MODULE HANDBOOK

2018

Bachelor of Education in Electrical Engineering
Faculty of Engineering
Universitas Negeri Yogyakarta
Leading in Character Education

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1st SEMESTER

UNIVERSITAS NEGERI YOGYAKARTA
FACULTY OF ENGINEERING
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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Islamic Studies
Module level,if applicable:	Undergraduate
Code:	MKU6301
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	1st
Module coordinator:	Syukri Fathudin Achmad W. S.Ag., M.Pd
Lecturer(s):	Dr. Amir Syamsudin, S.Ag., M.Ag.
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	150 minutes lectures and 180 minutes structured activities per week.
Teaching and Learning Method	Discussion, Lecturing
Workload:	Total workload is 136 hours per semester which consists of 150 minutes lectures, 180 minutes structured activities, and 180 minutes self-study per week for 16 weeks.

Credit points:	3
Prerequisites course(s):	-
Expected learning Outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics ELO2 Demonstrate nationalism, responsibility, and tolerance to both society and environmet.
Course Oucomes:	CO1 Be faithful to God Almighty and be able to show a religious attitude. CO2 Uphold the value of humanity in carrying out duties based on religion, morals, and ethics. CO2.1 Describe human concepts. CO2.2 Describe the concept of religion. CO2.3 Describe the relationship between humans and religion CO2.4 Describe the understanding of Islam. CO2.5 Explain the characteristics of the Islamic religion. CO2.6 Explain the position of Islam among the religions in the world. CO2.7 Describe the basic framework of Islamic teachings. CO2.8 Describe the aqidah of Islam. CO2.9 Describe Islamic Syariah. CO2.10 Describe the character of Islam. CO3 Uphold the value of humanity in carrying out duties based on religion, morals, and ethics. CO3.1 Analyzing the sources of Islamic teachings. CO3.2 Analyzing Al-Qur'an as a source of Islamic teachings. CO3.3 Analyzing as-Sunnah as a source of Islamic teachings. CO3.4 Analyzing Ijtihad as a Source of Islamic teachings. CO4 Respect the diversity of cultures, views, religions, and beliefs, as well as other people's original opinions or findings. CO4.1 Implement Islamic politics in the life of Indonesian society.

<table>
<tr><td></td><td>CO4.2 Applying the value of Islam in realizing civil society.
CO4.3 Apply Islamic values in science.
CO4.5 Applying Islamic values in tolerance.
CO4.6 Understanding gender values in Islam.
CO4.7 Analyzing fundamentalism in Islam.
CO4.8 Analyzing marriage in Islam.</td></tr>
<tr><td>ELO and CO mapping</td><td><table>
<tr><th></th><th>ELO1</th><th>ELO2</th></tr>
<tr><td>CO1</td><td>✓</td><td></td></tr>
<tr><td>CO2</td><td></td><td>✓</td></tr>
<tr><td>CO3</td><td></td><td>✓</td></tr>
<tr><td>CO4</td><td></td><td>✓</td></tr>
</table></td></tr>
<tr><td>Courses Description:</td><td>Islamic Education Courses are required to pass for every Muslim student in all study programs. This course is designed with the intention to strengthen faith and piety in Allah SWT. as well as broadening the outlook on religious life, so that Muslim students who are of noble character, philosophical thinking, rational and dynamic attitude, and have a broad view, pay attention to the demands to establish harmony among human beings both in one religion and with other religious communities.</td></tr>
<tr><td>Assessments</td><td>1. The assessment is carried out to measure all learning achievements, namely attainment learning achievements (CO1) and (CO2).
2. Final scores include the results of general knowledge assessments obtained from individual assignments, group assignments, presentations, quizzes, Insert Exams, and Final Examinations with the following guidelines.

The final mark will be weight as follow:
<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td>1</td><td>CO1–CO2</td><td>Attitude (presence, activity, discipline, honesty)</td><td>Observation</td><td>10%</td></tr>
</table></td></tr>
</table>

	<table><tr><td></td><td></td><td>Individual Assessment</td><td>article</td><td>15%</td></tr><tr><td></td><td></td><td>Group Assessment</td><td>Presentation and Aricle</td><td>15%</td></tr><tr><td></td><td></td><td>Midterm</td><td>Written test</td><td>20%</td></tr><tr><td></td><td></td><td>Final Exam</td><td>Written test</td><td>40%</td></tr><tr><td colspan="4">Total</td><td>100%</td></tr></table>
Forms of media:	Board, LCD Projector, Laptop/Computer
Literature:	1. Marzuki. 2012. Pembinaan Karakter Mahasiswa melalui Pendidikan Agama Islam di Perguruan Tinggi Umum. Yogyakarta: Penerbit Ombak. 2. Marzuki. 2009. Prinsip dasar Akhlak mulia: Pengantar studi kondep-konsep dasaretika dalam Islam. Yogyakarta: Debut Wahana Press-FISE UNY. 3. Sudrajat, Ajat et all. 2008. Din Al-Islam: Pendidikan Agama Islam di Perguruan Tinggi Umum. Yogyakarta: UNY Press. 4. Ali, Mohammad Daud. 2000. Pendidikan Agama Islam. Jakarta: Rajawali Press. 5. Azra, Azyumardi. 1999. Pendidikan Islam: Tradisi dan Modernisasi Menuju Milenium Baru. Jakarta: Logos. 6. Al-Qur'an Al-Karim 7. Al-Abrasyi, M. Athiyah. 1987. Dasar-dasar Pokok Pendidikan Islam. Terj. H. Bustami A. Gani dan Djohar Bahry L.I.S. Jakarta: Bulan Bintang. Cet. V 8. Rahman, Fazlur. 1984. Islam. Bandung: Pustaka. 9. Nasution, Harun. 1979. Islam Ditinjau dari Berbagai Aspeknya. Jilid I & II. Jakarta: UI Press. 10. Musa, Muhammad Yusuf. 1988. Islam Suatu Kajian Komprehensif. Terj. A. Malik Madany dan Hamim Ilyas. Jakarta: Rajawali Press.
Date of revision	10 August 2018

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Science of Education
Module level,if applicable:	Undergraduate
Code:	MDK6201
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	1^{st}
Module coordinator:	Arif Rohman, M.Si
Lecturer(s):	Estu miyarso, M.Pd
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	100 minutes lectures and 120 minutes structured activities per week.
Teaching and Learning Method	Lecture, Discussion, Practicum, Question and Answer
Workload:	Total workload is 91 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes self-study per week for 16 weeks

Credit points:	2
Prerequisites course(s):	-
Expected learning Outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics ELO2 Demonstrate nationalism, responsibility, and tolerance to both society and environmet ELO3 Capable to perform professional works in his/her field of expertise both individual and team works
Course Oucomes:	CO1 Embodying academic values, norms, and ethics. CO1.1 Understand the meaning and nature of education. CO1.2 Understand the relationship between education and the development of human civilization. CO1.3 Understanding when the education process can occur. CO1.4 Understanding why educational practice needs to be based on educational theory. CO1.5 Understand the foundations and essence of the historical red thread of education in Indonesia and education streams CO1.6 Understand the nature of education. CO1.7 Understand the science of education and its role in the theory and practice of education. CO2 Respecting the diverse cultures, views, religions and beliefs, as well as opinions or original invention of others. CO2.1 Understanding the understanding of the education system. CO2.2 Understand the meaning and importance of interaction and interdependence between components of the education system. CO2.3 Understand the importance of the formation of a whole person. CO2.4 Understand the central role of educators in the education process. CO2.5 Understand the essence of lifelong education. CO2.6 Know the forms and ways of lifelong education. CO2.7 Identify the nature of the problem of education.

<table>
<tr><td></td><td>CO2.8 Understanding the categorization of educational problems.
CO3 Apply logical, critical, systematic, and innovative thinking in the context of knowledge and/or technology development or implementation based on the respective field.
CO3.1 Understand the importance of educational renewal / innovation efforts.</td></tr>
<tr><td>ELO and CO mapping</td><td>
<table>
<tr><th></th><th>ELO1</th><th>ELO2</th><th>ELO3</th></tr>
<tr><td>CO1</td><td>✓</td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td>✓</td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td>✓</td></tr>
</table>
</td></tr>
<tr><td>Courses Description:</td><td>This course discusses the basic principles of education and the basic concepts of education and its application in educational praxis which includes: the phenomenon of education, the historical point of view of education, the nature of education and education, education as a system, and issues (issues of education in contexts) educational renewal (innovation).</td></tr>
<tr><td>Assessments</td><td>1. Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude compared to the attitude of students in general. The results of the attitude assessment are not a component of the student's final grade, but rather as one of the graduation requirements. Students will graduate from this course if at least have a good attitude. Attitude assessment also considers the activeness of students following lectures.
2. The final score includes the results of the attitude assessment obtained from discussions, individual assignments, group assignments, presentations, Insert Tests, and Final Exams with the following guidelines.</td></tr>
</table>

No	CO	Assessment Object	Assessment Technique	Weight
1	CO1-CO3	Assignment	Completion of Tasks and Papers	20%
		Practicum report	Small Discussion / Seminar	20%
		Final Project Performance	Mid Semester Exam	20%
		Final Project Report	Final exams	25%
		Attendance	Documentation	15%
			Total	100%

Forms of media:	Board, LCD Projector, Laptop/Computer

Literature:

1. Arif Rohman. 2009. Memahami Pendidikan dan Ilmu Pendidikan. Yogyakarta: Laksbang Mediatama.
2. Depdikbud . 1985. Pendidikan di Indonesia dari Jaman ke Jaman. Jakarta : Balai Pustaka
3. Dwi Siswoyo dkk. 2007. Ilmu Pendidikan. Yogyakarta: UNY Press.
4. Dirto Hadisusanto, Suryati Sidharto, & Dwi siswoyo. 1995. Pengantar Ilmu Pendidikan. Yogyakarta : FIP IKIP YOGYAKARTA.
5. Driyarkara . 1980. Driyarkara tentang Pendidikan. Yogyakarta : Penerbit Kanisius.
6. John I. Goodlad,. Educational Renewal. San francisco : Jossey-Bass Publishers
7. John Dewey. 1950. Democracy and Education. New York : The Macmillan Company.
8. Imam Barnadib & Sutari Imam Barnadib. 1996. Beberapa Aspek Substansial Ilmu Pendidikan. Yogyakarta : Penerbit Andi.
9. ------------------ .2002. Filsafat Pendidikan. Yogyakarta : Penerbit Adicita Karya Nusa

	10. Noeng Muhadjir. 2000. Ilmu Pendidikan dan Perubahan Sosial. Yogyakarta : Rake Sarasin. 11. Sumitro, dkk. 2006. Pengantar Ilmu Pendidikan. Yogyakarta : UNY Press. 12. Tilaar, H.A.R. 2002. Pendidikan dan Perubahan Sosial : Pengantar Pedagogik Transformatif untuk Indonesia . Jakarta : Penerbit Grasindo 13. ------------------ 2005. Manifesto Pendidikan Nasional. Jakarta : Penerbit Buku Kompas. 14. Umar Tirtahardja & La Sulo. 1997. Pengantar Pendidikan. Jakarta : Ditjen Dikti, Depdikbud. 15. UU No. 20 Tahun 2003. Tentang Sistem Pendidikan Nasional. 16. Wardiman Djojonegoro .1996. Lima Puluh Tahun Perkembangan Pendidikan Indonesia. Jakarta : Depdikbud.
Date of revision	30 August 2018

Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Mathematics
Module level, if applicable:	Undergraduate
Code:	KTF6205
Sub-heading, if applicable:	-
Classes, if applicable:	-
Semester:	1st
Module coordinator:	Drs. Nur Kholis, M.Pd.
Lecturer(s):	Team
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	100 minutes lectures and 120 minutes structured activities per week.
Teaching and Learning Method	Lecturing
Workload:	Total workload is 91 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes self-study per week for 16 weeks.

Credit points:	2
Prerequisites course(s):	-
Expected learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics. ELO3 Can carry out work in accordance with the professional field of expertise both individually and in teams ELO4 Master in basic sciences and principles of electric ELO7 Analyze and solve technical problems related to electrical engineering by applying the principles of Mathematics.
Course Outcomes	CO1 Devotion to God Almighty and able to show religious attitude. CO2 Demonstrates a responsible and independent attitude towards the assigned work. CO3 Knowledge of the principles of Mathematics and Physics related to the principles of electricity. CO3.1 Understanding notations or symbols in mathematics, numbers, basic algebraic rules, logarithms, trigonometry, number systems. CO3.2 Understand the concept of complex numbers & numbers systems. CO3.3 Understand the concepts of matrices & systems of linear equations. CO3.4 Understand the differential concept for functions with 1 independent variable CO3.5 Understand integral concepts for functions with 1 independent variable. CO4 Analyze and solve technical problems related to electrical engineering by applying the principles of Mathematics. CO4.1 Apply notations or symbols in mathematics, numbers, basic algebraic rules, logarithms, trigonometry, number systems in understanding the next concept. CO4.2 Solve problems that require complex numbers & numbers systems. CO4.3 Solve problems that require matrices & systems of linear equations. CO4.4 Solve problems that require a differential for functions with 1 independent variable. CO4.5 Solve problems that require integrals for functions with 1 independent variable:

<table>
<tr><td>ELO and CO mapping</td><td>
<table>
<tr><th></th><th>ELO1</th><th>ELO3</th><th>ELO4</th><th>ELO7</th></tr>
<tr><td>CO1</td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td>✓</td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td></td><td>✓</td></tr>
<tr><td>CO4</td><td></td><td></td><td>✓</td><td>✓</td></tr>
</table>
</td></tr>
<tr><td>Courses Description:</td><td>This course gives cognitive experience to students in learning mathematics. Students are given cognitive experience through axiomatic, deductive and logical and systematic reasoning to build a model or formula. The reasoning material in mathematics is as follows: number systems, complex numbers, matrices, differentials, and integrals (indeterminate and certain) for functions with one free change.

Students after attending this lecture are expected to be able to apply these concepts in learning engineering concepts in courses in electrical engineering study programs.</td></tr>
<tr><td>Assessments</td><td>The assessment was conducted to measure all learning outcomes, namely attainment learning achievements (CO1), general skills (CO2), knowledge (CO3), and special skills (CO4).

1. Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude compared to the attitude of students in general. The results of the attitude assessment are not a component of the student's final grade, but rather as one of the graduation requirements. Students will graduate from this course if at least have a good attitude. Attitude assessment also considers the activeness of students following lectures.

2. Final scores include the results of the assessment of knowledge, general skills, and special skills obtained from individual assignments, group assignments, presentations, quizzes, insert tests, and final semester examinations with the following guidelines.

The final mark will be weight as follow:</td></tr>
</table>

No	CO	Assessment Object	Assessment Technique	Weight
1	CO2	Atitude (attendance, activity, discipline, honesty)	Observation	10%
	CO3, CO4	Individual Task	Written Test	15%
		Group Task	Written test	15%
		Midterm	Written test	20%
		Final Exam	Written test	40%
			Total	100%

Forms of media:	Board, LCD Projector, Laptop/Computer
Literature:	1. Ayres, F,Jr. (1981) , *Calculus* 2/ed, SI, SNP, Singapore. 2. Stroud, K.A. *Matematika Teknik* 3. Mizrahi, Abe & Sullivan, Michael. *Calculus and Analytic Geometry* 4. Spiegel, Murray R. *Matrices*
Date of revision	29 August 2018

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Physics
Module level, if applicable:	Undergraduate
Code:	KTF6206
Sub-heading, if applicable:	-
Classes, if applicable:	-
Semester:	1^{st}
Module coordinator:	Muhfizaturrahmah, S.T., M.Eng
Lecturer(s):	Team
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	100 minutes lectures and 120 minutes structured activities per week.
Teaching and Learning Method	Lecturing
Workload:	Total workload is 91 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes self-study per week for 16 weeks.

Credit points:	2
Prerequisites course(s):	-
Expected learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics. ELO3 Can carry out work in accordance with the professional field of expertise both individually and in teams. ELO4 Master in basic sciences and principles of electric ELO7 Able to manage vocational education and training in the field of Electrical Engineering by utilizing information and communication technology.
Course Outcomes	CO1 Internalize academic values, norms and ethics. CO2 Demonstrates responsibility for work in their area of expertise independently. CO3 Knowledge of the principles of Mathematics and Physics related to the principles of electricity. CO3.1 Mastering the quantities and units used in the field of electrical physics. CO3.2 Mastering the calculation of vector quantities. CO4 Knowledge of law and the basic theory of electricity. CO4.1 Mastering the electric field concept. CO4.2 Mastering the concept of electrical potential. CO4.3 Mastering the principle of capacitance. CO4.4 Mastering the concept of Electric Current and Direct Current (DC) Electrical Circuits. CO4.5 Mastering theories about magnetic fields. CO4.6 Know the sources of the magnetic field and the laws that relate to it. CO4.7 Mastering the process of magnetic inductance. CO5 Analyze and solve technical problems routinely related to electric power engineering by applying the principles of Mathematics, Physics and Chemistry. CO5.1 Able to use the principle of DC parallel series circuits in analyzing simple electrical circuits.

<table>
<tr><td>ELO and CO mapping</td><td>

	ELO1	ELO3	ELO4	ELO7
CO1	✓			
CO2		✓		
CO3				✓
CO4			✓	✓
CO5			✓	✓

</td></tr>
<tr><td>Courses Description:</td><td>Engineering Physics courses include a review of basic science, namely quantities, units, vectors and physics course material related to the electrical field, namely electric fields, electric potential, capacitance, electric currents and direct current (DC) circuits, magnetic fields, sources source of magnetic fields and magnetic induction.</td></tr>
<tr><td>Assessments</td><td>

1. Assessment is carried out to measure all learning achievements, namely attainment learning achievements (CO1), general skills (CO2), knowledge (CO3), and special skills (CO4 and CO5).
2. Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude compared to the attitude of students in general. The results of the attitude assessment are not a component of the student's final grade, but rather as one of the graduation requirements. Students will graduate from this course if at least have a good attitude. Attitude assessment also considers the activeness of students following lectures.
3. Final grades include the results of the assessment of knowledge, general skills, and special skills obtained from individual assignments, group assignments, presentations, quizzes, insert tests, and final semester examinations with the following guidelines.

The final mark will be weight as follow:

No	CO	Assessment Object	Assessment Technique	Weight
1	CO1–	Assignment	1. Accuracy of answer	20%

</td></tr>
</table>

		CO5		results 2. Written	
			Participation	Observation	15%
			Attendance	Observation	10%
			Midterm	1. Accuracy of answer results 2. Written	25%
			Final Exam	1. Accuracy of answer results 2. Written	30%
				Total	100%
Forms of media:	Board, LCD Projector, Laptop/Computer				
Literature:	1. Alvin, H., 1998, 3000 Solved Problem in Phisic, New York: Mc Graw-Hill Book Company. 2. Beiser, A., 1985, Applied Physic, New York: Mc Graw-Hill, Inc. 3. Halliday, David, dan Robert Resnick, 1987, (Penterjemah oleh Pantur Silaban dan Erwin Sucipto). *Fisika Jilid I* Edisi Ketika, Jakarta: Penerbit Erlangga. 4. Sears, FW, Sudaryono, PJ, 1984, (Penyadur) *Mekanika, Panas dan Bunyi.* Jakarta : Penerbit Binacipta.				
Date of revision	30 August 2018				

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Fundamentals of Electrical
Module level, if applicable:	Undergraduate
Code:	EKO6201
Sub-heading, if applicable:	-
Classes, if applicable:	-
Semester:	1st
Module coordinator:	Dr. Edy Supriyadi, M.Pd.
Lecturer(s):	Team
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	100 minutes lectures and 120 minutes structured activities per week.
Teaching and Learning Method	Student Center Learning
Workload:	Total workload is 91 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes self-study per week for 16 weeks.

