboratory*				2,92															2,92			
39	301D4112	*Engineering Economics*					x								x									
40	302D4112	*Probability and Statistics*					x	x																
41	303D4112	*Electric Measurement*				x	x																	
42	304D4112	*Electromagnetics*		x																		x		
43	342D4122	*Numerical Methods*						2,51														2,51		
44	343D4122	*Energy Conversion*		x																		x		
45	344D4122	*Environmental Science*	1,57											1,51										

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
46	345D4122	*Management and Entrepreneurship*													2,71		2,71							
47	402D4112	*Research Methods and Scientific Writing*											x									x		
48	305D4112	*Alternating Current Transmission Systems*			x																			
49	306D4112	*Electric Power System Analysis*			x																			
50	307D4112	*Electric Machines Analysis 1 + Laboratory*			x														x					
51	308D4112	*Electric Power Protection System 1*			x																			
52	309D4112	*Electric Power Generation Systems*			x																			
53	310D4112	*Power System Control and Stability*			x																			
54	348D4122	*Electric Power Distribution Systems + Laboratory*			x														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					
59	311D4113	*Antenna and Propagation + Laboratory*				x			x											x				
60	312D4112	*Telecommunication Transmission Systems*			x																			
61	353D4122	*Cellular Communication*				x		x																
62	354D4122	*Wireless Technology*		x			x																	
63	322D4113	*Access Network Technology*		x																				
64	321D4112	*Data Communications*		x			x																	
65	329D4113	*Control Systems + Laboratory*			x														x					
66	330D4112	*Process Control Technology*			x														x			x		
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			

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
70	331D4112	*Industrial Robotics*				x														x				
71	333D4113	*Electronic Instrumentation Systems + Laboratory*				x														x				
72	319D4113	*Microprocessor-based Systems + Laboratory*				x														x				
73	335D4113	*Digital System Design + Laboratory*				x															x			
74	380D4123	*Embedded Systems Design + Laboratory*				x															x			x
75	336D4113	*Computer Architecture 1 + Laboratory*				x														x				
76	379D4123	*Power Electronics + Laboratory*				x															x			x
77	334D4112	*Computer Network-based SCADA*				x														x			x	
78	337D4112	*Industrial Automation + Laboratory (PLC)*				x														x		x		

Number of Courses where Assessment Data (per PI) are collected:	**1**	**2**	**12**	**4**	**2**	**4**	**3**	**1**	**0**	**0**	**0**	**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**	**0,00**	**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**	**3,49**	**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**	**-0,49**	**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**	**0,00**	**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**			**2,84**			**2,83**			**3,03**			**3,16**		
Student Outcomes Code:	**SO-1**				**SO-2**			**SO-3**			**SO-4**			**SO-5**			**SO-6**			**SO-7**		

Table F.5: The Direct Assessment Sheets 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	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
1	011U0032	*Civic Education*														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																		
8	104D4112	*Advanced Chemistry*	2,70																					
9	012U0032	*State Ideology: Pancasila*														x								
10	010U0032	*English*								x														
11	017U0033	*Calculus 2*			x																		x	
12	022U0033	*Physics 2*			x																		x	
13	105D4123	*Electric Circuits 2*			x																			
14	106D4122	*Digital Systems*				x			x															
15	107D4122	*Computer Programming*						x																
16	108D4121	*Electric Circuits Laboratory*																		x				
17	109D4121	*Digital Systems Laboratory*						x												x				
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																				

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
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					
28	007U0032	*Social Science of Maritime Culture*												x										
29	210D4123	*Advanced Mathematics 2*			x																		x	
30	211D4122	*Linear Systems*			x																		x	
31	212D4122	*Electric Machines*		x			x																	
32	213D4122	*Basic Multimedia*		x			x																	
33	214D4122	*Integrated Electronics*				x			x															
34	215D4122	*Microprocessor Systems and Interfaces*			x				x															
35	216D4122	*Basic Control Systems*			x			x																
36	217D4122	*Electric Installation + Laboratory*				x															x			
37	218D4121	*Integrated Electronics Laboratory*																x		x				
38	219D4121	*Microprocessor Systems and Interfaces Laboratory*				x															x			
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		
43	342D4122	*Numerical Methods*						x														x		
44	343D4122	*Energy Conversion*		x																		x		
45	344D4122	*Environmental Science*	x											x										

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
46	345D4122	*Management and Entrepreneurship*													x		x							
47	402D4112	*Research Methods and Scientific Writing*											2,84									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					
51	308D4112	*Electric Power Protection System 1*			x																			
52	309D4112	*Electric Power Generation Systems*			3,43																			
53	310D4112	*Power System Control and Stability*			2,75																			
54	348D4122	*Electric Power Distribution Systems + Laboratory*			x														x					
55	349D4122	*Electric Power Protection System 2 + Laboratory*			x														x					
56	350D4122	*Electric Machines Analysis 2 + Laboratory*			x														x					
57	351D4122	*Power Systems Operations*			x																			
58	352D4122	*High Voltage Engineering + Laboratory*			x														x					
59	311D4113	*Antenna and Propagation + Laboratory*				x			x											x				
60	312D4112	*Telecommunication Transmission Systems*			x																			
61	353D4122	*Cellular Communication*				x		x																
62	354D4122	*Wireless Technology*		x			x																	
63	322D4113	*Access Network Technology*		x																				
64	321D4112	*Data Communications*		x			x																	
65	329D4113	*Control Systems + Laboratory*			x														x					
66	330D4112	*Process Control Technology*			x														x			x		
67	373D4122	*Optimal Control Systems*			x														x					
68	372D4123	*Digital Control Systems + Laboratory*																		x				x
69	375D4122	*Control Systems Design*				x															x			