Credit points:	2
Prerequisites course(s):	-
Expected learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics. ELO3 Can be handled according to the expertise of each team. ELO4 Master in basic sciences and principles of electric. ELO7 Capable to manage vocational education and training in the field of Electrical Engineering by utilizing information and communication technology.
Course Outcomes	CO1 Devotion to God Almighty and able to show religious attitude. CO2 Demonstrates a responsible and independent attitude towards the assigned work. CO3 Knowledge of law and the basic theory of electricity. CO3.1 Having knowledge about the basic concepts and laws of electricity. CO3.2 Having knowledge about the elements of electrical circuits. CO3.3 Having knowledge of the methods and theorems of the analysis of unidirectional electric circuit. CO3.4 Having knowledge of the phasor concept. CO3.5 Having knowledge about single-phase alternating electrical circuits. CO3.6 Having knowledge about measuring instruments and how to read them. CO4 Students have comprehensive knowledge about the phasor concept and its application in a series of alternating one-phase sources, selecting a measuring instrument and analyzing the results of measurements of electrical quantities. CO4.1 Able to analyze the basic concepts and laws of electricity. CO4.2 Being able to analyze the elements of the electrical circuit. CO4.3 Able to apply the methods and theorems of electrical circuit analysis on direct source electric circuits. CO4.4 Able to apply the concept of phasors in a single-phase alternating source electric circuit. CO4.5 Able to apply the electrical circuit analysis in a single-phase alternating electric circuit. CO4.6 Able to measure electrical quantities using a measuring instrument and analyze the measurement results.

<table>
<tr>
<td>ELO and CO mapping</td>
<td>
<table>
<tr><th></th><th>ELO1</th><th>ELO2</th><th>ELO4</th><th>ELO5</th><th>ELO6</th></tr>
<tr><td>CO1</td><td>✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td>✓</td><td></td><td>✓</td></tr>
<tr><td>CO4</td><td></td><td></td><td>✓</td><td></td><td>✓</td></tr>
</table>
</td>
</tr>
<tr>
<td>Courses Description:</td>
<td>Electrical Basic Course will develop student competence on the concepts and basic laws of electricity, electrical circuit elements, methods and theorems of unidirectional source circuit analysis, phasor concepts and their application in a series of alternating single-phase sources, selecting a measuring instrument and analyzing the results of measuring electric quantities . Lectures are carried out with a variety of approaches that fit the context of the material and the potential of students, including: contextual, cooperative, and problem based learning that leads to student center learning. Continuous assessment is carried out on a competency basis and harmonized with lecture activities.</td>
</tr>
<tr>
<td>Assessments</td>
<td>Assessment is carried out to measure all learning achievements, namely attainment learning achievements (CO1) and (CO2), knowledge (CO3), and skills (CO4).

1. Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude compared to the attitude of students in general. The results of the attitude assessment are not a component of the student's final grade, but rather as one of the graduation requirements. Students will graduate from this course if at least have a good attitude. Attitude assessment also considers the activeness of students following lectures.

2. Final grades include the results of the assessment of attitudes, knowledge, and skills obtained from individual assignments, group assignments, presentations, Mid Semester Exams, and Final Semester Exams with the following guidelines.</td>
</tr>
</table>

<table>
<tr><td></td><td>
<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td rowspan="4">1</td><td>CO2</td><td>Self-Assessment</td><td>Observation</td><td>5%</td></tr>
<tr><td rowspan="3">CO2, CO3</td><td>Task</td><td>PBL Rubric</td><td>35%</td></tr>
<tr><td>Midterm</td><td>Written test</td><td>30%</td></tr>
<tr><td>Final Exam</td><td>Written test</td><td>30%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table>
</td></tr>
<tr><td>Forms of media:</td><td>Board, LCD Projector, Laptop/Computer</td></tr>
<tr><td>Literature:</td><td>1. Alexander Sadiku. 2007. Fundamentals of Electric Circuits. New York: McGraw-Hill International Edition.
2. Ridsdale. (1984) Elecetrical Circuits for Engineering. New York: McGrawHill.
3. Sudjana Sapi’ie. Alat Ukur dan Pengukuran Listrik. Jakarta: Pradnya Paramita.
4. Mohamad Ramdani. 2008. Rangkaian Listrik. Jakarta: Erlangga.
5. Mussama, Imam Mustholiq. Pegangan Kuliah Dasar Listrik, Listrik DC dan AC. Yogyakarta: FT UNY (tidak dipublikasikan).
6. Mussama, Imam Mustholiq. Pengukuran Listrik, Jilid 1 dan Jilid 2. Yogyakarta: FT UNY (tidak dipublikasikan).
7 Budiono Mismail. 1995. Rangkaian Listrik, Jilid Pertama. Bandung: ITB</td></tr>
<tr><td>Date of revision</td><td>29 Agustus 2018</td></tr>
</table>

UNIVERSITAS NEGERI YOGYAKARTA
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Web:ft.uny.ac.id, E-mail: elektro@uny.ac.id

Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Electronics
Module level, if applicable:	Undergraduate
Code:	EKO6202
Sub-heading, if applicable:	-
Classes, if applicable:	-
Semester:	1^{st}
Module coordinator:	Sardjiman Djojo Pernoto, M.Pd
Lecturer(s):	Team
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	100 minutes lectures and 120 minutes structured activities per week.
Teaching and Learning Method	Lecturing
Workload:	Total workload is 91 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes self-study per week for 16 weeks.

Credit points:	2
Prerequisites course(s):	-
Expected learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics. ELO3 Can be handled according to the expertise of each team. ELO4 Master in basic sciences and principles of electric. ELO5 Mastering work standards, work methods, work implementation, and testing in the field of electric power engineering or industrial automation
Course Outcomes	CO1 Devotion to God Almighty and able to show religious attitude CO2 Demonstrates a responsible and independent attitude towards the assigned work. CO3 Students can develop (plan, make analog electronic circuits and analyze. CO3.1 Understand the basics and characteristics of analog electronics, and their applications. CO4 Able to present the results of series analysis. CO4.1 Plan, make analog electronic circuits and analyze. CO4.2 Able to present the results of series analysis.
ELO and CO mapping	(see table below)
Courses Description:	This course discusses and practices the basics of analog electronics, the characteristics of electronic components, rectifier circuits, transistor circuits as switches and amplifiers, operational amplifiers and wave generator circuits.

	ELO1	**ELO3**	**ELO4**	**ELO6**
CO1	✓			
CO2		✓		
CO3			✓	✓
CO4			✓	✓

<table>
<tr><td>Assessments</td><td>
1. Assessment is carried out to measure all learning achievements, namely attainment learning achievements (CO1), general skills (CO2), knowledge (CO3), and special skills (CO4).
2. Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude compared to the attitude of students in general. The results of the attitude assessment are not a component of the student's final grade, but rather as one of the graduation requirements. Students will graduate from this course if at least have a good attitude. Attitude assessment also considers the activeness of students following lectures.
3. Final grades include the results of an assessment of knowledge, general skills, and special skills obtained from individual assignments, group assignments, presentations, quizzes, Insertion Exams, and Final Semester Exams with the following guidelines.
The final mark will be weight as follow:
<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td rowspan="7">1</td><td>CO2</td><td>Presentation</td><td>Observation</td><td>10%</td></tr>
<tr><td rowspan="6">CO3, CO4</td><td>Individual Task</td><td rowspan="6">a. skill set results
b. Written</td><td>10%</td></tr>
<tr><td>Group Task</td><td>10%</td></tr>
<tr><td>Quiz</td><td>20%</td></tr>
<tr><td>Midterm</td><td>20%</td></tr>
<tr><td>Final Exam</td><td>30%</td></tr>
<tr></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table>
</td></tr>
</table>

Forms of media:	Board, LCD Projector, Laptop/Computer
Literature:	1. Robert Boylestad Louis Nashelsky, Electronic Devies and Circuit Theory 7 Edition (1999) Prenties Hall, Inc. 2. Hayt Neudeck, Electronic Circuit Analysis n Desaign (1978) Library of Congress Catalog Printied in USA 3. Herman Dwi Suryono, Elektronika: Teori dan Penerapan (1996) Fakultas Pendidikan Teknologi Kejuruan, Institus Keguruan dan Ilmu Pendidikan Yogyakart 4. K.F. Ibrahim, Prinsip Dasar Elektronika (1986) PT. MULTI MEDIA Jakarta
Date of revision	29 August 2018

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Digital Engineering Laboratory Work
Module level, if applicable:	Undergraduate
Code:	EKO6303
Sub-heading, if applicable:	-
Classes, if applicable:	-
Semester:	1^{st}
Module coordinator:	Faranita Surwi, S.T., M.T.
Lecturer(s):	Team
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	250 minutes lectures and 300 minutes structured activities per week.
Teaching and Learning Method	Discussion, Demonstration, and Lecturing
Workload:	Total workload is 227 hours per semester which consists of 250 minutes lectures, 300 minutes structured activities, and 300 minutes self-study per week for 16 weeks.

Credit points:	3
Prerequisites course(s):	-
Expected learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics. ELO2 Demonstrate nationalism, responsibility, and tolerance to both society and environment ELO4 Master in basic sciences and principles of electric ELO6 Capable to make plans, implement, and evaluate learning in electric power or industrial automation expertise
Course Outcomes	CO1 Devotion to God Almighty and able to show religious attitude CO2 Demonstrates a responsible and independent attitude towards the assigned work CO3 Explain the concept of elementary numbers CO3.1 Understand the basic principles, characteristics, analysis of digital circuits and their applications. CO4 conversion of decimal, binary, octal, and hexadecimal numbers. CO4.1 Arranging a digital circuit and can solve obstacles that occur.
ELO and CO mapping	(see mapping table below)
Courses Description:	This course discusses and practices basic number concept materials, basic logic gates and expansion gates, boolean algebra, flip-flop circuits, counters, registers, adder-subtractors, ADC-DAC, and decoder-encoders.

	ELO1	**ELO2**	**ELO4**	**ELO6**
CO1	✓			
CO2		✓		
CO3			✓	✓
CO4			✓	✓

Assessments	Assessment is carried out to measure all learning achievements, namely attainment learning achievements (CO 1), general skills (CO 2), knowledge (CO 3), and special skills (CO 4 and O 5). 1. Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude compared to the attitude of students in general. The results of the attitude assessment are not a component of the student's final grade, but rather as one of the graduation requirements. Students will graduate from this course if at least have a good attitude. Attitude assessment also considers the activeness of students following lectures. 2. Final grades include the results of an assessment of knowledge, general skills, and special skills obtained from individual assignments, group assignments, presentations, quizzes, Insertion Exams, and Final Semester Exams with the following guidelines. The final mark will be weight as follow:

No	**CO**	**Assessment Object**	**Assessment Technique**	**Weight**
1	CO2	Presentation	Observation	10%
	CO3, CO4	Individual Task	a. Skill set results b. Written	10%
		Group Task		10%
		Quiz		20%
		Midterm		20%
		Final Exam		30%
			Total	100%

Forms of media:	Board, LCD Projector, Laptop/Computer
Literature:	1. Ronald J. Tocci, Digital Systems Principles and Applications, Prentice-Hall 2. Herlambang, Ariadie Chandra, Lab Sheet Praktik Teknik Digital
Date of revision	30 August 2018

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Computer Programming Laboratory Work
Module level, if applicable:	Undergraduate
Code:	EKO6204
Sub-heading, if applicable:	-
Classes, if applicable:	-
Semester:	1st
Module coordinator:	Drs. Mutaqin, M.Pd.,M.T.
Lecturer(s):	Team
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	200 minutes lectures and 240 minutes structured activities per week.
Teaching and Learning Method	Lecturing
Workload:	Total workload is 181 hours per semester which consists of 200 minutes lectures, 240 minutes structured activities, and 240 minutes self-study per week for 16 weeks.

<table>
<tr><td>Credit points:</td><td>2</td></tr>
<tr><td>Prerequisites course(s):</td><td>-</td></tr>
<tr><td>Expected learning outcomes:</td><td>After taking this course the students have ability to:
ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics.
ELO2 Demonstrate nationalism, responsibility, and tolerance to both society and environmet
ELO4 Master in basic sciences and principles of electric
ELO5 Master in work standards, work methods, work implementations, and testing in electric power or industrial automation expertise.
ELO6 Capable to make plans, implement, and evaluate learning in electric power or industrial automation expertise</td></tr>
<tr><td>Course Outcomes</td><td>CO1 Devotion to God Almighty and able to show religious attitude.
CO2 Demonstrates a responsible and independent attitude towards the assigned work.
CO3 Students have the ability to identify problems, analyze needs, design, apply and test simple computer programming.
CO4 Students master the basics of programming, can use C ++ in solving problems, and create projects based on C ++ programming.</td></tr>
<tr><td>ELO and CO mapping</td><td>
<table>
<tr><th></th><th>ELO1</th><th>ELO2</th><th>ELO4</th><th>ELO5</th><th>ELO6</th></tr>
<tr><td>CO1</td><td>✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>CO4</td><td></td><td></td><td>✓</td><td>✓</td><td>✓</td></tr>
</table>
</td></tr>
<tr><td>Courses Description:</td><td>This course will discuss, study, and practice algorithms and computer programming. The programming language used is an intermediate programming language (C ++ programming language). The material that will be given in this course includes: programming, basic programming, being able to use</td></tr>
</table>

<table>
<tr><td></td><td>C ++ in solving problems, and making projects based on C ++ programming. Lectures are conducted using the student center. Learning strategies, theory delivery, teaching, assignments, and presentations. The evaluation system uses assignments and tests.</td></tr>
<tr><td>Assessments</td><td>
The assessment is carried out to measure all learning achievements, namely attainment learning achievements (CO 1 and CO 2), knowledge and skills (CO 3 and CO 4).
1. Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude compared to the attitude of students in general. The results of the attitude assessment are not a component of the student's final grade, but rather as one of the graduation requirements. Students will graduate from this course if at least have a good attitude. Attitude assessment also considers the activeness of students following lectures.
2. Final grades include the results of an assessment of knowledge, general skills, and special skills obtained from individual assignments, group assignments, presentations, quizzes, Insertion Exams, and Final Semester Exams with the following guidelines.
The final mark will be weight as follow:
<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td rowspan="5">1</td><td>CO2</td><td>Presentation</td><td>Obseervation</td><td>10%</td></tr>
<tr><td rowspan="4">CO3
CO4
CO5</td><td>Individual Task</td><td rowspan="4">a. Skill set results
b. Written</td><td>10%</td></tr>
<tr><td>Group Task</td><td>10%</td></tr>
<tr><td>Quiz</td><td>20%</td></tr>
<tr><td>Midterm</td><td>20%</td></tr>
</table>
</td></tr>
</table>

	<table><tr><td></td><td></td><td>Final Exam</td><td></td><td>30%</td></tr><tr><td colspan="4">Total</td><td>100%</td></tr></table>
Forms of media:	Board, LCD Projector, Laptop/Computer
Literature:	1. Bambang Hariyanto,Ir.(1997). Sistem Operasi, Bandung : Informatika 2. Yogiyanto. (1995) Turbo C++l V.5. Yogyakarta: Andi Offset 3. Abdul Kadir, (1999). Bahasa C++. Yogyakarta: Andi Offset 4. Mutaqin (2007). Algoritma dan Pemrograman. Yogyakarta: FT UNY
Date of revision	30 August 2018

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Engineering Drawing Laboratory Work
Module level, if applicable:	Undergraduate
Code:	EKO6205
Sub-heading, if applicable:	-
Classes, if applicable:	-
Semester:	1^{st}
Module coordinator:	Dr. phil Nurhening Yuniarti, S.Pd.,M.T.
Lecturer(s):	Team
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	200 minutes lectures and 240 minutes structured activities per week.
Teaching and Learning Method	Demonstration, Simulation.
Workload:	Total workload is 181 hours per semester which consists of 200 minutes lectures, 240 minutes structured activities, and 240 minutes self-study per week for 16 weeks.

Credit points:	2
Prerequisites course(s):	-
Expected learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics. ELO3 Can carry out work in accordance with the professional field of expertise both individually and in teams. ELO4 Master in basic sciences and principles of electric ELO5 Master in work standards, work methods, work implementations, and testing in electric power or industrial automation expertise. ELO6 Capable to make plans, implement, and evaluate learning in electric power or industrial automation expertise
Course Outcomes	CO1 Devotion to God Almighty and able to show religious attitude. CO2 Demonstrates a responsible and independent attitude towards the assigned work. CO3 Demonstrates responsibility for work in their area of expertise independently. CO4 Mastery of drawing with pictorial techniques. CO4.1 Understanding the concepts and functions of technical drawings. CO4.2 Mastery of drawing with pictorial techniques. CO4.3 Mastery of symbols used in the field of electrical engineering. CO5 Mastery of symbols is used in the field of electrical engineering. CO5.1 Mastery of the switch image. CO5.2 Mastery of drawing lighting installations. CO5.3 Mastery of drawing power installations CO5.4 Mastery draws control circuits CO5.5 Mastery of basic commands of Autocad software. CO6 Facilitating, evaluating, implementing learning and learning outcomes in a professional manner, as well as community partnerships within the framework of vocational education in carrying out duties as a teaching profession CO6.1 Mastery of further commands of Autocad software CO6.2 Mastery of drawing PCB designs with software

<table>
<tr><td>ELO and CO mapping</td><td>
<table>
<tr><th></th><th>ELO1</th><th>ELO3</th><th>ELO4</th><th>ELO5</th><th>ELO6</th></tr>
<tr><td>CO1</td><td>✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td>✓</td><td></td><td>✓</td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td>✓</td><td>✓</td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td>✓</td><td>✓</td></tr>
<tr><td>CO6</td><td></td><td></td><td></td><td>✓</td><td>✓</td></tr>
</table>
</td></tr>
<tr><td>Courses Description:</td><td>This course will provide knowledge and drawing skills that include: understanding and function of technical drawings, technical drawing requirements, pictorial drawings, electrical and electronic engineering symbols, drawing switches and maintenance diagrams, lighting and power installations, control circuits carried out manually with using drawing equipment or using Autocad and PCB Wizard software.</td></tr>
<tr><td>Assessments</td><td>Assessment is carried out to measure all learning achievements, namely attainment of attitudes, general skills, knowledge, and skills

1. Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude compared to the attitude of students in general. The results of the attitude assessment are not a component of the student's final grade, but rather as one of the graduation requirements. Students will graduate from this course if at least have a good attitude. Attitude assessment also considers the activeness of students following lectures.

2. Final grades include the results of an assessment of knowledge, general skills, and special skills obtained from individual assignments, group assignments, presentations, quizzes, Insertion Exams, and Final Semester Exams with the following guidelines.</td></tr>
</table>

<table>
<tr><td></td><td>The final mark will be weight as follow:
<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td rowspan="4">1</td><td rowspan="4">CO1–CO12</td><td>Assignment</td><td>Practicum report</td><td>40%</td></tr>
<tr><td>Midterm</td><td>Practicum</td><td>20%</td></tr>
<tr><td>Final Exam</td><td>Practicum</td><td>30%</td></tr>
<tr><td>Attendance</td><td>Documentation</td><td>10%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table></td></tr>
<tr><td>Forms of media:</td><td>Board, LCD Projector, Laptop/Computer</td></tr>
<tr><td>Literature:</td><td>1. Zamtinah. Diktat Gamb ar Teknik. FPTK IKIP Yogyakarta
2. http://elektro-uny.net/moodle dengan password masuk
3. _______. (2002). Persyaratan Umum Instalasi Listrik 2000. Badan Standarisasi Nasional.
4. Chandra, Handi. (2003). Dasar-dasar AutoCad 2000. PT. Elex Media Komputindo.
5. Scrhriever, Errol G. (1984). Electrical Drafting. Prentince-Hall, Inc.</td></tr>
<tr><td>Date of revision</td><td>29 August 2018</td></tr>
</table>

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Mechanical Technology Laboratory Work
Module level,if applicable:	Undergraduate
Code:	EKO6206
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	1^{st}
Module coordinator:	Toto Sukisno, S.Pd., M.Pd.
Lecturer(s):	1. Drs. Sunomo, M.T. 2. Drs. Mutaqin, M.Pd.,M.T.
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	100 minutes lectures and 120 minutes structured activities per week.
Teaching and Learning Method	Discussion, Demonstration, Lecturing, Practice
Workload:	Total workload is 91 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes self-study per week for 16 weeks.

Credit points:	2
Prerequisites course(s):	-
Expected learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics ELO3 Can carry out work in accordance with the professional field of expertise both individually and in teams. ELO5 Master in work standards, work methods, work implementations, and testing in electric power or industrial automation expertise. ELO6 Capable to make plans, implement, and evaluate learning in electric power or industrial automation expertise
Course Outcomes	CO1 Devoted to God Almighty and able to show a religious attitude and rusty with gratitude for the gifts that have been owned. CO2 Students actively participate, take responsibility, and have the motivation to develop themselves. CO3 Students are able to work in a professional manner by paying attention to and following aspects of work health, safety and security. CO3.1 Knowing about bench work theory such as; file, saw, cut and bend. CO4 Having the ability to communicate effectively, think critically and make the right decisions. CO4.1 Able to carry out work benches such as: file, sawing, cutting, and bending.

<table>
<tr>
<td>ELO and CO mapping</td>
<td>
<table>
<tr><th></th><th>ELO1</th><th>ELO2</th><th>ELO4</th><th>ELO5</th><th>ELO6</th></tr>
<tr><td>CO1</td><td>✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td></td><td></td><td>✓</td></tr>
<tr><td>CO4</td><td></td><td></td><td>✓</td><td>✓</td><td></td></tr>
</table>
</td>
</tr>
<tr>
<td>Courses Description:</td>
<td>Mechanical Technology Practice Lectures will equip capable and skilled students to use bench work equipment such as: file, sawing, cutting, and bending the plate carefully and considering K3 asphalt. Students are also able to apply knowledge and skills from exercises to production.</td>
</tr>
<tr>
<td>Assessments</td>
<td>
1. Assessment is carried out to measure all learning achievements, namely attainment learning achievements (CO1), general skills (CO2), knowledge (CO3), and special skills (CO4 and CO5).

2. Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude compared to the attitude of students in general. The results of the attitude assessment are not a component of the student's final grade, but rather as one of the graduation requirements. Students will graduate from this course if at least have a good attitude. Attitude assessment also considers the activeness of students following lectures.

3. Final grades include the results of an assessment of knowledge, general skills, and special skills obtained from individual assignments, group assignments, presentations, quizzes, Insertion Exams, and Final Semester Exams with the following guidelines.

The final mark will be weight as follow:
<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td>1</td><td>CO2–</td><td>Presentation</td><td>Observation</td><td>10%</td></tr>
</table>
</td>
</tr>
</table>

<table>
<tr><td></td><td><table>
<tr><td></td><td>CO6</td><td>Individual Task</td><td>Occuration result progam</td><td>10%</td></tr>
<tr><td></td><td></td><td>Group Task</td><td>written test</td><td>10%</td></tr>
<tr><td></td><td></td><td>Quiz</td><td>written test</td><td>20%</td></tr>
<tr><td></td><td></td><td>Mid</td><td>written test</td><td>20%</td></tr>
<tr><td></td><td></td><td>Final Exam</td><td>written test</td><td>30%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table></td></tr>
<tr><td>Forms of media:</td><td>Board, LCD Projector, Laptop/Computer</td></tr>
<tr><td>Literature:</td><td>1. Gerling, Henrich, 1974, All About Machine Tool, Willey Eastern
2. De Meyere, 1975, Work Preparation Planing, MIDC Indonesia</td></tr>
<tr><td>Date of revision</td><td>10 August 2018</td></tr>
</table>

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	English
Module level,if applicable:	Undergraduate
Code:	MKU6211
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	1st
Module coordinator:	Dr. phil. Nurhening Yuniarti, M.T
Lecturer(s):	1. Muhfizaturrahmah, S.T., M.Eng
Language:	English
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	100 minutes lectures and 120 minutes structured activities per week.
Teaching and Learning Method	Discussion, Demonstration, Lecturing, Practice
Workload:	Total workload is 91 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes self-study per week for 16 weeks.

Credit points:	2
Prerequisites course(s):	-
Expected learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics ELO3 Capable to perform professional works in his/her field of expertise both individual and team works ELO4 Mastering work standards, work methods, work implementation, and testing in the field of electric power engineering or industrial automation ELO9 Capable to develop a vocational education innovation and publish scientific paper
Course Outcomes	CO1 Internalize academic values, norms and ethics. CO2 Internalize the spirit of independence, struggle, and entrepreneurship. CO3 Knowledge of the preparation of scientific works including work reports in accordance with scientific procedures based on data and information analysis. CO3.1 Mastering the procedures for writing a script in English. CO3.2 Mastering scientific presentation techniques in English CO4 Apply logical, critical, systematic, and innovative thinking in the context of developing or implementing science and/ or technology in accordance with their area of expertise. CO4.1 Able to understand scientific writing in English. CO4.2 Able to understand scientific conversation in English. CO4.3 Able to speak in English. CO4.4 Able to make writing in English.

<table>
<tr><td>ELO and CO mapping</td><td>
<table>
<tr><th></th><th>ELO1</th><th>ELO2</th><th>ELO3</th><th>ELO8</th><th>ELO9</th></tr>
<tr><td>CO1</td><td>✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td>✓</td><td></td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td>✓</td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Courses Description:</td><td>English courses include material to activate students' Listening, Reading, Speaking, Writing and Grammar abilities in using English especially in the fields of electrical engineering and education.</td></tr>
<tr><td>Assessments</td><td>

Assessment is carried out to measure all learning achievements, namely attainment learning achievements (CO1), general skills (CO2), knowledge (CO3), and special skills (CO4).
Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude compared to the attitude of students in general. The results of the attitude assessment are not a component of the student's final grade, but rather as one of the graduation requirements. Students will graduate from this course if at least have a good attitude. Attitude assessment also considers the activeness of students following lectures.
Final grades include the results of an assessment of knowledge, general skills, and special skills obtained from individual assignments, group assignments, presentations, activeness, attendance, and Final Examinations with the following guidelines.

The final mark will be weight as follow:
<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td>1</td><td>CO1,2,4</td><td>Assignment</td><td>The suitability of the task with the rules of the English language.</td><td>30%</td></tr>
</table>
</td></tr>
</table>

				Written.	
		CO1,2,3	Presentation	Observation	15%
			Participation	Observation	15%
			Attendance	Observation	10%
			Final Exam	The suitability of the task with the rules of the English language. Written.	30%
				Total	100%
Forms of media:	Board, LCD Projector, Laptop/Computer				
Literature:	1. Betty S. Azar. Understanding and using english Grammar. Pearson Educaation. NewYork. USA. 2002				
Date of revision	10 August 2019				

2^{nd} SEMESTER

Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP) **MODULE HANDBOOK**

Module name:	Pancasila
Module level,if applicable:	Undergraduate
Code:	MDU6208
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	2nd
Module coordinator:	Suripno, SH., M.Pd.
Lecturer(s):	MKU Team
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	The form of learning is in the form of lectures, which consist of 100 minutes of face-to-face activities per week per semester; (2) structured assignment activities 120 minutes per week per semester; and (3) 120 minutes of independent activities per week per semester.
Teaching and Learning Method	Demonstration, Simulation, and Discussion
Workload:	Total workload is 26 hours 40 minutes of face-to-face activities per semester

Credit points:	2
Prerequisites course(s):	-
Expected learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, practice the values, norms, and academic ethics. ELO2 Demonstrate nationalism, responsibility, and tolerance to both society and environmet
Course Outcomes	CO1 Devoted to God Almighty and able to show a regius attitude, honest and patient. CO2 Acting as proud and loving citizens of the country, having nationalism and a sense of responsibility to the country and nation. CO2.1 Analyzing and Becoming Pancasila Lifestyle as a Basis for the Development of Knowledge. CO2.2 Analyzing and evaluating Pancasila as a state foundation. CO3 Contribute to improving the quality of community, nation, and state life the progress of civilization based on Pancasila. CO3.1 Explain and understand Pancasila in the Study of the History of the Indonesian Nation
ELO and CO mapping	(see table below)
Courses Description:	This lecture discusses the foundation and objectives of Pancasila Education, Pancasila in the historical context of the struggle of the Indonesian, Pancasila as a philosophical system, Pancasila as political ethics and national ideology, Pancasila in the context of the R.I and Pancasila state administration as a paradigm of life in society, nation and state

	ELO1	**ELO2**
CO1	✓	
CO2		✓
CO3		✓

<table>
<tr><td>Assessments</td><td>
The assessment was carried out to measure all learning achievements, namely attitude attainment (CO1), (CO2), (CO3).
Final grades include the results of the assessment of knowledge, general skills, and special skills obtained from individual assignments, group assignments, presentations, quizzes, insert tests, and final semester examinations with the following guidelines
<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td>1</td><td>CO1</td><td>Attitude (presence, activity, discipline, honesty)</td><td>Observation</td><td>10%</td></tr>
<tr><td rowspan="4">2</td><td rowspan="4">CO2-CO3</td><td>Individual assignment</td><td>Article, Presentations and Papers</td><td>15%</td></tr>
<tr><td>Group Assignment</td><td>Article, Presentations and Papers</td><td>15%</td></tr>
<tr><td>Midterm</td><td>Written Test</td><td>20%</td></tr>
<tr><td>Final Exam</td><td>Written Test</td><td>40%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table>
</td></tr>
<tr><td>Forms of media:</td><td>Board, LCD Projector, Laptop/Computer</td></tr>
<tr><td>Literature:</td><td>

Rukiyati, dkk. 2013. Pendidikan Pancasila di Perguruan Tinggi. Yogyakarta: UNY Press.
Yudi Latif, 2012. Negara Paripurna: Historisitas, Rasionalitas, dan Aktualitas. Jakarta: PT Gramedia
Latif, Yudi. (2012). Mata Air Keteladanan. Pancasila dalam Perbuatan. Bandung: Mizan. Kaelan. (2004). Pendidikan Pancasila. Yogyakarta: Paradigma.
Franz Magnis-Suseno. (2003). Etika Politik. Jakarta: PT. Gramedia Pustaka Utama. Cet. Ke-7.
Bahar, Saafroedin & Hudawati, Nanie (peny). (1998). Risalah Sidang-sidang BPUPKI – PPKI 28 Mei – 22 Agustus 1945. Jakarta: Sekretariat Negara RI
Ali, As’ad Said. (2009) Negara Pancasila, Jalan Kemaslahatan Bersama. Jakarta: LP3ES
Ismail, Faisal. (1999). Ideologi Hegemoni dan Otoritas Agama, Wacana Ketegangan Kreatif Islam dan Pancasila.Yogyakarta: Tiara Wacana.
Bouchier,David. (2007). Pancasila Versi Orde Baru dan asal muasal Negara Organis. Jakarta: Gema Insani Press

</td></tr>
</table>

	9. A. Ubaidillah & Abdul Rozak. (2013). Pendidikan Kewarganegaraan: Pancasila, Demokrasi,HAM,dan Masyarakat Madani. Jakarta: ICCE UIN Jakarta. 10. Undang-Undang Dasar RI Tahun 1945 (Setelah Amandemen I-IV).
Date of revision	18 August 2018

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Education Management
Module level,if applicable:	Undergraduate
Code:	MDK6203
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	2rd
Module coordinator:	Dr. phil. Nurhening Yuniarti, M.T
Lecturer(s):	1. Dr. Cepi Safruddin Abdul Jabar, M.Pd
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	150 minutes lectures and 180 minutes structured activities per week.
Teaching and Learning Method	Discussion, Demonstration, Lecturing, Practice
Workload:	Total workload is 136 hours per semester which consists of 150 minutes lectures, 180 minutes structured activities, and 180 minutes self-study per week for 16 weeks.

<table>
<tr><td>Credit points:</td><td>3</td></tr>
<tr><td>Prerequisites course(s):</td><td>-</td></tr>
<tr><td>Expected learning outcomes:</td><td>After taking this course the students have ability to:
ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics
ELO6 Capable to make plans, implement, and evaluate learning in electric power or industrial automation expertise</td></tr>
<tr><td>Course Outcomes</td><td>CO1 Devoted to God Almighty and able to show a religious attitude, honest and patient.
CO2 Internalize academic values, norms and ethics.
CO3 Apply education management to schools, education and training institutions in the field of Electrical Engineering.
CO3.1 Applying the planning process (planning) in the management of vocational education in schools, education and training institutions in the field of Electrical Engineering.
CO3.2 Applying the organizing process (organizing) in the management of vocational education in schools, training and training institutions in the field of Electrical Engineering.
CO3.3 Implement a leadership process (leading) in the management of vocational education in schools, education and training institutions in the field of Electrical Engineering.
CO3.4 Implement a controlling process in the management of vocational education in schools, education and training institutions in the field of Electrical Engineering.</td></tr>
<tr><td>ELO and CO mapping</td><td><table>
<tr><th></th><th>ELO1</th><th>ELO6</th></tr>
<tr><td>CO1</td><td>✓</td><td></td></tr>
<tr><td>CO2</td><td>✓</td><td></td></tr>
<tr><td>CO3</td><td></td><td>✓</td></tr>
</table></td></tr>
</table>

Courses Description:	This Education Management course provides knowledge in the management of educational organizations (Vocational High Schools, Vocational Education and Training Institutions) which includes planning, organizing, leadership, and controlling human resources independently. effective and efficient so that educational organization goals are achieved. This lecture is carried out using student centered learning strategies (student center learning) by utilizing technology as a learning resource. Assessment of lectures uses three elements, namely: active participation in the classroom, communication of interactions in presentations, and individual competency tests. The main studies in this course include: Strategic Planning, School Based Management, Management Information Systems in Education, Transformational and Transactional Leadership, Learning Leadership (Instructional Leadership), Assurance Systems Internal Quality (SPMI), Implementation of Integrated Quality Management (Total Quality Management), ISO 9001: 2015 Standard Quality Management System, Application of Balance Scorecard, and Implementation of Quality Control Groups
Assessments	1. The assessment is carried out to measure all learning outcomes, namely attitudes learning achievements (CO 1 and CO 2), and special skills (CO 3) 2. Attitude assessment is carried out at each meeting by using the method of observation and / or self-assessment with the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if the student shows significantly better or less good attitude compared to the attitude of students in general. The results of the attitude assessment do not become a major component of the student's final grade, but rather as one of the graduation requirements. Students are declared to graduate from this course if at least have a good attitude. Attitude assessment also considers the activeness of students in attending lectures. 3. Final scores include the results of attitude assessment, special skills obtained from individual assignments, group assignments, presentations, with the following guidelines

<table>
<tr>
<td></td>
<td>
<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td>1</td><td>CO1 and CO 2</td><td>a. Active in class
b. Duty
c. Discussion
d. Presentation</td><td>a. Observation
b. Rubric
c. Observation
d. Rubric</td><td>20%</td></tr>
<tr><td>2</td><td>CO 6</td><td>a. Presentation
b. Discussion</td><td>a. Rubric
b. Observation</td><td>80%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table>
</td>
</tr>
<tr><td>Forms of media:</td><td>Board, LCD Projector, Laptop/Computer</td></tr>
<tr><td>Literature:</td><td>11. B. Suryosubroto. 2004. Manajemen Pendidikan di Sekolah. Jakarta: Rineka Cipta.
12. Hadari Nawawi. 1981. Administrasi Pendidikan. Jakarta: Gunung Agung.
13. Hartati Sukirman, et all. 1998. Adminstrasi dan Supervisi Pendidikan. Yogyakarta: UPP IKIP Yogyakarta
14. Oteng Sutisna. 1989. Administrasi Pendidikan: Dasar Teoritis Untuk Praktek Profesional. Bandung: Angkasa.
15. Made Pidarta. 1986. Pemikiran Tentang Supervisi Pendidikan. Surbaya: Sarana Press.
16. Soekarto Indrafachrudi. 1994. Mengatur Bagaimana Memimpin Sekolah yang Baik. Jakarta: Ghalia Indonesia.
17. Soewadji Lazaruth. 1988. Kepala Sekolah dan tanggungjawabnya. Yogyakarta: Kanisius.
18. Wayne K. Hoy & Cecil G.Miskel. 2013. Educational Administrator: Theory, Research and Practice 4th Ed. New York: McGraw Hill, Inc.
19. John Wales & Joseph Bondi. 1986. Supervision: A Guide to Practice 2nd. Colombus: Charles E. Merril Publishing Company.
20. Stephen Murgatroyd and Colin Morgan. 1993. Total Quality Management and the School. Buckingham-Philadelphia: Open University Press.
21. Thomas J. Segiovani. 1988. Supervision of Teaching. USA: ASCD.</td></tr>
<tr><td>Date of revision</td><td>10 August 2018</td></tr>
</table>

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Mathematics Engineering
Module level, if applicable:	Undergraduate
Code:	EKO6307
Sub-heading, if applicable:	-
Classes, if applicable:	-
Semester:	2nd
Module coordinator:	Drs. Nur Kholis, M.Pd.
Lecturer(s):	Team
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	150 minutes lectures and 120 minutes structured activities per week.
Teaching and Learning Method	Lecturing
Workload:	Total workload is 104 hours per semester which consists of 150 minutes lectures, 120 minutes structured activities, and 120 minutes self-study per week for 16 weeks.

Credit points:	3
Prerequisites course(s):	-
Expected learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, practice the values, norms, and ethics. ELO3 Capable to perform professional works in his/her field of expertise both individual and team works ELO4 Master in basic sciences and principles of electric ELO7 Capable to manage vocational education and training of electrical engineering expertise by utilizing information and communications technology.
Course Outcomes	CO1 Devotion to God Almighty and able to show religious attitude. CO2 Demonstrates a responsible and independent attitude towards the assigned work. CO3 Mastering knowledge about the principles of Mathematics and Physics related to the principles of electricity CO3.1 Understanding function's differential and integral with two free changer or more. CO3.2 Understanding vector analysis. CO3.3 Understanding Order 2 and 3 Linear Differential Equations. CO3.4 Understanding Laplace Transforms and Laplace Transform Inversions. CO4 Analyze and solve technical problems related to electrical engineering by applying the principles of Mathematics. CO4.1 Solve differentials and integrals for polynomial, trigonometric, and exponential equations. CO4.2 Solve ordinary differential equations and apply ordinary differential equations to the field of electrical engineering. CO4.3 Solve linear differential equations and apply linear differential equations to the field of electrical engineering. CO4.4 Solve Laplace transform and inverse derived from a problem in the field of electrical engineering.

ELO and CO mapping	<table><tr><th></th><th>ELO1</th><th>ELO3</th><th>ELO4</th><th>ELO7</th></tr><tr><td>CO1</td><td>✓</td><td></td><td></td><td></td></tr><tr><td>CO2</td><td></td><td>✓</td><td></td><td></td></tr><tr><td>CO3</td><td></td><td></td><td>✓</td><td></td></tr><tr><td>CO4</td><td></td><td></td><td></td><td>✓</td></tr></table>
Courses Description:	This course gives cognitive experience to students in learning mathematics. Students are given cognitive experience through axiomatic, deductive and logical and systematic reasoning to build a form of certainty. The reasoning materials in this engineering mathematics course are: differential and integral for functions with two (2) or more changes, vector analysis, ordinary differential equations and linear differential equations, and the basics of Laplace transformations, which will be applied in engineering electro. Lectures are carried out using the student centered learning approach. Competency-based assessment involves active participation, and communication of interactions between individuals and groups.
Assessments	The assessment was carried out to measure all learning achievements, namely attitude attainment (CO1) and (CO2), knowledge (CO3) and skills (CO4). 1. Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude compared to the attitude of students in general. The results of the attitude assessment are not a component of the student's final grade, but rather as one of the graduation requirements. Students will graduate from this course if at least have a good attitude. Attitude assessment also considers the activeness of students following lectures. 2. Final grades include the results of the assessment of knowledge, general skills, and special skills obtained from individual assignments, group assignments, presentations, quizzes, insert tests, and final semester examinations with the following guidelines.