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
70	331D4112	*Industrial Robotics*				3,22														3,22				
71	333D4113	*Electronic Instrumentation Systems + Laboratory*				x														x				
72	319D4113	*Microprocessor-based Systems + Laboratory*				x														x				
73	335D4113	*Digital System Design + Laboratory*				x															x			
74	380D4123	*Embedded Systems Design + Laboratory*				x															x			x
75	336D4113	*Computer Architecture 1 + Laboratory*				x														x				
76	379D4123	*Power Electronics + Laboratory*				x															x			x
77	334D4112	*Computer Network-based SCADA*				x														x			x	
78	337D4112	*Industrial Automation + Laboratory (PLC)*				x														x		x		

	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:	**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**	**2,84**	**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**	**2,84**	**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**	**0,16**	**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**	**79,00**	**0,00**	**105,00**	**83,00**	**0,00**	**0,00**	**251,00**	**12,00**	**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**			**2,78**			**2,82**			**3,07**			**3,37**		
Student Outcomes Code:	**SO-1**				**SO-2**			**SO-3**			**SO-4**			**SO-5**			**SO-6**			**SO-7**		

Table F.6: The Direct Assessment Sheets 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
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
1	011U0032	*Civic Education*														x								
2	009U0032	*Bahasa Indonesia*										x												
3	016U0033	*Calculus 1*			x																			
4	020U0033	*Physics 1*			x																			
5	101D4113	*Electrical Circuits 1*			x																			
6	102D4112	*Logic Circuits*				x																		
7	103D4112	*Engineering Drawing*				x																		
8	104D4112	*Advanced Chemistry*	x																					
9	012U0032	*State Ideology: Pancasila*														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				
18	008U0032	*Concept of Science and Technology*													x									
19	201D4113	*Advanced Mathematics 1*			x																		x	
20	202D4112	*Basic Electric Power (Systems)*		x																				
21	203D4112	*Basic Telecommunication (Systems)*		x																				

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
22	204D4112	*Basic Electronics*			x																			
23	205D4112	*Electric Material Physics*	x																					
24	206D4112	*Advanced Physics*			x																		x	
25	207D4111	*Basic Electric Power Laboratory*																	x					
26	208D4111	*Basic Telecommunication Laboratory*																	x					
27	209D4111	*Basic Electronics Laboratory*																	x					
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			
39	301D4112	*Engineering Economics*					x								x									
40	302D4112	*Probability and Statistics*					x	x																
41	303D4112	*Electric Measurement*				x	x																	
42	304D4112	*Electromagnetics*		x																		x		
43	342D4122	*Numerical Methods*						2,86														2,86		
44	343D4122	*Energy Conversion*		2,87																		2,87		
45	344D4122	*Environmental Science*	2,76											2,76										

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
46	345D4122	*Management and Entrepreneurship*													2,42		2,42							
47	402D4112	*Research Methods and Scientific Writing*											x									x		
48	305D4112	*Alternating Current Transmission Systems*			x																			
49	306D4112	*Electric Power System Analysis*			x																			
50	307D4112	*Electric Machines Analysis 1 + Laboratory*			x														x					
51	308D4112	*Electric Power Protection System 1*			x																			
52	309D4112	*Electric Power Generation Systems*			x																			
53	310D4112	*Power System Control and Stability*			x																			
54	348D4122	*Electric Power Distribution Systems + Laboratory*			3,02														3,02					
55	349D4122	*Electric Power Protection System 2 + Laboratory*			x														x					
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					
59	311D4113	*Antenna and Propagation + Laboratory*				x			x											x				
60	312D4112	*Telecommunication Transmission Systems*			x																			
61	353D4122	*Cellular Communication*				2,38		2,38																
62	354D4122	*Wireless Technology*		3,88			3,88																	
63	322D4113	*Access Network Technology*		x																				
64	321D4112	*Data Communications*		x			x																	
65	329D4113	*Control Systems + Laboratory*			x														x					
66	330D4112	*Process Control Technology*			x														x			x		
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			

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
70	331D4112	*Industrial Robotics*				x														x				
71	333D4113	*Electronic Instrumentation Systems + Laboratory*				x														x				
72	319D4113	*Microprocessor-based Systems + Laboratory*				x														x				
73	335D4113	*Digital System Design + Laboratory*				x															x			
74	380D4123	*Embedded Systems Design + Laboratory*				x															x			x
75	336D4113	*Computer Architecture 1 + Laboratory*				x														x				
76	379D4123	*Power Electronics + Laboratory*				x															x			x
77	334D4112	*Computer Network-based SCADA*				x														x			x	
78	337D4112	*Industrial Automation + Laboratory (PLC)*				x														x		x		

Number of Courses where Assessment Data (per PI) are collected:	1	4	12	6	3	5	3	1	0	0	0	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	0,00	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	2,84	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	0,16	-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	0,00	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			2,69			2,89			3,15			2,65		
Student Outcomes Code:	SO-1				SO-2			SO-3			SO-4			SO-5			SO-6			SO-7		