<table>
<tr><td></td><td>

No	CO	Assessment Components	Assessment Technique	Weight
1	CO2	Attitude (presence, activity, discipline, honesty)	Observation	10%
2	CO3-CO4	a. Individual assignment	Homework	10%
		b. Group assignment	Written Test	10%
		c. Midterm	Written Test	30%
		d. Final Exam	Written Test	40%
			Total	100%

</td></tr>
<tr><td>Forms of media:</td><td>Board, LCD Projector, Laptop/Computer</td></tr>
<tr><td>Literature:</td><td>

1 Ayres, Frank, Jr. 1981 , *Calculus* 2nd ed, Singapore: McBraw-Hill International Book Company.
2 Stroud, K.A. & Booth, Dexter J. 2003. *Matematika Teknik*. Jakarta: Penerbit Erlangga.
3 Mizrahi, Abe & Sullivan, Michael. 1986.*Calculus and Analytic Geometry*. Belmont, California: Wadswoth Publishing Company.
4 Wardiman. 1982. *Persamaan Diferensial.* FMIPA – UGM: Diktat perkuliahan
5 Spiegel, Murray R. 1981. *Vector.* Singapore: McBraw-Hill International Book Company.
6 Spiegel, Murray R. 1999. *Transformasi Laplace*. Jakarta: Penerbit Erlangga.
7 Spiegel, Murray R. 1992. *Matematika Lanjutan untuk Para Insinyur dan Ilmuwan.* Jakarta: Penerbit Erlangga.

</td></tr>
<tr><td>Date of revision</td><td>29 July 2018</td></tr>
</table>

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Electrical Circuit
Module level,if applicable:	Undergraduate
Code:	EKO6308
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	2rd
Module coordinator:	Dr. Edy Supriyadi
Lecturer(s):	1. Eko Prianto,S.Pd.T,M.Eng 2. Mutaqin,M.Pd,MT.
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	300 minutes lectures and 360 minutes structured activities per week.
Teaching and Learning Method:	Discussion, Demonstration, and Lecturing

Workload:	Total workload is 272 hours per semester which consists of 300 minutes lectures, 360 minutes structured activities, and 360 minutes self-study per week for 16 weeks.
Credit points:	3
Prerequisites course(s):	-
Expected Learning Outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, practice the values, norms, and academic ethics. ELO3 Capable to perform professional works in his/her field of expertise both individual and team works. ELO4 Master in basic sciences and principles of electric ELO7 Capable to manage vocational education and training of electrical engineering expertise by utilizing information and communications technology.
Course Outcomes:	CO1 Devoted to God Almighty and able to show a regius attitude, honest and patient. CO2 Demonstrates a responsible and independent attitude towards the assigned work. CO3 Knowledge of law and the basic theory of electricity. CO3.1 Knowledge about alternating source electrical circuit analysis CO3.2 Knowledge about natural responses and steady state responses CO3.3 Knowledge about magnetic couplings CO3.4 Knowledge about the analysis of three-phase electrical circuits CO3.5 Knowledge about power factor improvement CO3.6 Knowledge about measuring three-phase quantities CO4 Analyze and solve technical problems routinely related to electric power engineering by applying the principles of Mathematics, Physics and Chemistry. CO4.1 Able to analyze alternating electrical circuits CO4.2 Able to analyze natural responses and steady state responses CO4.3 Able to analyze about magnetic couplings CO4.4 Able to analyze three-phase electrical circuits CO4.5 Able to apply power factor improvements to the electric power system

	CO4.6 Able to measure the magnitude of three phases and analyze the measurement results.
ELO and CO mapping:	<table><tr><th></th><th>ELO1</th><th>ELO3</th><th>ELO4</th><th>ELO7</th></tr><tr><td>CO1</td><td>✓</td><td></td><td></td><td></td></tr><tr><td>CO2</td><td></td><td>✓</td><td></td><td></td></tr><tr><td>CO3</td><td></td><td></td><td>✓</td><td></td></tr><tr><td>CO4</td><td></td><td></td><td></td><td>✓</td></tr></table>
Courses Description:	This Electrical Circuit will develop student competencies in the analysis of alternating source circuits, natural responses and steady state responses, magnetic coupling circuits, three-phase circuits, power factor improvements and measurement of three-phase electric quantities, and the application of three-phase circuits in electric power systems. Lectures are carried out with various approaches that are appropriate to the context of the material and the potential of students, including: contextual, cooperative, and problem based learning that leads to student center learning. Continuous assessment is carried out on a competency basis and harmonized with lecture activities.
Study/exam achievements:	The assessment was carried out to measure all learning achievements, namely attitude attainment (CO1) and (CO2), knowledge (CO3) and skills (CO4). 1. Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude compared to the attitude of students in general. The results of the attitude assessment are not a component of the student's final grade, but rather as one of the graduation requirements. Students will graduate from this course if at least have a good attitude. Attitude assessment also considers the activeness of students following lectures. 2. Final grades include the results of the assessment of knowledge, general skills, and special skills obtained from individual assignments, group assignments, presentations, quizzes, insert tests, and final semester examinations with the following guidelines.

<table>
<tr><td></td><td>
<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td>1</td><td>CO2</td><td>Self Assessment</td><td>Observation</td><td>5%</td></tr>
<tr><td rowspan="3">2</td><td rowspan="3">CO3-CO4</td><td>Assignment</td><td>Rubric PBL</td><td>35%</td></tr>
<tr><td>Midterm</td><td>Written Test</td><td>30%</td></tr>
<tr><td>Final Exam</td><td>Written Test</td><td>30%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table>
</td></tr>
<tr><td>Forms of media:</td><td>Board, LCD Projector, Laptop/Computer</td></tr>
<tr><td>Literature:</td><td>
1. Alexander Sadiku. 2007. Fundamentals of Electric Circuits. New York: McGraw-Hill International Edition.
2. Ridsdale. (1984) Electrical Circuits for Engineering. New York: McGrawHill.
3. Sudjana Sapi’ie. Alat Ukur dan Pengukuran Listrik. Jakarta: Pradnya Paramita.
4. Mohamad Ramdani. 2008. Rangkaian Listrik. Jakarta: Erlangga.
5. Mussama, Imam Mustholiq. Pegangan Kuliah Dasar Listrik, Listrik DC dan AC. Yogyakarta: FT UNY (tidak dipublikasikan).
6. Mussama, Imam Mustholiq. Pengukuran Listrik, Jilid 1 dan Jilid 2. Yogyakarta: FT UNY (tidak dipublikasikan).
7. Budiono Mismail. 1995. Rangkaian Listrik, Jilid Pertama. Bandung: ITB
</td></tr>
<tr><td>Date of revision:</td><td>31 August 2019</td></tr>
</table>

UNIVERSITAS NEGERI YOGYAKARTA
FACULTY OF ENGINEERING
DEPARTMENT OF ELECTRICAL ENGINEERING EDUCATION
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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP) **MODULE HANDBOOK**

Module name:	Electronics Practices
Module level,if applicable:	Undergraduate
Code:	EKO6209
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	2^{nd}
Module coordinator:	Drs. Sunomo, M.T.
Lecturer(s):	Team
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	200 minutes lectures and 240 minutes structured activities per week.
Teaching and Learning Method	Discussion, Demonstration, and Lecturing
Workload:	Total workload is 181 hours per semester which consists of 200 minutes lectures, 240 minutes structured activities, and 240 minutes self-study per week for 16 weeks.

Credit points:	2
Prerequisites course(s):	-
Expected learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, practice the values, norms, and ethics. ELO3 Capable to perform professional works in his/her field of expertise both individual and team works. ELO4 Master in basic sciences and principles of electric ELO5 Master in work standards, work methods, work implementations, and testing in electric power or industrial automation expertise. ELO7 Capable to manage vocational education and training of electrical engineering expertise by utilizing information and communications technology.
Course outcomes:	CO1 Devoted to God Almighty and able to show a regius attitude, honest and patient. CO2 Internalize academic values, norms and ethics. CO3 Demonstrates a responsible and independent attitude towards the assigned work. CO4 Knowledge of law and the basic theory of electricity. CO4.1 Linking the electronic theory with the practice that will be taken. CO5 Knowledge of the preparation of scientific works including work reports in accordance with scientific procedures based on data and information analysis. CO5.1 Make a report related to bridge diode with capacitor filter and load resistor. CO5.2 Make a report related transistor as a switch. CO5.3 Make a report related transistor as a comon emitter amplifier. CO5.4 Make a report the operation amplifier as a reversing amplifier and not reverse. CO5.5 Make a report the operation amplifier as a wave generator. CO5.6 Make an electronic practice report. CO6 Knowledge of design, analysis and application of measurement systems related to the quantity and quality of Electric Power Engineering or Industrial Automation.

<table>
<tr><td></td><td>
CO6.1 Analyze bridge diode with capacitor filter and load resistor.
CO6.2 Analyze transistors as switches.
CO6.3 Analyze transistors as common emitter.
CO6.4 Analyze operational amplifier as a reversing amplifier and not reverse.
CO6.5 Analyze operational amplifier as wave generator.
CO6.6 Analyze electronic circuits.
CO7 Apply the theory of measurement and measuring parameters of electrical parameters.
CO7.1 Connect and read the measurement results with a voltmeter, current with a millimeterampere, and explain the functional buttons on the oscilloscope.
CO7.2 Connects and reads directional voltage waves, alternating and mixed voltage waves and wave frequencies with an oscilloscope.
</td></tr>
<tr><td>ELO and CO mapping:</td><td>
<table>
<tr><th></th><th>ELO1</th><th>ELO3</th><th>ELO4</th><th>ELO5</th><th>ELO7</th></tr>
<tr><td>CO1</td><td>✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td>✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td>✓</td><td></td><td></td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td>✓</td><td></td></tr>
<tr><td>CO6</td><td></td><td></td><td></td><td></td><td>✓</td></tr>
<tr><td>CO7</td><td></td><td></td><td></td><td></td><td>✓</td></tr>
</table>
</td></tr>
<tr><td>Courses Description:</td><td>Electronic Practice lectures are to prove the count of the electronic theory that has been obtained in the Electronics course, and practice the skills to assemble electronic components and measure electrical quantities such as voltage, current and frequency as well as calculating the value of voltage reinforcement. In order to achieve the objectives of this course, the implementation is individual, meaning that each student receives a practicum module, a voltage, current, and oscilloscope and a sine wave signal generator. In practice, each student carries out five practical titles; i.e. a bridge diode as a rectifier with a capacitor filter, a transistor as a switch, a transistor as a amplifier, an operating amplifier as a reversing</td></tr>
</table>

<table>
<tr><td></td><td>and not reversing amplifier, and an operating amplifier as a wave generator. The implementation strategy is that each topic is covered in 100 minutes. With this strategy every meeting in 200 minutes, there are a maximum of 10 participants. The implementation is that every participant enters once every two weeks, taking turns or changing his friends. Participants who were not included at the time were assigned by the lecturer to calculate the amount of output requested in the worksheets to compare with the results of the practice, so participants only entered together in their study groups at meetings 1 to 3. Competency evaluation includes timeliness in completing each practicum topic , including assembling, measuring and comparing it with theoretical calculations. Perfect score is obtained if students are able to complete each worksheet from 5 worksheets in accordance with the specified time, which is 5 x 100 minutes with the results of theoritical calculations and practicum data differing by a maximum of 25%, without damaging the practicum equipment.</td></tr>
<tr><td>Assessment:</td><td>
The assessment was carried out to measure all learning achievements, namely attitude attainment (CO1), (CO2), (CO3), knowledge (CO4) and (CO5) and skills (CO6) and (CO7).
1. Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude compared to the attitude of students in general. The results of the attitude assessment are not a component of the student's final grade, but rather as one of the graduation requirements. Students will graduate from this course if at least have a good attitude. Attitude assessment also considers the activeness of students following lectures.
2. Final grades include the results of the assessment of knowledge, general skills, and special skills obtained from individual assignments, group assignments, presentations, quizzes, insert tests, and final semester examinations with the following guidelines
<table>
<tr><th>No</th><th>CO</th><th>Assessment Components</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td rowspan="3">1</td><td rowspan="3">CO4-CO7</td><td>Practice Performance of each topic</td><td>Practice</td><td>60%</td></tr>
<tr><td>Midterm</td><td>Practice</td><td>20%</td></tr>
<tr><td>Final Exam</td><td>Practice</td><td>20%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table>
</td></tr>
</table>

Forms of media:	Board, LCD Projector, Laptop/Computer
Literature:	1 Lembar kerja Praktikum Elektronika Jurusan Pendidikan Teknik Elektro 2 Robert Boylestad & Louis Nashelsky, (1992),.Electronic Devices and Circuit Theory, Englewood Cliffs, New Jersey, Prrentice-Hall Inc.
Date of revision	30 August 2018

Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP) **MODULE HANDBOOK**

Module name:	Fundamentals of Electricity Work
Module level,if applicable:	Undergraduate
Code:	EKO6210
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	2^{nd}
Module coordinator:	Dr. Edy Supriyadi
Lecturer(s):	Team
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	200 minutes lectures and 240 minutes structured activities per week.
Teaching and Learning Method	Discussion, Demonstration, and Lecturing
Workload:	Total workload is 181 hours per semester which consists of 200 minutes lectures, 240 minutes structured activities, and 240 minutes self-study per week for 16 weeks.
Credit points:	2

Prerequisites course(s):	-
Expected learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, practice the values, norms, and academic ethics. ELO3 Capable to perform professional works in his/her field of expertise both individual and team works. ELO4 Master in basic sciences and principles of electric ELO5 Master in work standards, work methods, work implementations, and testing in electric power or industrial automation expertise. ELO7 Capable to manage vocational education and training of electrical engineering expertise by utilizing information and communications technology.
Course outcomes:	CO1 Devoted to God Almighty and able to show a regius attitude, honest and patient. CO2 Demonstrates a responsible and independent attitude towards the assigned work. CO3 Knowledge of law and the basic theory of electricity. CO3.1 Understand the types of tools and materials used in practice. CO3.2 Understand how to use use of electrical measuring devices. CO3.3 Understand how to use a multimeter. CO3.4 Understand how to use a oscilloscope/CRO. CO3.5 Understand the principle of charging and discharging capacitors and inductors. CO3.6 Understand the characteristics of components R, L and C. CO3.7 Understanding the characteristics of R-L-C series and parallel circuits in an AC source. CO3.8 Understand the effect of frequency on the R-L-C circuit. CO3.9 Understanding the three-phase network source. CO3.10 Understanding the characteristics of the load at the three phase source. CO3.11 Understanding phase sequences on three phase systems. CO3.12 Understand the three-phase power measurement system. CO4 Apply the theory of measurement and measure electrical devices. CO4.1 Capable to choose the tools and materials used for practice.

	CO4.2 Capable to choose the measuring instrument used for practice. CO4.3 Apply the use of a multimeter correctly. CO4.4 Apply the use of a oscilloscope/CRO correctly. CO4.5 Apply the process of charging and discharging capacitors and inductors. CO4.6 Measuring the amount of current and power on the R-L-C load on a dc or ac power source. CO4.7 Apply measurements to series R-L-C series and parallel to AC sources. CO4.8 Test the effect of frequency on the R-L-C circuit. CO4.9 Stringing and measuring three-phase network sources. CO4.10 Arranging and measuring load characteristics at three phase sources. CO4.11 Test the phase sequence in a three phase system. CO4.12 Measuring power on a three phase system.
ELO and CO mapping:	(see table below)
Courses Description:	The Basic Electric Practice will develop student competencies regarding basic electricity concepts and law, electrical circuit elements, methods and theorems of unidirectional source circuit analysis, phasor concepts and their application in a series of alternating one-phase sources, selecting measuring tools and analyzing measurement results electric quantity. Lectures are carried out with various approaches that are appropriate to the context of the material and the potential of students, including: contextual, cooperative, and problem based learning that leads to student center learning. Continuous assessment is carried out on a competency basis and harmonized with lecture activities.

	ELO1	ELO3	ELO4	ELO5	ELO7
CO1	✓				
CO2		✓			
CO3			✓		
CO4					✓

<table>
<tr><td>Assessment:</td><td>
The assessment was carried out to measure all learning achievements, namely attitude attainment (CO1) and (CO2), knowledge (CO3) and skills (CO4).
1. Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude compared to the attitude of students in general. The results of the attitude assessment are not a component of the student's final grade, but rather as one of the graduation requirements. Students will graduate from this course if at least have a good attitude. Attitude assessment also considers the activeness of students following lectures.
2. Final grades include the results of the assessment of knowledge, general skills, and special skills obtained from individual assignments, group assignments, presentations, quizzes, insert tests, and final semester examinations with the following guidelines
<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td>1</td><td>CO2</td><td>Attitude (presence, activity, discipline, honesty)</td><td>Observation</td><td>10%</td></tr>
<tr><td rowspan="3">2</td><td rowspan="3">CO3-CO4</td><td>Practice Performance of each topic</td><td>Rubric assessment of the implementation of lectures and reports</td><td>40%</td></tr>
<tr><td>Midterm</td><td>Practice Exam</td><td>20%</td></tr>
<tr><td>Final Exam</td><td>Practice Exam</td><td>30%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table>
</td></tr>
<tr><td>Forms of media:</td><td>Board, LCD Projector, Laptop/Computer</td></tr>
<tr><td>Literature:</td><td>
1 Alexander Sadiku. 2007. Fundamentals of Electric Circuits. New York: McGraw-Hill International Edition.
2 Ridsdale. (1984) Elecetrical Circuits for Engineering. New York: McGrawHill.
3 Sudjana Sapi’ie. Alat Ukur dan Pengukuran Listrik. Jakarta: Pradnya Paramita.
4 Mohamad Ramdani. 2008. Rangkaian Listrik. Jakarta: Erlangga.
</td></tr>
</table>

	5 Mussama, Imam Mustholiq. Pegangan Kuliah Dasar Listrik, Listrik DC dan AC. Yogyakarta: FT UNY (not published). 6 Mussama, Imam Mustholiq. Pengukuran Listrik, Jilid 1 dan Jilid 2. Yogyakarta: FT UNY (not published). 7 Budiono Mismail. 1995. Rangkaian Listrik, Jilid Pertama. Bandung: ITB
Date of revision	13 July 2018

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP) **MODULE HANDBOOK**

Module name:	Control System
Module level,if applicable:	Undergraduate
Code:	EKO6211
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	2nd
Module coordinator:	Sigit Yatmono, M.T.
Lecturer(s):	Team
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	100 minutes lectures and 120 minutes structured activities per week.
Teaching and Learning Method	Discussion and Lecturing
Workload:	Total workload is 91 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes self-study per week for 16 weeks.

Credit points:	2
Prerequisites course(s):	-
Expected learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics ELO3 Capable to perform professional works in his/her field of expertise both individual and team works ELO4 Master in basic sciences and principles of electric ELO7 Capable to manage vocational education and training of electrical engineering expertise by utilizing information and communications technology
Course outcomes:	CO1 Devoted to God Almighty and able to show a regius attitude, honest and patient. CO2 Menunjukkan sikap bertanggung jawab atas pekerjaan di bidang keahliannya dan memiliki motivasi mengembangkan diri. CO3 Mastering knowledge about the principles of Mathematics and Physics related to the principles of electricity. CO3.1 Understand the basic concepts of control systems which include the introduction of control system components, types of basic control actions (open and closed loop). CO3.2 Understand the concept of control system mathematical modeling of physical system characteristics. CO3.3 Understand the concept of system response analysis by calculating manual formulas. CO3.4 Understand the concept of testing the stability of a control system using the Hurwitz and Routh stability concept methods. CO3.5 Understand the concept of PID regulation in a control system. CO4 Knowledge of identifying, formulating and solving control systems in Electric Power Engineering or

	Industrial Automation. CO4.1 Formulate and describe the functions of the control system aided by MATLAB software. CO4.2 Analyze system response tests from mathematical model equations using MATLAB software. CO4.3 Analyze system stability tests from mathematical equation models using MATLAB software. CO4.4 Determine the PID control coefficient and application examples using the Matlab program and the microcontroller code. CO5 Analyze and solve technical problems related to electrical engineering by applying the principles of Mathematics. CO5.1 Apply mathematical principles in particular, linear equations, and numerical calculations in the problem of the mathematical model of the control system. CO5.2 Model the control system in the form of a block diagram. CO5.3 Analyze control system response tests. CO5.4 Analyze the control system stability test. CO5.5 Design a PID-based control system, determine the coefficients of Kp, Ki and Kd.
ELO and CO mapping:	(see table below)
Courses Description:	Control system basic discusses the understanding of control systems, process dynamics and modeling, sequential control, control with a good feedback technique, mathematical modeling of physical systems with block diagram approach with its Laplace transform and signal flow graph, orde system response analysis 1,2 and high; system stability settings, application examples and basic control actions (on / off, P, PI, PD, PID). As well as an introduction to using MATLAB as a response analysis tool, system stability and controller design.

	ELO1	**ELO3**	**ELO4**	**ELO7**
CO1	✓			
CO2		✓		
CO3			✓	
CO4				✓
CO5				✓

Assessment:

The assessment was carried out to measure all learning achievements, namely attitude attainment (CO1) dan (CO2), knowledge (CO3), and skills (CO4) and (CO5).

1. Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude compared to the attitude of students in general. The results of the attitude assessment are not a component of the student's final grade, but rather as one of the graduation requirements. Students will graduate from this course if at least have a good attitude. Attitude assessment also considers the activeness of students following lectures.

2. Final grades include the results of the assessment of knowledge, general skills, and special skills obtained from individual assignments, group assignments, presentations, quizzes, insert tests, and final semester examinations with the following guidelines

No	CO	Assessment Object	Assessment Technique	Weight
1	CO1-CO2	Active in class	Observation	15%
		Assignment	Rubric	
		Discussion	Observation	
		Presentation	Rubric	
2	CO3	Quiz	Test	50%
		Assignment	Rubric	
		Midterm	Test	
		Final Exam	Test	
		Presentation	Rubric	
3	CO4-CO5	Model the control system	Assignment	35%
		Calculate control system response characteristics manually	Test	
		Analyzing the control system with Matlab software	Assignment	
		Discussion	Rubric	
		Presentation	Rubric	
			Total	100%

Forms of media:	Board, LCD Projector, Laptop/Computer
Literature:	1 Ahmad Faozan Alfi, 2002, Dasar Sistem Kendali, Diktat Kuliah JPTE UNY. 2 Heru Dibyo Laksono, 2014, Sistem Kendali dengan MATLAB, Graha Ilmu. 3 Ogata, Katsuhiko, 1995, Teknik Kontrol Automatik, Erlangga. 4 Nise, S Norman, 2011, Control system Engineering, John Wolley & Sons 5 Dorf, Richard C, 2008, Modern Control Systems, Pearson Education International.
Date of revision	13 July 2018

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Computer Network Laboratory Work
Module level,if applicable:	Undergraduate
Code:	EKO6212
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	2^{nd}
Module coordinator:	Deny Budi Hertanto, M.Kom.
Lecturer(s):	Team
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	300 minutes lectures and 360 minutes structured activities per week.
Teaching and Learning Method	Discussion, Demonstration, and Lecturing
Workload:	Total workload is 272 hours per semester which consists of 300 minutes lectures, 360 minutes structured activities, and 360 minutes self-study per week for 16 weeks.

Credit points:	3
Prerequisites course(s):	-
Expected learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, practice the values, norms, and academic ethics.. ELO3 Capable to perform professional works in his/her field of expertise both individual and team works. ELO4 Master in basic sciences and principles of electric ELO7 Capable to manage vocational education and training of electrical engineering expertise by utilizing information and communications technology
Course outcomes:	CO1 Devoted to God Almighty and able to show a regius attitude, honest and patient. CO2 Demonstrates a responsible and independent attitude towards the assigned work. CO3 Knowledge of law and the basic theory of electricity. CO3.1 Understand the Basic Introduction to Computer Networks. CO3.2 Understand LAN Cabling. CO3.3 Understand Internet Protocol Addressing. CO3.4 Understand Subnetting. CO3.5 Understand Static Routing with the Packet Tracer Program. CO3.6 Understand Computer Network Design Using Switches and Routers CO4 Identifying and solving current and future problems in Electric Power Engineering or Industrial Automation using the laws and basic theories of electricity within a broader application framework. CO4.1 Resolve Basic Introduction to Computer Networks Problems. CO4.2 Able to make UTP network cable to connect computers in the Local Area Network. CO4.3 Resolve computer network addressing issues. CO4.4 Resolve subnetting issues. CO4.5 Resolve Static Routing Problems with the Packet Tracer Simulation Program. CO4.6 Complete the Design of Computer Networks with Configuring the Switch and Router.

<table>
<tr><td>ELO and CO mapping:</td><td>

	ELO1	ELO3	ELO4	ELO7
CO1	✓			
CO2		✓		
CO3			✓	
CO4				✓

</td></tr>
<tr><td>Courses Description:</td><td>Computer Networks are courses that are given so that students are able to explain the concept of computer networks and implement local computer networks based on the TCP / IP protocol. The material covered includes the basic concepts of networks, network topology, network layers and protocols, IP addressing and routing. Computer Network Subjects are courses that consist of Theory and Practice which in implementing learning are carried out together. Computer Networks are courses that are given so that students are able to explain the concept of computer networks and implement local computer networks based on the TCP / IP protocol. The material covered includes the basic concepts of networks, network topology, network layers and protocols, IP addressing and routing. Theory courses are held in odd semester, while Practice courses are conducted in even semester.</td></tr>
<tr><td>Assessment:</td><td>The assessment was carried out to measure all learning achievements, namely attitude attainment (CO1) dan (CO2), knowledge (CO3) and skills (CO4).

1. Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude compared to the attitude of students in general. The results of the attitude assessment are not a component of the student's final grade, but rather as one of the graduation requirements. Students will graduate from this course if at least have a good attitude. Attitude assessment also considers the activeness of students following lectures.

2. Final grades include the results of the assessment of knowledge, general skills, and special skills obtained from individual assignments, group assignments, presentations, quizzes, insert tests, and final semester examinations with the following guidelines</td></tr>
</table>

	<table><tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr><tr><td>1</td><td>CO2</td><td>Attitude (presence, activity, discipline, honesty)</td><td>Observation</td><td>10%</td></tr><tr><td rowspan="6">2</td><td rowspan="6">CO3-CO4</td><td>Online Exam</td><td>e-learning quiz</td><td>10%</td></tr><tr><td>Competence test 1</td><td>Written Test</td><td>10%</td></tr><tr><td>Competence test 2</td><td>Practice Test</td><td>15%</td></tr><tr><td>Competence test 3</td><td>Written Test</td><td>15%</td></tr><tr><td>Competence test 4</td><td>Simulation</td><td>20%</td></tr><tr><td>Competence test 5</td><td>Written, Simulation, and Interview Test</td><td>20%</td></tr><tr><td colspan="4">Total</td><td>100%</td></tr></table>
Forms of media:	Board, LCD Projector, Laptop/Computer
Literature:	1 Deny Budi Hertanto. 2014. Modul Jaringan Komputer. Bahan Pertkuliahan Teknik Elektro. Yogyakarta : FT UNY 2 Cisco Study Lab, 2008, Student Lab Manual, CCNA Networking Academy 3 Tanenbaum, Andrew, 2003, Jaringan Komputer, New York: Prenhallindo 4 Stalling, William, 2007, Jaringan Komputer, Jakarta: Salemba Teknika
Date of revision	13 July 2018

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Microprocessor System
Module level,if applicable:	Undergraduate
Code:	EKO6213
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	2nd
Module coordinator:	Dr. Moh. Khairudin
Lecturer(s):	Team
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	100 minutes lectures and 120 minutes structured activities per week.
Teaching and Learning Method	Discussion and Lecturing
Workload:	Total workload is 91 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes self-study per week for 16 weeks.

Credit points:	2
Prerequisites course(s):	-
Expected learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics. ELO3 Can carry out work in accordance with the professional field of expertise both individually and in teams. ELO4 Master in basic sciences and principles of electric. ELO5 Master in work standards, work methods, work implementations, and testing in electric power or industrial automation expertise. ELO7 Able to manage vocational education and training in the field of Electrical Engineering by utilizing information and communication technology.
Course outcomes:	CO1 Devoted to God Almighty and able to show a religious attitude, honest and patient. CO2 Demonstrates responsibility for work in their area of expertise independently. CO3 Knowledge of law and the basic theory of electricity. CO4 Knowledge of the preparation of scientific papers including work reports in accordance with scientific procedures based on data and information analysis. CO5 Knowledge of identifying, formulating and solving control systems in Electric Power Engineering or Industrial Automation. CO6 Identifying and solving current and future problems in Electric Power Engineering or Industrial Automation using the laws and basic theories of electricity within a broader application framework. CO7 Apply automation techniques for the purposes of electrical and renewable energy (magnetic contactors, power electronics, PLCs, and microcontrollers).

ELO and CO mapping:	<table><tr><th></th><th>ELO1</th><th>ELO3</th><th>ELO4</th><th>ELO5</th><th>ELO7</th></tr><tr><td>CO1</td><td>✓</td><td></td><td></td><td></td><td></td></tr><tr><td>CO2</td><td></td><td>✓</td><td></td><td></td><td></td></tr><tr><td>CO3</td><td></td><td></td><td>✓</td><td></td><td></td></tr><tr><td>CO4</td><td></td><td></td><td></td><td>✓</td><td></td></tr><tr><td>CO5</td><td></td><td></td><td></td><td></td><td>✓</td></tr><tr><td>CO6</td><td></td><td></td><td></td><td></td><td>✓</td></tr><tr><td>CO7</td><td></td><td></td><td></td><td></td><td>✓</td></tr></table>
Courses Description:	This course discusses the introduction of microprocessors or microcomputers, MPF-1 Z-80 Microprocessors, MPF-1 Microcontroller programming, Arithmetic and logic operations, MPF-1 functioning, parallel interface and interrupt techniques. Followed by discussing the microcontroller system which includes microcontroller system architecture, microcontroller minimum system, type of microcontroller, microcontroller programming, input and output ports, uploading programs to the microcontroller and microcontroller applications in electrical engineering systems

Assessment:

The assessment was conducted to measure all learning outcomes, namely attainment learning achievements CO 1 and CO 2; knowledge CO 3 and CO 4; and skills CO 5, CO 6, and CO 7.

1. Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude compared to the attitude of students in general. The results of the attitude assessment are not a component of the student's final grade, but rather as one of the graduation requirements. Students will graduate from this course if at least have a good attitude. Attitude assessment also considers the activeness of students following lectures.
2. Final grades include the results of the assessment of knowledge, general skills, and special skills obtained from individual assignments, group assignments, quizzes, Insertion Exams, and Final Examinations with the following guidelines.

No	CO	Assessment Object	Assessment Technique	Weight
1	CO1 and CO2	Attitude (presence, activity, discipline, honesty)	Observation	5%
2	CO3, CO4, CO5, CO6, and CO7	a. Assignment 1- 4	Written test	20%
		b. Project Assignment	Project accuracy	15%
		c. Quiz	Written test	20%
		d. Midterm exam	Written test	20%
		e. Final exams	Written test	20%
			Total	100%

Forms of media:	Board, LCD Projector, Laptop/Computer
Literature:	1 Gayenelly B. Grover & Francois Penichorex. (1993).The Acknowledgement of Z80, Barkeley : SYBEX Inc. 2 Andrianto, Heri. (2008). Pemrograman Mikrokontroler AVR ATMEGA 16 menggunakan Bahasa C (CodeVision AVR). Bandung: Informatika. 3 Atmel. (2008). ATMega16. Diakses pada tanggal 22 Juli 2013, dari http://www.atmel.com/images/doc2466.pdf. 4 Sigit Yatmono dkk, Z80 Simulator Media Belajar Simulasi, UNY Press, 2014.
Date of revision	13 July 2018

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Electrical Machinery
Module level,if applicable:	Undergraduate
Code:	EKO6314
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	2nd
Module coordinator:	Dr. Sukir, M.T.
Lecturer(s):	Team
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	150 minutes lectures and 180 minutes structured activities per week.
Teaching and Learning Method	Discussion and Lecturing
Workload:	Total workload is 136 hours per semester which consists of 150 minutes lectures, 180 minutes structured activities, and 180 minutes self-study per week for 16 weeks.

Credit points:	3
Prerequisites course(s):	-
Expected learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics ELO3 Capable to perform professional works in his/her field of expertise both individual and team works ELO4 Master in basic sciences and principles of electric ELO7 Capable to manage vocational education and training of electrical engineering expertise by utilizing information and communications technology
Course Outcomes:	CO1 Fear God Almighty and be able to show a religious attitude, honest and patient CO2 Demonstrates responsibility for work in their area of expertise independently CO3 Knowledge of the principles of Mathematics and Physics related to the principles of electricity. CO3.1 Understanding the principles of Mathematics in particular trigonometry, differentials, and integrals in electrical machines. CO3.2 Understanding the principles of Physics in particular rotating motion, torque, magnetic fields, Faraday's law, and Lorenz force in electric machines. CO4 Knowledge of law and the basic theory of electricity. CO4.1 Understanding direct current generator. CO4.2 Understanding direct current motor. CO4.3 Understand 1 phase transformer. CO4.4 Understand 3 phase transformer. CO4.5 Understand the measuring transformer. CO4.6 Understanding the alternating current motor is not synchronous. CO4.7 Understand the alternating current generator synchronously (alternator). CO4.8 Understand the alternating current motor synchronously.

CO5 Analyze and solve technical problems related to electrical engineering by applying the principles of Mathematics.

CO5.1 Apply mathematical principles, especially trigonometry, differentials, and integrals in electrical machines.
CO5.2 Solve technical problems of direct current motors.
CO5.3 Solve technical problems of phase I transformers.
CO5.4 Solve 3 phase transformer technical problems.
CO5.5 Solve technical problems of measuring transformers.
CO5.6 Solve technical problems of motor alternating current not synchronously.
CO5.7 Solve the technical problems of the motor alternating current.

CO6 Apply the theory of electricity generation in general and energy efficiency in the field of generation.

CO6.1 Apply the theory of direct current generator.
CO6.2 Apply the theory of alternating current generator synchronously (alternator).

ELO and CO mapping:

	ELO1	**ELO3**	**ELO4**	**ELO7**
CO1	✓			
CO2		✓		
CO3			✓	
CO4			✓	
CO5				✓
CO6				✓

Courses Description:

Electric Machine are courses that consist of Theory and Practice which in the implementation of learning are carried out separately. Theory courses are held in odd semester, while Practice courses are conducted in even semester. On this occasion only the description of the subject of Electric Machine Theory will be delivered, the Electric Machine Theory consists of 3 (three) sub materials, namely: (a). Direct Current Machine that strips about Generators and Motors. (b). Transformer that examines 1 (one) phase and 3 (three) phase power transformers, and special transformers. (c). Alternating Current

<table>
<tr><td></td><td>Machine that peels about a synchronous machine consisting of 3 phase and 1 phase induction motors. (b). Simultaneous (synchronous) engines which strip away alternators and synchronous motors. A summary of each sub-material includes: a set of equality, working principles, characteristics and simple analysis of each sub-material.</td></tr>
<tr><td>Assessment:</td><td>The assessment is carried out to measure all learning achievements, namely attainment learning achievements, namely: CLO 1 (A.1.1) and CLO 2 (A.3.2)), knowledge learning achievements, namely: CLO 3 (K.1.1) and CLO 4 (K 1.2) and the achievement of learning skills, namely: CLO 5 (S.1.6) and CLO 6 (S.2.10).

1. Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude than the attitude of students in general. The results of attitude assessment especially CLO 1 (A.1.1) do not become components of the student's final grade, but rather as one of the requirements for graduation, students will graduate from this course if they have a minimum of good attitude. However, for CLO 2 (A.3.2) included in the final assessment.

2. Final grades include the results of an assessment of knowledge, and skills obtained from individual assignments, group assignments, presentations, quizzes, insert tests, and final semester examinations with the following guidelines.

<table>
<tr><th>No</th><th>CO</th><th>Assessment Components</th><th>Assessment Technique</th><th>Percent</th></tr>
<tr><td>1</td><td>CO2</td><td>Attitude (presence, activity, discipline, honesty)</td><td>Observation</td><td>10%</td></tr>
<tr><td rowspan="4">2</td><td rowspan="4">CO3-CO4</td><td>Individual assignments</td><td>Individual task</td><td>15%</td></tr>
<tr><td>Group assignments</td><td>Group task</td><td>15%</td></tr>
<tr><td>Midterm exam</td><td>Written test</td><td>20%</td></tr>
<tr><td>Final exam</td><td>Written test</td><td>40%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table></td></tr>
<tr><td>Forms of media:</td><td>Board, LCD Projector, Laptop/Computer</td></tr>
<tr><td>Literature:</td><td>1 Sunyoto. 2014. Mesin Listrik Arus Searah. Bahan Pertkuliahan Teknik Elektro. Yogyakarta : FT UNY</td></tr>
</table>

	2 Sunyoto. Dkk. Mesin arus Searah. Modul Pembelajaran I. Yogyakarta : FT UNY 3 Sunyoto. 2015. Transformator. Bahan Pertkuliahan Teknik Elektro. Yogyakarta : FT UNY 4 Sunyoto, dkk. Transformator. Modul Pembelajaran II. Yogyakarta : FT UNY 5 Sunyoto. 2015 Mesin Listrik Arus Bolak-Balikr. Bahan Pertkuliahan Teknik Elektro. Yogyakarta : FT UNY 6 Austen Styigant (1981). The J&P Transformer Book. London, Butterworths 7 Jurek,ST (1976). Electrical Macine for techniciant and technician engineers. London : Longman 8 Theraja.BL (1980). Tex Book of electrical tecnology. New Delhi : Nirja 9 Wildi.T (1981). Electrical Power Technology. New York. John willy & Son
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3rd SEMESTER

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Civic Education
Module level,if applicable:	Undergraduate
Code:	MKU6207
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	3rd
Module coordinator:	Dr. Eny Kusdarini, S.H., M.Hum.
Lecturer(s):	Team
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	100 minutes lectures and 120 minutes structured activities per week.
Teaching and Learning Method	Discussion
Workload:	Total workload is 91 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes self-study per week for 16 weeks.
Credit points:	2
Prerequisites course(s):	-
Expected learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics ELO2 Demonstrate nationalism, responsibility, and tolerance to both society and environmet

	ELO3 Capable to perform professional works in his/her field of expertise both individual and team works
Course Outcomes:	CO1. Devoted to God Almighty and able to show a religious attitude, honest and patient CO2. Contribute to improving the quality of life in a society, nation, state, and advancement of civilization based on Pancasila CO2.1 Analyze the Nature and Objectives of Development of Citizenship Education in Higher Education CO3. Acting as proud and loving citizens of the country, having nationalism and a sense of responsibility to the country and nation CO3.1 Analyzing the Urgency of National Identity CO3.2 Analyzing the Implementation of National Integration CO3.3 Analyzing the shape of the Indonesian Constitution and Regulations under the Constitution CO3.4 Analyzing the Harmony of the Obligations and Rights of States and Citizens CO4. Respect the diversity of cultures, views, religions, and beliefs, as well as other people's original opinions or findings CO4.1 Analyzing Democracy sourced from Pancasila CO4.2 Analyzing Archipelago Insight CO5. Obey the law and discipline in social and state life CO5.1 Analyzing the Concept of Fair Law Enforcement CO5.2 Analyzing the Concepts and Challenges of National Defense and National Defense CO6. Demonstrates responsibility for work in their area of expertise independently CO6.1 Develop Citizenship Projects Regarding theContextual Issues of Citizenship Education in the context of Al Islam Kemuhammadiyahan

<table>
<tr><td>ELO and CO mapping:</td><td>
<table>
<tr><th></th><th>ELO1</th><th>ELO2</th><th>ELO3</th></tr>
<tr><td>CO1</td><td>✓</td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td>✓</td><td></td></tr>
<tr><td>CO3</td><td></td><td>✓</td><td></td></tr>
<tr><td>CO4</td><td></td><td>✓</td><td></td></tr>
<tr><td>CO5</td><td></td><td>✓</td><td></td></tr>
<tr><td>CO6</td><td></td><td></td><td>✓</td></tr>
</table>
</td></tr>
<tr><td>Courses Description:</td><td>This course contains basic concepts of insight and enthusiasm nationality, patriotism, democracy, legal awareness, respect for diversity and participation to build a nation based on Pancasila. Corresponding with its function, Citizenship Education organizes education nationality, democracy, law, multiculturalism and citizenship for students

in order to support the realization of citizens who are aware of their rights and obligations, and smart, skilled and character so that they can be relied on to build nation.</td></tr>
<tr><td>Assessment:</td><td>

Assessment is carried out to measure all learning achievements, namely attainment learning achievements (CO 1), (CO 2), (CO 3), (CO 4), (CO 5), and (CO 6).
Final scores include the results of general knowledge assessment obtained from individual assignments, group assignments, project citizens, Midterm Exams, and Final Semester Exams with the following guidelines.

<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td>1</td><td>CO1</td><td>Attitude (presence, activity, discipline, honesty)</td><td>Observation</td><td>15%</td></tr>
<tr><td rowspan="3">1</td><td rowspan="3">CO2, CO3, CO4, CO5, and</td><td>Duty</td><td>Article</td><td>20%</td></tr>
<tr><td>Project Citizen</td><td>Presentations and Papers</td><td>20%</td></tr>
<tr><td>Midterm exam</td><td>Written test</td><td>20%</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><td></td><td>
<table>
<tr><td></td><td>CO6</td><td>Final exams</td><td>Written test</td><td>25%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table>
</td></tr>
<tr><td>Forms of media:</td><td>Board, LCD Projector, Laptop/Computer</td></tr>
<tr><td>Literature:</td><td>Main Literature:
22. Sunarso, dkk. (2006). Pendidikan Kewarganegaraan. Yogyakarta: UNY Press.
23. Tim Penyusun. (2016). Pendidikan Kewarganegaraan Untuk Perguruan Tinggi. Jakarta: Direktorat Jenderal Pembelajaran dan Kemahasiswaan Kementerian Riset Teknologi Pendidikan Tinggi.
24. Taniredja, T. (2010). Pendidikan Kewarganegaraan di Perguruan Tinggi Muhammadiyah. Bandung: Alfabeta.

Supporting literature
1. Branson, MS. (1998). The Role of Civic Education. Calabasas: Center of Civic Education (CCE) diakses di http://civiced.org
2. Budimansyah, D dan Suryadi. K. (2008). PKn dan Masyarakat Multikultural. Bandung: SPS UPI Bandung
3. Cogan, J dan Derricot, R. (1998). Citizenship for The 21st Century International Perspective on Education. London: Kogan Page.
4. Hardiman, BF. 2011. Hak-Hak Asasi Manusia, Polemik dengan Agama dan Kebudayaan. Jakarta: Kanisius
5. Kaelan. (2002). Filsafat Pancasila, Pandangan Hidup Bangsa Indonesia. Yogyakarta: Paradigma.
6. Kranenburg. (1975). Ilmu Negara Umum. Jakarta: Pradnya Paramita.
7. Mahfud MD, M. (2001). Dasar dan Struktur Ketatanegaraan Indonesia. Jakarta: PT Rineka Cipta.
8. Mahfud MD, M. (2000). Demokrasi dan Konstitusi di Indonesia: Studi Tentang Interaksi Politik dan Kehidupan Ketatanegaraan. Jakarta: PT Rineka Cipta
9. Miriam Budiardjo. (1986). Dasar-dasar Ilmu Politik, Jakarta: PT. Gramedia, cet. X
10. Mohtar Mas’oed. (1999). Negara, Kapital dan Demokrasi, Yogyakarta: Pustaka Pelajar
11. Pranowo, MB. (2010). Multidimensi Ketahanan Nasional. Jakarta: Pustaka Alvabet
12. Riyanto, Astim, (2009). Teori Konstitusi. Bandung: Yapemdo.</td></tr>
</table>

	13. Sanusi, A. (2006). Model Pendidikan Kewarganegaraan Menghadapi Perubahan dan Gejolak Sosial. Bandung: CICED. 14. Surbakti, Ramlan. (2010). Memahami Ilmu Politik. Jakarta. Grasindo. 15. Suroyo, D. (2002). Integrasi Nasional dalam Perspektif Sejarah Indonesia. Pidato Pengukuhan Guru Besar Ilmu Sejarah pada Fakultas Sastra, Undip Semarang 16. Tilaar, HAR. (2007). MengIndonesia Etnisitas dan Identitas Bangsa Indonesia. Jakarta: PT Rineka Cipta. 17. Torres, Carlos Alberto. (1998). Democracy, Education, and Multiculturalism: Dilemmas of Citizenship in a Global Word. Roman and Littlefield publisher. 18. Undang-Undang Republik Indonesia Nomor 12 Tahun 2006 Tentang Kewarganegaraan 19. Undang-Undang Republik Indonesia Nomor 12 Tahun 2011 Tentang Tata Urutan aturan Perundang-Undangan di Indonesia 20. Undang-Undang Republik Indonesia Nomor 24 Tahun 2009 Tentang Bendera, Bahasa, dan Lambang Negara, serta Lagu Kebangsaan. 21. Undang-Undang Republik Indonesia Nomor 48 Tahun 2009 Tentang Kekuasaan Kehakiman. 22. Undang-Undang Republik Indonesia Nomor 3 tahun 2002 tentang Pertahanan Negara. 23. Wahab, A dan Sapriya. (2011). Teori dan landasan Pendidikan Kewarganegaraan. Bandung: Alfabeta. 24. Winataputra, US. (2001). Jati Diri Pendidikan Kewarganegaraan Sebagai Wahana Sistematik Pendidikan Demokrasi. Bandung: Disertasi SPS UPI Bandung.
Date of revision	6 July 2018

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Educational Psychology
Module level,if applicable:	Undergraduate
Code:	MDK6202
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	3rd
Module coordinator:	Dr. Ketut Ima Ismara, M.Pd., M.Kes.,
Lecturer(s):	Team
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	100 minutes lectures and 120 minutes structured activities per week.
Teaching and Learning Method	Discussion
Workload:	Total workload is 91 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes self-study per week for 16 weeks.
Credit points:	2
Prerequisites course(s):	-
Expected learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics. ELO2 Demonstrate nationalism, responsibility, and tolerance to both society and environmet

	ELO5 Mastering work standards, work methods, work implementation, and testing in the field of electric power engineering and industrial automation. ELO6 Capable to make plans, implement, and evaluate learning in electric power or industrial automation expertise
Course Outcomes:	CO1. Being pious to God Almighty and able to demonstrate religiousness, honesty, and patience. CO2. Contributing to the improvement of the quality of life in the community, the nation, the state, and the advancement of civilization based on Pancasila. CO3. Knowledge on developing scientific paper, including work report that is in line with scientific procedure based on the analysis, information, and data, and the ability to interpret and communicate in an accurate and accountable manner in order to solve problems and phenomena related to the occupation. CO4. Apply education management at school and training institution in the field of electrical engineering CO5 Manage the laboratory and workshop at training center and technology and vocational education according to the provisions of the work safety and health standards in the field of electrical engineering
ELO and CO mapping:	(see table below)
Courses Description:	Educational Psychology Lectures will develop contextual thinking (according to the characteristics of the study program) and develop elements of learning media and learning methods as learning resources based on information technology and / or computers. The main studies include: designing self success, getting to know yourself, learning strategies and realizing self success. It also examines the application of computer-based learning media will discuss the design of mind concept maps (mind mapping) with mindjet software. Lectures are carried out using problem based learning and project based learning

	ELO1	ELO2	ELO5	ELO6
CO1	✓			
CO2		✓		
CO3			✓	
CO4				✓
CO5				✓

<table>
<tr><td></td><td>methods. The final task of this lecture individually is to make a book about self-success design. Competency-based assessment involves active participation, and communication of interactions between individuals and groups.</td></tr>
<tr><td>Assessments:</td><td>

Assessment is carried out to measure all learning achievements, namely attainment learning achievements (CO 1), general skills (CO 2), knowledge (CO 3), and special skills (CO 4 and CO 5).
Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude compared to the attitude of students in general. The results of the attitude assessment are not a component of the student's final grade, but rather as one of the graduation requirements. Students will graduate from this course if at least have a good attitude. Attitude assessment also considers the activeness of students following lectures.
Final grades include the results of the assessment of knowledge, general skills, and special skills obtained from individual assignments, group assignments, presentations, quizzes, insert tests, and final semester examinations with the following guidelines.

<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td>1</td><td>CO2</td><td>Presentation</td><td>Observation</td><td>10%</td></tr>
<tr><td>2</td><td>CO3, CO4 and CO5</td><td>a. Individual assignments
b. tim assignments
c. quiz
d. Midterm exam
e. Final Exams</td><td>e. Accuracy of program results
f. Written</td><td>10%
10%
20%
20%
30%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table>
</td></tr>
<tr><td>Forms of media:</td><td>Board, LCD Projector, Laptop/Computer</td></tr>
<tr><td>Literature:</td><td>

Elliott et. al . 2000. Educational Psychology: Effective Teaching, Effective Learning, 3/e. New York: Mc Graw Hill, inc.
Howard E. Gardner. 2006. Multiple Intelligences: New Horizons in Theory and Practice.

</td></tr>
</table>

	3. Howard L. Kingsley. 1948. *The nature and conditions of learning*. New York: Prentice-Hall, inc. 4. Sardiman A.M . 2004. *Interaksi dan motivasi belajar mengajar*. Indonesia: Raja grafindo Persada. 5. Sri Esti Wuryani Djiwandono. 2006. *Psikologi Pendidikan revisi II*. Jakarta: Grasindo. 6. Thomas Amstrong. 2002. Sekolah Para Juara. ASCD.
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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Control Systems Laboratory Work
Module level,if applicable:	Undergraduate
Code:	EKO 6215
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	3rd
Module coordinator:	Ariadie Chandra Nugraha, M.T.
Lecturer(s):	Dr. Istanto Wahyu Djatmiko, M.Pd. Dr. Edy Supriyadi, M.Pd. Rustam Asnawi, Ph.D
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	The form of learning is in the form of lectures, which consist of 100 minutes of face-to-face activities per week per semester; (2) structured assignment activities 120 minutes per week per semester; and (3) 120 minutes of independent activities per week per semester.
Teaching and Learning Method	Discussion, Demonstration, and *Lecturing*
Workload:	Total workload is 26 hours 40 minutes of face-to-face activities per semester
Credit points:	2
Prerequisites course(s):	-
Expected learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics

	ELO3 Capable to perform professional works in his/her field of expertise both individual and team works ELO4 Master in basic sciences and principles of electric ELO5 Master in work standards, work methods, work implementations, and testing in electric power or industrial automation expertise. ELO6 Capable to make plans, implement, and evaluate learning in electric power or industrial automation expertise
Course Outcomes	CO1. Being pious to God Almighty and able to demonstrate religiousness, honesty, and patience. CO2. Demonstrating responsibility on the respective profession of expertise in an independent manner. CO3. Knowledge on the principles of Mathematics and Physics in relation to the principles of electrical power CO3.1 Students are able to explain a simple open loop control system with one sensor and one actuator. CO4. Knowledge on developing scientific paper, including work report that is in line with scientific procedure based on the analysis, information, and data, and the ability to interpret and communicate in an accurate and accountable manner in order to solve problems and phenomena related to the occupation. CO4.1 Students are able to explain the analysis of first order control system which is realized in the open loop control system to regulate motor speed. CO4.2 Students are able to explain the closed loop control system to control motor speed and position (servomechanism) and analyze the transient response and steady state of the system. CO4.3 Students are able to explain the characteristics of each parameter P (Proportional), I (Integral), and D (Derivative). CO5. Facilitate, assess, and implement the learning process and learning results in a professional manner, as well as building community partnership in the scope of vocational education in conducting duties of the teacher profession CO5.1 Students are able to assemble a simple open loop control system with one sensor and one

	actuator. CO5.2 Students are able to arrange a first-order control system which is realized in an open loop control system to regulate motor speed. CO5.3 Students are able to arrange a closed loop control system to control motor speed and position (servomechanism) and analyze the transient response and steady state conditions of the system. CO5.4 Students are able to arrange the PID control system.
ELO and CO mapping	<table><tr><th></th><th>ELO1</th><th>ELO3</th><th>ELO4</th><th>ELO5</th><th>ELO6</th></tr><tr><td>**CO1**</td><td>✓</td><td></td><td></td><td></td><td></td></tr><tr><td>**CO2**</td><td></td><td>✓</td><td></td><td></td><td></td></tr><tr><td>**CO3**</td><td></td><td></td><td>✓</td><td></td><td></td></tr><tr><td>**CO4**</td><td></td><td></td><td></td><td>✓</td><td></td></tr><tr><td>**CO5**</td><td></td><td></td><td></td><td></td><td>✓</td></tr></table>
Courses Description:	The Control System Practice is a practical course that aims to have students competing in explaining and assembling several types of control systems, including a simple open loop control system and closed loop control system for controlling motor speed and position (servomechanism). Students are expected to be able to explain the response of first and second order systems, both the transient response and the steady state of the system. Furthermore, students are expected to be able to assemble the PID control system and be able to explain the characteristics of each parameter P (Proportional), I (Integral), and D (Derivative). Lectures are carried out using the Project-Based Learning (PjBL) approach, which is that at each meeting each student must complete a practice unit that has been outlined in a worksheet (jobsheet / labsheet). Competency-based assessment by observing performance per week. The final exam is carried out to check competency per student where students must complete exam questions independently. In addition, the assessment also includes active individual participation and group cooperation during lectures.

<table>
<tr>
<td>Assessments</td>
<td>
The assessment was carried out to measure all learning outcomes, namely attainment learning achievements (CO 1 and CO 2), knowledge (CO 3 and CO 4), and special skills (CO 5).
1. Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude compared to the attitude of students in general. Attitude assessment also considers the activeness of students following lectures.
2. Final grades include the results of the attitude, knowledge and skills assessment obtained from individual assignments, group assignments, presentations, quizzes, Midterm Examinations, and Final Semester Exams with the following guidelines.
<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td>1</td><td>CO1</td><td>Assessment of attitude, presence, discipline, activeness</td><td>Observation</td><td>10%</td></tr>
<tr><td>2</td><td>CO2</td><td>Practice report, performance per practice, performance of Final Practice Exams</td><td>Observation</td><td>10%</td></tr>
<tr><td rowspan="4">3</td><td rowspan="4">CO3, CO4, and CO5</td><td>a. Performance per practice</td><td rowspan="4">Observation
Individual Practice Test (adapts to the technique used)</td><td>15%</td></tr>
<tr><td>b. Quiz</td><td>10%</td></tr>
<tr><td>c. Practice Report</td><td>20%</td></tr>
<tr><td>d. Final exams</td><td>35%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table>
.
</td>
</tr>
<tr><td>Forms of media:</td><td>Board, LCD Projector, Laptop/Computer</td></tr>
<tr><td>Literature:</td><td>11. Labsheet (lembar kerja praktikum) Praktik Sistem Kendali.</td></tr>
</table>

	12. Ahmad Faozan Alfi, 2002, *Dasar Sistem Kendali*, Diktat Kuliah JPTE UNY. 13. Heru Dibyo Laksono, 2014, *Sistem Kendali dengan MATLAB*, Graha Ilmu. 14. Ogata, Katsuhiko, 1995, *Teknik Kontrol Automatik*, Erlangga.
Date of revision	18 August 2018

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Microprocessor Systems Laboratory Work
Module level,if applicable:	Undergraduate
Code:	EKO 6216
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	3rd
Module coordinator:	Muh. Khairudin, MT., Ph.D
Lecturer(s):	Rustam Asnawi, Ph.D Dr. Edy Supriyadi, M.Pd. Totok Heru TM., M.Pd
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	The form of learning is in the form of lectures, which consist of 100 minutes of face-to-face activities per week per semester; (2) structured assignment activities 120 minutes per week per semester; and (3) 120 minutes of independent activities per week per semester.
Teaching and Learning Method	Discussion, Demonstration, and *Lecturing*
Workload:	Total workload is 26 hours 40 minutes of face-to-face activities per semester
Credit points:	2
Prerequisites course(s):	-

Expected learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics ELO3 Capable to perform professional works in his/her field of expertise both individual and team works ELO5 Master in work standards, work methods, work implementations, and testing in electric power or industrial automation expertise. ELO6 Capable to make plans, implement, and evaluate learning in electric power or industrial automation expertise ELO7 Capable to manage vocational education and training of electrical engineering expertise by utilizing information and communications technology
Course Outcomes	CO1. Being pious to God Almighty and able to demonstrate religiousness, honesty, and patience. CO2. Demonstrating responsibility on the respective profession of expertise in an independent manner. CO3. Knowledge on developing scientific paper, including work report that is in line with scientific procedure based on the analysis, information, and data, and the ability to interpret and communicate in an accurate and accountable manner in order to solve problems and phenomena related to the occupation. CO3.1 Explain the history and concept of microprocessors, microprocessor systems, Z-80 microprocessors, microcontrollers and microcontroller systems. CO4. Apply information and communication technology in conducting duties as instructor and educational staff CO4.1. Students understand the components of the Z-80 Microprocessor system, memory maps and addressing mode (data transfer). CO4.2 Students understand the structure and programming instructions of the Z-80 microprocessor CO4.3 Students understand arithmetic and logic programming and the function of Register Flag CO4.4 Students understand jumping and looping programming CO4.5 Students understand Stack Pointer (Push and

<table>
<tr><td></td><td>Pop) programming
CO4.6 Students understand Arduino Microcontroller programming and C language microcontroller system
CO4.7 Students understand the programming of digital data input and output on the Arduino microcontroller system
CO4.8 Students understand the concept of ADC and analog data acquisition in Arduino microcontroller
CO4.9 Students understand the concept of instructions and timers
CO5. Have full mastery of automation engineering for electrical power and renewable energy (magnetic contactor, electronic power PLC and microcontroller).
CO5.1 Students understand the application of a microcontroller on motor control</td></tr>
<tr><td>ELO and CO mapping</td><td>
<table>
<tr><th></th><th>ELO1</th><th>ELO3</th><th>ELO5</th><th>ELO 6</th><th>ELO7</th></tr>
<tr><td>CO1</td><td>✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td>✓</td><td></td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td>✓</td><td></td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td></td><td>✓</td></tr>
</table>
</td></tr>
<tr><td>Courses Description:</td><td>This course discusses the introduction of microprocessors or microcomputers, Zilog-80 Microprocessors, MPF-1 Microcontroller programming, various addressing modes, Arithmetic and logic operations, jump and loop operations, parallel interface and interrupt techniques. Followed by discussing the microcontroller system which includes microcontroller system architecture, microcontroller minimum system, type of microcontroller, microcontroller programming, input and output ports and microcontroller applications in electrical engineering systems.</td></tr>
</table>

<table>
<tr>
<td>Assessments</td>
<td>

Assessment is carried out to measure all learning achievements, namely attainment learning achievements (CO 1), general skills (CO 2), knowledge (CO 3), and special skills (CO 4 and CO 5).
Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude compared to the attitude of students in general. The results of the attitude assessment are not a component of the student's final grade, but rather as one of the graduation requirements. Students will graduate from this course if at least have a good attitude. Attitude assessment also considers the activeness of students following lectures.
Final grades include the results of the assessment of knowledge, general skills, and special skills obtained from individual assignments, group assignments, presentations, quizzes, insert tests, and final semester examinations with the following guidelines.

<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td>1</td><td>CO2</td><td>Presentaton</td><td>Observation</td><td>10%</td></tr>
<tr><td rowspan="4">2</td><td rowspan="4">CO3, CO4, and CO5</td><td>a. Individual assignments
b. Tim assignments</td><td>The effectiveness and efficiency of the program as well as the accuracy of the program results</td><td>10%
10%</td></tr>
<tr><td>c. Practicum report</td><td>Written</td><td>20%</td></tr>
<tr><td>d. Midterm exam</td><td>Written test design program</td><td>20%</td></tr>
<tr><td>e. Final exam</td><td>Z-80 programming ability test (Program effectiveness and efficiency)</td><td>30%</td></tr>
<tr><td colspan="3"></td><td>Total</td><td>100%</td></tr>
</table>
</td>
</tr>
<tr>
<td>Forms of media:</td>
<td>Board, LCD Projector, Laptop/Computer</td>
</tr>
<tr>
<td>Literature:</td>
<td>

Alan G.Smith. Introduction to Arduino. 2011, http://www.introtoarduino.com/downloads/IntroArduinoBook.pdf, downloaded: Aug 2018
Andrianto, Heri. (2008). Pemrograman Mikrokontroler AVR ATMEGA 16 menggunakan Bahasa C (CodeVision AVR). Bandung: Informatika.

</td>
</tr>
</table>

	3. Gayenelly B. Grover & Francois Penichorex. (1993).The Acknowledgement of Z80, Barkeley : SYBEX Inc. 4. Sigit Yatmono dkk, Z80 Simulator Media Belajar Simulasi, UNY Press, 2014. 5. Simon Monk, Programming Arduino Getting Started with Sketches, McGraw Hill Companies, 2012 6. Sriharsa, B. S., Zabiullah., Vishnu, S. B., & Sanju, V. (2016). Password protected locking system using arduino. BVICAM's Internasional Journal of Technology, 8(1), 959-964. 7. Tony Olsson. Arduino Wearable Projects. Packt Publishing, Birmingham-Mumbai. 2015 8. ---------, Z-80 Microprosesor Handbook, Zilog
Date of revision	18 August 2019

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Electrical Circuit Laboratory Work
Module level,if applicable:	Undergraduate
Code:	EKO6217
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	3rd
Module coordinator:	Faranita Surwi, S.T.,M.T.
Lecturer(s):	Rustam Asnawi, ST.,MT.,PhD.
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	The form of learning is in the form of lectures, which consist of 150 minutes of face-to-face activities per week per semester; (2) structured assignment activities 180 minutes per week per semester; and (3) 180 minutes of independent activities per week per semester.
Teaching and Learning Method	Discussion, Demonstration, and *Lecturing*
Workload:	Total workload is 53 hours 20 minutes of face-to-face activities per semester.
Credit points:	3
Prerequisites course(s):	-
Expected learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics ELO3 Capable to perform professional works in his/her field of expertise both individual and team works

	ELO4 Master in basic sciences and principles of electric ELO5 Master in work standards, work methods, work implementations, and testing in electric power or industrial automation expertise. ELO7 Capable to manage vocational education and training of electrical engineering expertise by utilizing information and communications technology
Course Outcomes	CO1. Being pious to God Almighty and able to demonstrate religiousness, honesty, and patience. CO2. Demonstrating responsibility on the respective profession of expertise in an independent manner. CO3. Knowledge on the law and basic theories of electricity. CO3.1 Understand the types of tools and materials used in practice CO3.2 Understand the use of electrical measuring devices used in practice. CO3.3 Understanding the Effect of RLC Loads on DC and AC sources CO3.4 Understanding the Node Analysis Method CO3.5 Understanding the Mesh Analysis Method CO3.6 Understanding Thevenin, Norton and Superposition Series Analysis Methods CO3.7 Understanding the Star-Triangle Connection System at the source. CO3.8 Understanding the 3 Phase Balanced and Unbalanced Power System CO3.9 Understanding the effect of frequency on series and parallel RLC loads CO3.10 Understanding the Parallel Series Resonance Method and Finding the Reactance Price CO3.11 Understanding impedance and admittance measurements CO3.12 Understand the transformation of star-triangles at weights CO4. Identify and solve current and future problems of electrical power engineering or industrial automation using the laws and basic theories of electricity in the scope of wider applications.

<table>
<tr><td></td><td>
CO4.1 Having the ability to choose the tools and materials used for practice
CO4.2 Having the ability to choose the measuring instrument used for practice
CO4.3 Understanding the Effect of RLC Loads on DC and AC sources
CO4.4 Understanding the Node Analysis Method
CO4.5 Understanding the Mesh Analysis Method
CO4.6 Understanding Thevenin, Norton and Superposition Series Analysis Methods
CO4.7 Understanding the Star-Triangle Connection System at the source.
CO4.8 Understanding the 3 Phase Balanced and Unbalanced Power System
CO4.9 Understanding the effect of frequency on series and parallel RLC loads
CO4.10 Understanding the Parallel Series Resonance Method and Finding the Reactance Price
CO4.11 Understanding impedance and admittance measurements
CO4.12 Understand the transformation of star-triangles at weights
</td></tr>
<tr><td>ELO and CO mapping</td><td>
<table>
<tr><th></th><th>ELO1</th><th>ELO3</th><th>ELO4</th><th>ELO5</th><th>ELO7</th></tr>
<tr><td>CO1</td><td>✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td>✓</td><td>✓</td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td>✓</td><td>✓</td></tr>
</table>
</td></tr>
<tr><td>Courses Description:</td><td>This course contains basic concepts of Electric Circuits develop competence intact (affective, knowl knowledge, and more on ket e rampilan practice) associated with the introduction of materials and power tools, load electricity RLC, the introduction and use of various electrical measurements of both DC and AC, various types of circuits DC and AC electricity , series, parallel and mixed circuits , charging and discharging inductors and capacitors, frequency effect on RL C series and parallel loads , resonance, star and triangle connections,phase sequence tests, measurement of 3 phase balanced and unbalanced load power, and power quality. Lectures carried out by demonstration, observation, practice, both individuals and groups. Competency-based assessment uses authentic assessments that cover : attendance, attitudes (piety,</td></tr>
</table>

<table>
<tr><td></td><td>participation , tidiness, cooperation, and work safety), knowledge and skills that are reflected in (group practice assignments, individual pre-practice reports , and competency tests (practice) as a whole individual al).</td></tr>
<tr><td>Assessments</td><td>

The assessment is carried out to measure all learning achievements, namely attainment learning achievements (CO 1 (A.1.1) and CO 2 (A.3.2)), knowledge (CO 3 (K.1.2)) and skills (CO 4 (S.2.7)).
Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude compared to the attitude of students in general. The results of the attitude assessment are not a component of the student's final grade, but rather as one of the graduation requirements. Students will graduate from this course if at least have a good attitude. Attitude assessment also considers the activeness of students following lectures.
Final scores include the results of the assessment of knowledge, general skills, and special skills obtained from individual assignments, group assignments, presentations, quizzes, insert tests, and final semester examinations with the following guidelines.

<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td>1</td><td>CO2</td><td>Attitude (presence, activity, discipline, honesty)</td><td>Observation</td><td>10%</td></tr>
<tr><td rowspan="3">2</td><td rowspan="3">CO3 and CO4</td><td>Implementation of lectures and practice reports</td><td>Rubric assessment of the implementation of lectures and reports</td><td>40%</td></tr>
<tr><td>Midterm exam</td><td rowspan="2">Practice Exam Questions</td><td>20%</td></tr>
<tr><td>Final exams</td><td>30%</td></tr>
<tr><td colspan="3"></td><td>Total</td><td>100%</td></tr>
</table>
</td></tr>
<tr><td>Forms of media:</td><td>Board, LCD Projector, Laptop/Computer</td></tr>
<tr><td>Literature:</td><td>

Kerchner & Corcoran. (1977). Alternating Current Circuit. New York: John Willey & Son. Chapter VI, VII, VIII, IX.
Mussama, Imam Mustholiq. Pegangan Kuliah Dasar Listrik, Listrik DC. Yogyakarta: FT UNY (tidak dipublikasikan).
Mussama, Imam Mustholiq. Pengukuran Listrik, Jilid 2. Yogyakarta: FT UNY (tidak dipublikasikan).

</td></tr>
</table>

	4. Ridsdale. (1984) *Elecetrical Circuits for Engineering.* New York: McGrawHill. Part Two. Chapter 7. 5. Wildi, Theodore. (2002). *Electrical Machines, Drives, and Power Systems*. Ohio: Prentice Hall. Part IV. Chapter 30. 6. ...., Buku Panduan Praktik Matakuliah Dasar Listrik. Yogyakarta: Jurusan Pendidikan Teknik Elektro FT UNY. 7. ...., (2012). Power Systems Protection, Power Quality, and Substation Automation. IDC Technologies & bookboon.com
Date of revision	18 August 2018

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Electric Machinery Laboratory Work
Module level,if applicable:	Undergraduate
Code:	EKO6218
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	3^{rd}
Module coordinator:	Drs. Sukir, M.T.
Lecturer(s):	Team
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	300 minutes lectures and 360 minutes structured activities per week.
Teaching and Learning Method	Lecture, Discussion, Practicum, Question and Answer
Workload:	Total workload is 272 hours per semester which consists of 300 minutes lectures, 360 minutes structured activities, and 360 minutes self-study per week for 16 weeks.
Credit points:	3
Prerequisites course(s):	-
Expected Learning Courses:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics ELO3 Capable to perform professional works in his/her field of expertise both individual and team works ELO4 Master in basic sciences and principles of electric

	ELO5 Master in work standards, work methods, work implementations, and testing in electric power or industrial automation expertise. ELO7 Capable to manage vocational education and training in the field of Electrical Engineering by utilizing information and communication technology. ELO9 Capable to develop a vocational education innovation and publish scientific paper.
Course Outcomes	CO1. Being pious to God Almighty and able to demonstrate religiousness, honesty, and patience. CO2. Demonstrating responsibility on the respective profession of expertise in an independent manner. CO3. Knowledge on the law and basic theories of electricity. CO3.1 Understanding direct current generator. CO3.2 Understanding direct current motor. CO3.3 Understand 1 phase transformer. CO3.4 Understanding 3 phase transformer. CO3.5 Understanding the alternating current motor is not synchronous. CO3.6 Understand the alternating current generator synchronously (alternator). CO3.7 Understand the alternating current motor synchronously. CO4. Knowledge on developing scientific paper, including work report that is in line with scientific procedure based on the analysis, information, and data, and the ability to interpret and communicate in an accurate and accountable manner in order to solve problems and phenomena related to the occupation. CO5. Analyze and solve regular technical problems in relation to electrical power engineering by applying the principles of mathematics, physics, and chemistry CO5.1 Solve technical problems of direct current motors. CO5.2 Solve technical problems of phase I transformers. CO5.3 Solve 3 phase transformer technical problems.

CO5.4	Solve technical problems of motor alternating current not synchronously.
CO5.5	Solve technical problems of the motor alternating current.
CO6.	Have full understanding on the general theory of electrical power plant and energy efficiency.
CO6.1	Apply the theory of direct current generator.
CO6.2	Apply the theory of alternating current generator synchronously (alternator).
CO7.	Apply electrical theories (single line diagram, wiring diagram, the laws of electricity, and electrical circuit).
CO7.1	Arranging electric measuring devices.
CO7.2	Reading electric measuring devices.
CO8.	Apply electrical power engineering safety system for safety of the equipment as well as user health and safety.
CO8.1	Apply Safety, security and health in practical trials.
CO9.	Develop scientific paper report that meets the scientific procedure based on analysis information and data, as well as interpret and communicate in an accurate and accountable manner to solve problems and issues related to the occupation
CO9.1	Prepare a practice report in accordance with established rules.

ELO and CO mapping

	ELO1	ELO3	ELO4	ELO5	ELO7	ELO9
CO1	✓					
CO2		✓				
CO3			✓			
CO4				✓		
CO5					✓	
CO6					✓	
CO7					✓	
CO8					✓	
CO9						✓

<table>
<tr><td>Courses Description:</td><td>This course gives experience about attitudes related to devotion to God, the practice of values, norms, and academic ethics, and can carry out work in accordance with professional fields of expertise both individually and in teams. In addition, this course also provides knowledge experience about mastering basic science and basic electricity, and skills related to being able to manage vocational education and training in the field of Electrical Engineering by utilizing information and communication technology. The study material discussed in this course includes: the application of the principles of Mathematics and Physics in electric machines, direct current generators, direct current motors, 1 phase transformers, 3 phase transformers, measuring transformers, non-synchronous alternating current motors, alternating current generator (alternator), and synchronous motor. The study of each material includes: a set of equality, working principles, characteristics, technical analysis, and application of each material.</td></tr>
<tr><td>Assessments:</td><td>The assessment was conducted to measure all learning outcomes, namely attainment learning achievements (CO 1 and CO 2), knowledge (CO 3 and CO 4), special skills (CO 5, CO 6, CO 7, and CO 8), and general skills (CO 9).

Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude compared to the attitude of students in general. Attitude assessment also considers the activeness of students following lectures.
Final scores include the results of the assessment of attitudes, knowledge, and skills obtained from observations of practice implementation, individual assignments in the form of practice reports, midterm individual practice exams, and end-semester individual practice exams, with the following assessment guidelines.

<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td>1</td><td>CO1 and CO2</td><td>Assessment of religious attitudes, presence, discipline, and activeness</td><td>Observation</td><td>10%</td></tr>
<tr><td>2</td><td>CO3, and</td><td>Individual assignments in</td><td>Assignment</td><td>20%</td></tr>
</table>
</td></tr>
</table>

	CO4	the form of practice reports.		
3	CO5, CO6, CO7, CO8, and CO9	The process of implementing practice.	Observation	20%
		Individual Mid Semester practice exams	Practice Test.	25%
		End of semester individual practice exams.	Practice Test.	25%
			Total	100%

Forms of media:	Board, LCD Projector, Laptop/Computer
Literature:	1. Sunyoto. 2017. *Diktat Mesin Listrik*. Yogyakarta: Fakultas Teknik Universitas Negeri Yogyakarta. 2. Theraja, B.L., & Theraja, A.K. 2017. *A Textbook of Electrical Technology in S.I. Units Volume 1: Basic Electrical Engineering*. New Delhi: S. Chand. 3. Theraja, B.L., & Theraja, A.K. 2017. *A Textbook of Electrical Technology in S.I. Units Volume 2: AC & DC Machines*. New Delhi: S. Chand. 4. Styigant, A. 2012. *The J&P Transformer Book*. London: Butterworths. 5. Jurek, S.T. 2010. *Electrical Macine for Techniciant and Technician Engineers*. London : Longman.
Date of revision	31 August 2018

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Power Electronics
Module level,if applicable:	Undergraduate
Code:	EKO6219
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	3rd
Module coordinator:	Dr. Istanto Wahyu Djatmiko, M.Pd.
Lecturer(s):	Muhammad Ali, M.T. Drs. Sunomo, M.T.
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	The form of learning is in the form of lectures, which consist of 100 minutes of face-to-face activities per week per semester; (2) structured assignment activities 120 minutes per week per semester; and (3) 120 minutes of independent activities per week per semester.
Teaching and Learning Method	Discussion, Demonstration, and *Lecturing*
Workload:	Total workload is 26 hours 40 minutes of face-to-face activities per semester
Credit points:	2
Prerequisites course(s):	-
Expected learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics

<table>
<tr><td></td><td>ELO3 Capable to perform professional works in his/her field of expertise both individual and team works
ELO5 Master in work standards, work methods, work implementations, and testing in electric power or industrial automation expertise.
ELO6 Capable to make plans, implement, and evaluate learning in electric power or industrial automation expertise</td></tr>
<tr><td>Course Outcomes</td><td>CO1. Being pious to God Almighty and able to demonstrate religiousness, honesty, and patience.
CO2. Embodying the spirit of independence, struggle, and entrepreneurship.
CO3. Knowledge on the principles of Mathematics and Physics in relation to the principles of electrical power
CO4. Knowledge on the law and basic theories of electricity.
CO5. Apply education management at school and training institution in the field of electrical engineering
CO6. Manage the laboratory and workshop at training center and technology and vocational education according to the provisions of the work safety and health standards in the field of electrical engineering</td></tr>
<tr><td>ELO and CO mapping</td><td><table><tr><th></th><th>ELO1</th><th>ELO3</th><th>ELO5</th><th>ELO6</th></tr><tr><td>CO1</td><td>✓</td><td></td><td></td><td></td></tr><tr><td>CO2</td><td></td><td>✓</td><td></td><td></td></tr><tr><td>CO3</td><td></td><td></td><td>✓</td><td></td></tr><tr><td>CO4</td><td></td><td></td><td>✓</td><td></td></tr><tr><td>CO5</td><td></td><td></td><td></td><td>✓</td></tr><tr><td>CO6</td><td></td><td></td><td></td><td>✓</td></tr></table></td></tr>
<tr><td>Courses Description:</td><td>This course discusses the conversion of electronic-based energy for the purposes of controlling large power electric equipment. This course material covers: the concept of power electronics, power electronics components, AC / DC conversion circuits (rectifier & converter), AC / AC (ac regulator & cycloconverter), DC / DC (chopper), DC / AC (inverter), applications PSpice in power electronics, and industrial drives and applications. Lectures are carried out</td></tr>
</table>

<table>
<tr><td></td><td>using the student center learning approach with problem based learning strategies. Competency-based assessment involves active participation in lectures, quizzes, midterm insertions, and final semester exams.</td></tr>
<tr><td>Assessments</td><td>

Assessment is carried out to measure all learning achievements, namely attainment learning achievements (CO 1 & 2), knowledge (CO 3 & 4), and special skills (CO 5 & 6).
Attitude assessment is carried out through direct observation of each student at each lecture meeting, including: attendance, discipline, personal and interpersonal interaction. This attitude assessment categories, namely: "Very Good", "Good", and "Less Good". The minimum attitude value is included in the "Good" category. By using observation and / or self-assessment techniques using the assumption that basically every student has a good attitude. The results of this attitude assessment are used as a consideration for determining the final assessment of this course.
The final grade includes the results of the knowledge assessment, and the specific skills obtained from individual assignments, group assignments, presentations, quizzes, insert tests, and final semester examinations are determined as follows.

<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td>1</td><td>CO1 and CO2</td><td>Attendance & discipline</td><td>Observation</td><td>5%</td></tr>
<tr><td rowspan="6">2</td><td rowspan="6">CO3, CO4, CO5, and CO6</td><td>Individual assignments</td><td rowspan="6">a. Accuracy of program results
b. written</td><td>10%</td></tr>
<tr><td>Tim assignments</td><td>5%</td></tr>
<tr><td>Quiz</td><td>15%</td></tr>
<tr><td>Midterm exam</td><td>20%</td></tr>
<tr><td>Insert Exam 2</td><td>20%</td></tr>
<tr><td>Final exam</td><td>25%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table>
</td></tr>
<tr><td>Forms of media:</td><td>Board, LCD Projector, Laptop/Computer</td></tr>
<tr><td>Literature:</td><td>1. Djatmiko, I.W. (2017). Elektronika Daya dan Penggerak (Drive) Elektrik Motor Listrik Berbantuan PSpice. Yogyakarta: UNY Press.</td></tr>
</table>

	2. Hart, DW. (2011). *Power Electronics*. New York: The McGraw-Hill Companies, Inc. 3. Hughes, A. (2006). *Electric Motors and Drives, 3rd Edition*. Burlington: Newnes 4. Polka, D. (2003). *Motor & Drives: A Practical Technology Guide.* North Carolina: The Instrumentation, Systems, and Automation Society. 5. Rashid, MH. (2011). Power Electronics Handbook: Devices, circuits, and applications, Third Edition. Oxford: Elsevier, Inc. 6. Singh, MD & Khanchandani, KB. (2007)). *Power Electronics*, Second Edition. New Delhi: Tata McGraw-Hill Publishing Company Limited.
Date of revision	18 August 2018

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Commercial Electricity Installation
Module level,if applicable:	Undergraduate
Code:	EKO6220
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	3rd
Module coordinator:	Dr. Djoko Laras Budiyo Taruno.
Lecturer(s):	1. Dr. Dra. Zamtinah, M.Pd. 2. Ir. Alex Sandria Jaya Wardhana, M.Eng
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	100 minutes lectures and 120 minutes structured activities per week.
Teaching and Learning Method	Discussion, Demonstration, and *Lecturing*
Workload:	Total workload is 91 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes self-study per week for 16 weeks.
Credit points:	2
Prerequisites course(s):	-
Expected learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics

	ELO2 Demonstrate nationalism, responsibility, and tolerance to both society and environmet ELO4 Master in basic sciences and principles of electric ELO5 Master in work standards, work methods, work implementations, and testing in electric power or industrial automation expertise. ELO6 Capable to make plans, implement, and evaluate learning in electric power or industrial automation expertise
Course Outcomes	CO1. Being pious to God Almighty and able to demonstrate religiousness, honesty, and patience. CO2. Demonstrating responsibility on the respective profession of expertise in an independent manner. CO3. Knowledge on the principles of Mathematics and Physics in relation to the principles of electrical power CO3.1 Mastering the concept of need identification and analysis in an electrical installation system CO3.2 Understand the principles of electricity and its relation to the operation and analysis of the electric power system. CO4. Knowledge on the law and basic theories of electricity. CO4.1 Understanding the components of the electric power system. CO4.2 Understanding the modeling of electric power systems with a Single Line Diagram. CO4.3 Understanding the types of interference in the electric power system CO4.4 Understanding load flow in electric power systems CO4.5 Understand short circuit interference in electric power systems CO4.6 Understand the improvement of power factors and voltage profiles in the electric power system CO4.7 Understand losses in the electric power system CO4.8 Understand prinsip of power system optimization principles CO5. Apply education management at school and training institution in the field of electrical engineering

	CO5.1 Apply mathematical principles especially diagrams, vectors, linear equations, and numerical calculations in power system problems. CO5.2 Model an electric power system in the form of a single line diagram CO5.3 Analyzing interference in the electric power system. CO5.4 Analyzing load flow on an electric power system. CO5.5 Analyze improvements in power factor and voltage profile on the electric power system CO5.6 Designing protection system coordination in the electric power system
ELO and CO mapping	see table below
Courses Description:	This course contains basic concepts of commercial electricity installations. Coverage of materials in this course covers materials and equipment for commercial electrical installations, protection systems, installation and applicable installation requirements, wiring diagrams and one line for commercial electrical installations, lighting and power installations in commercial buildings, designation of users and users and panels, systems earth and lightning rods in Indonesia and the commissioning test.
Assessments	1. Assessment is carried out to measure all learning achievements, namely attainment learning achievements (CO 1 & 2), knowledge (CO 3 & 4), and special skills (CO 5). 2. Attitude assessment is carried out through direct observation of each student at each lecture meeting, including: attendance, discipline, personal and interpersonal interaction. This attitude assessment categories, namely: "Very Good", "Good", and "Less Good". The minimum attitude value is included in the "Good" category. By using observation and / or self-assessment techniques using the assumption that basically every student has a good attitude. The results of this attitude assessment are used as a consideration for determining the final assessment of this course.

ELO and CO mapping:

	ELO1	ELO2	ELO4	ELO5	ELO6
CO1	✓				
CO2		✓			
CO3			✓		
CO4				✓	
CO5					✓

<table>
<tr>
<td></td>
<td>
3. The final grade includes the results of the knowledge assessment, and the specific skills obtained from individual assignments, group assignments, presentations, quizzes, insert tests, and final semester examinations are determined as follows.
<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td rowspan="4">1</td><td rowspan="4">CO1, CO2, CO3, CO4, and CO5</td><td>Attendance</td><td>Documentation</td><td>10%</td></tr>
<tr><td>Assignment</td><td>Presentation / written test</td><td>40%</td></tr>
<tr><td>Midterm Exam</td><td>Presentation / written test</td><td>20%</td></tr>
<tr><td>Final Exam</td><td>Presentation / written test</td><td>30%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table>
</td>
</tr>
<tr><td>Forms of media:</td><td>Board, LCD Projector, Laptop/Computer</td></tr>
<tr><td>Literature:</td><td>
1. Scheneider Electric Indonesia. (2002). Panduan Aplikasi Teknis. PT. Scheneider Indonesia.
2. Ir. Imam Sugandi, dkk. Panduan Instalasi Listrik Untuk Rumah. Yayasan Usaha Penunjang Tenaga Listrik: Jakarta.
3. John Wiley & Sons. (2000). Electrical Installation Handbook. Publicis MCD Verlag: Munich.
4. Robert L. Smith & Stephen L. Herman. (2002). Electrical Wiring Industrial 7th Edition. Delmar.
5. Ray C. Mullin & Robert L. Smith. (2002). Electrical Wiring Commercial 7th Edition. Delmar.
</td></tr>
<tr><td>Date of revision</td><td>18 August 2018</td></tr>
</table>

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Commercial Electricity Installation Lab. Work
Module level,if applicable:	Undergraduate
Code:	EKO6221
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	3^{rd}
Module coordinator:	Dr. Djoko Laras Budiyo Taruno.
Lecturer(s):	1. Ir. Alex Sandria Jaya Wardhana, M.Eng 2. Ahmad Raditya Cahya Baswara, S.T., M.Eng.
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	200 minutes lectures and 240 minutes structured activities per week.
Teaching and Learning Method	Lecture, Discussion, Practicum, Question and Answer
Workload:	Total workload is 181 hours per semester which consists of 200 minutes lectures, 240 minutes structured activities, and 240 minutes self-study per week for 16 weeks.
Credit points:	2
Prerequisites course(s):	-
Expected learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics. ELO3 Capable to perform professional works in his/her field of expertise both individual and team works

	ELO5 Master in work standards, work methods, work implementations, and testing in electric power or industrial automation expertise. ELO7 Capable to manage vocational education and training in the field of Electrical Engineering by utilizing information and communication technology
Course Outcomes	CO1. Being pious to God Almighty and able to demonstrate religiousness, honesty, and patience. CO2. Demonstrating responsibility on the respective profession of expertise in an independent manner. CO3. Knowledge on developing scientific paper, including work report that is in line with scientific procedure based on the analysis, information, and data, and the ability to interpret and communicate in an accurate and accountable manner in order to solve problems and phenomena related to the occupation. CO3.1 Understand the characteristics and working principles of the components used in industrial electrical installations CO3.2 Mastering the concept of using measurement instruments used in commercial electrical installations CO4 Have full mastery and apply maintenance and repairmen methods for electrical power or industrial automation system. CO4.1 Arranging the motor control system 1 phase direct online system on the control panel box CO4.2 Arranging the control system reverses the direction of rotation of the motor 1 phase on the panel box (fwd-rev) manually and automatically CO4.3 Makes and applies a variety of lighting installation systems to commercial electrical installations CO5 Have full mastery of automation engineering for electrical power and renewable energy (magnetic contactor, electronic power PLC and microcontroller); CO5.1 Measuring light intensity and analyzing the measurement results CO5.2 Conduct measurements of ground resistance and conduct an analysis of the measurement results

ELO and CO mapping:	<table><tr><th></th><th>ELO1</th><th>ELO3</th><th>ELO5</th><th>ELO7</th></tr><tr><td>CO1</td><td>✓</td><td></td><td></td><td></td></tr><tr><td>CO2</td><td></td><td>✓</td><td></td><td></td></tr><tr><td>CO3</td><td></td><td></td><td>✓</td><td></td></tr><tr><td>CO4</td><td></td><td></td><td></td><td>✓</td></tr><tr><td>CO5</td><td></td><td></td><td></td><td>✓</td></tr></table>
Courses Description:	This course practices the application of industrial electrical installations ranging from safety systems to system automation in electrical installations in industry. The scope of material in this course covers the identification of electrical components commonly used in industry, motor control of 3 phases both manually and automatically, improvement of power factor using bank capacitors either by manual or automatic settings, automatic main failure as main network backup (PLN) when automatic and relay based shutdown, 20 kv medium voltage protection system and industrial installation based on programmable logic control (PLC).
Assessments:	1. Assessment is carried out to measure all learning achievements, namely attainment learning achievements (CO 1), general skills (CO 2), knowledge (CO 3), and special skills (CO 4 and CO 5). 2. Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude compared to the attitude of students in general. The results of the attitude assessment are not a component of the student's final grade, but rather as one of the graduation requirements. Students will graduate from this course if at least have a good attitude. Attitude assessment also considers the activeness of students following lectures. 3. Final grades include the results of the assessment of knowledge, general skills, and special skills obtained from individual assignments, group assignments, presentations, quizzes, insert tests, and final semester examinations with the following guidelines. <table><tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr><tr><td>1</td><td>CO2</td><td>Presentation</td><td>Observation</td><td>10%</td></tr><tr><td>2</td><td>CO3, CO4, and</td><td>Individual assignments</td><td>Accuracy of program results</td><td>10%</td></tr></table>

	<table><tr><td></td><td>CO5</td><td>Tim assignments</td><td>Accuracy of program results</td><td>10%</td></tr><tr><td></td><td></td><td>Quiz</td><td>written</td><td>20%</td></tr><tr><td></td><td></td><td>Midterm exam</td><td>written</td><td>20%</td></tr><tr><td></td><td></td><td>Final exam</td><td>written</td><td>30%</td></tr><tr><td colspan="3"></td><td>Total</td><td>100%</td></tr></table>
Forms of media:	Board, LCD Projector, Laptop/Computer
Literature:	1. Tim Instalasi. Jobsheet Praktik Instalasi Listrik Komersial. 2. Ir. Imam Sugandi, dkk. Panduan Instalasi Listrik Untuk Rumah. Yayasan Usaha Penunjang Tenaga Listrik: Jakarta. 3. John Wiley & Sons. (2000). Electrical Installation Handbook. Publicis MCD Verlag: Munich. 4. Ray C. Mullin & Robert L. Smith. (2002). Electrical Wiring Commercial 7th Edition. Delmar. 5. Ronald P. O'Riley. (1988). Electrical Grounding. Delmar Publishesrs Inc. 6. Scheneider Electric Indonesia. (2002). Panduan Aplikasi Teknis. PT. Scheneider Indonesia.
Date of revision	09 July 2019

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Occupational Health And Safety
Module level,if applicable:	Undergraduate
Code:	KTF6207
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	3rd
Module coordinator:	Dr. Ketut Ima Ismara, M.Pd, M.Kes
Lecturer(s):	1. Dr. phil Nurhening Yuniarti, S.Pd.,M.T.
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	100 minutes lectures and 120 minutes structured activities per week.
Teaching and Learning Method	Lecture, Discussion, Question and Answer
Workload:	Total workload is 91 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes self-study per week for 16 weeks.
Credit points:	2
Prerequisites course(s):	-
Expected learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics ELO3 Capable to perform professional works in his/her field of expertise both individual and team works

<table>
<tr><td></td><td>ELO5 Master in work standards, work methods, work implementations, and testing in electric power or industrial automation expertise.
ELO6 Capable to make plans, implement, and evaluate learning in electric power or industrial automation expertise.</td></tr>
<tr><td>Course Outcomes</td><td>CO1. Being pious to God Almighty and able to demonstrate religiousness, honesty, and patience.
CO2. Contributing to the improvement of the quality of life in the community, the nation, the state, and the advancement of civilization based on Pancasila.
CO3. Knowledge on developing scientific paper, including work report that is in line with scientific procedure based on the analysis, information, and data, and the ability to interpret and communicate in an accurate and accountable manner in order to solve problems and phenomena related to the occupation.
CO4. Apply education management at school and training institution in the field of electrical engineering
CO5. Manage the laboratory and workshop at training center and technology and vocational education according to the provisions of the work safety and health standards in the field of electrical engineering</td></tr>
<tr><td>ELO and CO mapping:</td><td><table>
<tr><th></th><th>ELO1</th><th>ELO3</th><th>ELO5</th><th>ELO6</th></tr>
<tr><td>CO1</td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td>✓</td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td>✓</td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td>✓</td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td>✓</td></tr>
</table></td></tr>
<tr><td>Courses Description:</td><td>This course discusses OHS Management based on the theories that are already available, analyzing the risk of work accidents by existing methods, and then making materials for analyzing examples of work accidents in the electric and heavy equipment fields to achieve safe conditions (safety workplace) .</td></tr>
</table>

<table>
<tr>
<td>Assessments:</td>
<td>

Assessment is carried out to measure all learning achievements, namely attainment learning achievements (CO 1), general skills (CO 2), knowledge (CO 3), and special skills (CO 4 and CO 5).
Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude compared to the attitude of students in general. The results of the attitude assessment are not a component of the student's final grade, but rather as one of the graduation requirements. Students will graduate from this course if at least have a good attitude. Attitude assessment also considers the activeness of students following lectures.
Final grades include the results of the assessment of knowledge, general skills, and special skills obtained from individual assignments, group assignments, presentations, quizzes, insert tests, and final semester examinations with the following guidelines.

<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td>1</td><td>CO2</td><td>Presentation</td><td>Observation</td><td>10%</td></tr>
<tr><td rowspan="5">2</td><td rowspan="5">CO3, CO4, and CO5</td><td>Individual assignments</td><td>Written</td><td>10%</td></tr>
<tr><td>Tim assignments</td><td>Liveliness of the discussion</td><td>10%</td></tr>
<tr><td>Searching Assignments</td><td>Papers</td><td>20%</td></tr>
<tr><td>Midterm exam</td><td>Papers</td><td>20%</td></tr>
<tr><td>Final exam</td><td>Papers</td><td>30%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table>
</td>
</tr>
<tr>
<td>Forms of media:</td>
<td>Board, LCD Projector, Laptop/Computer</td>
</tr>
<tr>
<td>Literature:</td>
<td>

International Labour Organization (ILO). 2014. Safety and Health at Work: A Vision for Sustainable Prevention. Jerman: ILO.
Ismara Ima, Eko Prianto, 2016. Keselamatan dan Kesehatan Kerja di Bidang Kelistrikan_Electrical Safety. solo: ADIMEKA.

</td>
</tr>
</table>

	3. Ismara Ima, Eko Priyanto. 2017. Bagaimanakah Agar Laboratorium dan Bengkel Pendidikan Vokasi menjadi NYAMAN, SELAMAT dan SEHAT?. Yogyakarta:Unypress. 4. Ismara Ima, dkk. 2018. Prinsip-Prinsip Keselamatan dan Kesehatan Kerja dalam LKS SMK. Yogyakarta: Kemendikbud. 5. John Ridley. (2008). Ikhtisar Kesehatan dan Keselamatan Kerja Edisi Ketiga. Jakarta: Erlangga. 6. Tim K3 FT UNY. 2014. Buku Ajar Keselamatan dan Kesehatan Kerja FT UNY. Yogyakarta: UNY Press.
Date of revision	09 July 2018

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Educational Socio-Antropology
Module level,if applicable:	Undergraduate
Code:	MDK6204
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	3^{rd}
Module coordinator:	Dr. Ariefa Efianingrung, M.Si
Lecturer(s):	1. Dr. Ariefa Efianingrung, M.Si 2. Datu Jatmiko, M.A
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	100 minutes lectures and 120 minutes structured activities per week.
Teaching and Learning Method	Discussion, Inquiry and Lecturing.
Workload:	Total workload is 91 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes self-study per week for 16 weeks.
Credit points:	2
Prerequisites course(s):	-
Expected learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics ELO2 Demonstrate nationalism, responsibility, and tolerance to both society and environmet

<table>
<tr><td></td><td>ELO8 Capable to apply research methods and preparation of scientific works</td></tr>
<tr><td>Course Outcome:</td><td>
CO1. Being pious to God Almighty and able to demonstrate religiousness, honesty, and patience.
CO2. Contributing to the improvement of the quality of life in the community, the nation, the state, and the advancement of civilization based on Pancasila.
CO2.1 Describe the relevance between education and society and culture.
CO3. Working together and having the social sensibility as well as caring on the people and environment.
CO3.1 Identify social capital and cultural capital that determine the success and failure of education
CO4 Knowledge of pedagogical and didactic concepts in planning technological and vocational education learning devices in the field of Electrical Engineering.
CO4.1 Describe education that is suitable for multicultural Indonesian society
</td></tr>
<tr><td>ELO and CO mapping:</td><td>
<table>
<tr><th></th><th>ELO1</th><th>ELO2</th><th>ELO8</th></tr>
<tr><td>CO1</td><td>✓</td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td>✓</td><td></td></tr>
<tr><td>CO3</td><td></td><td>✓</td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td>✓</td></tr>
</table>
</td></tr>
<tr><td>Courses Description:</td><td>This course discusses education as a socio-cultural process. This course provides basic knowledge about the importance of climate, approaches, and socio-cultural influences, both from school and from outside the school (family, peer groups, nation-society, and mass media) in multicultural (pluralistic) societies.) and education that is most suitable for humans (anthropos) in realizing Indonesia's national education goals now and in the future.</td></tr>
</table>

<table>
<tr>
<td>Assessments</td>
<td>
1. The assessment is carried out to measure all learning achievements, namely attainment learning achievements (CO 1), (CO 2), and (CO 3) General knowledge (CO 4).
2. Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude compared to the attitude of students in general. The results of the attitude assessment are not a component of the student's final grade, but rather as one of the graduation requirements. Students will graduate from this course if at least have a good attitude. Attitude assessment also considers the activeness of students following lectures.
3. Final grades include the results of general knowledge assessments obtained from individual assignments, group assignments, presentations, quizzes, Insert Exams, and Final Examinations with the following guidelines.
<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td>1</td><td>CO2, CO3</td><td>Attitude (presence, activity, discipline, honesty)</td><td>Observation</td><td>10%</td></tr>
<tr><td rowspan="4">2</td><td rowspan="4">CO3, CO4, CO5,</td><td>Individual assignments</td><td>Article</td><td>15%</td></tr>
<tr><td>Tim assignments</td><td>Presentation and paper</td><td>15%</td></tr>
<tr><td>Midterm exam</td><td>Written test</td><td>20%</td></tr>
<tr><td>Final exam</td><td>Written test</td><td>40%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table>
</td>
</tr>
<tr>
<td>Forms of media:</td>
<td>Board, LCD Projector, Laptop/Computer</td>
</tr>
<tr>
<td>Literature:</td>
<td>
1. Septiarti, SW., dkk. 2017. Sosiologi dan Antropologi Pendidikan. Yogyakarta: UNY. Press.
2. Ballantine, Jeanne H. 1985. Schools and Society: A Reader in Education and Sociology. London:Mayfield Publishing Company.
3. Deal, Terrence E. & Peterson, Kent D. 2011. Shaping School Culture: Pitfals, Paradoxes, & Promises. San Fransisco: Jossey-Bass.
4. Farida Hanum. 2011. Sosiologi Pendidikan. Yogyakarta: Kanwa Publisher.
5. Harrison, L. E. & Huntington, S. P. (ed). 2000. Culture Matters, How Values Shape Human Progress.New York : Basic Books.
6. Imran Manan. 1989. Anthropologi Pendidikan, Suatu
</td>
</tr>
</table>

	Pengantar (Terj. George F. Kneller). Jakarta P2LPTK Dirjen Dikti. 7. Sunyoto Usman. 2015. Sosiologi: Sejarah, Teori, dan Metodologi. Yogyakarta: Pustaka Pelajar. 8. -------------------. 2018. Modal Sosial. Yogyakarta: Pustaka Pelajar. 9. Suyata, dkk. 2000. *Modul Sosio-Antropologi Pendidikan*. Semi-Que. 10. Tilaar, H.A.R. 1999. *Pendidikan, Kebudayaan, dan Masyarakat Madani Indonesia*. Bandung : Remaja Rosdakarya. 11. -----------------. 2004. *Multikulturalisme : Tantangan-tantangan Global Masa Depan dalam Transformasi Pendidikan.* Jakarta : Grasindo. 12. -----------------. 2012. Perubahan Sosial dan Pendidikan: Pengantar Pedagogik Transformatif untuk Indonesia. Jakarta: Rineka Cipta. 13. Young Pai.1990. *Cultural Fondations of Education*. Columbus : Merrill Publishing Company.
Date of revision	10 August 2018

4th SEMESTER

UNIVERSITAS NEGERI YOGYAKARTA
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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Technology and Vocational Education
Module level,if applicable:	Undergraduate
Code:	KTF6208
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	4^{th}
Module coordinator:	Dr. Istanto Wahyu Djatmiko, M.Pd.
Lecturer(s):	Team
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	100 minutes lectures and 120 minutes structured activities per week.
Teaching and Learning Method	Discussion, Quiz, Inquiry and Lecturing.
Workload:	Total workload is 91 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes self-study per week for 16 weeks.
Credit points:	2
Prerequisites course(s):	-
Expected learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics ELO2 Demonstrate nationalism, responsibility, and tolerance to both society and environmet ELO3 Can be handled according to the expertise of each team

<table>
<tr><td></td><td>ELO5 Master in work standards, work methods, work implementations, and testing in electric power or industrial automation expertise.
ELO6 Capable to make plans, implement, and evaluate learning in electric power or industrial automation expertise</td></tr>
<tr><td>Courses Outcomes:</td><td>CO1 Showing polite, disciplined, and honest attitude during lectures.
CO2 Can carry out the tasks of Technology and Vocational Education (TVE) or vocational education (VE) courses both independently and in groups.
CO3 Mastering the concepts of technology and vocational education or vocational education (VE).
CO4 Able to apply the concept of PV in the organization of education and training in the field of electrical engineering.
CO5 Being able to analyze technological trends and employment for the development of VE.
CO6 Able to analyze VE policy issues to improve the quality of TVE.</td></tr>
<tr><td>ELO and CO mapping:</td><td><table>
<tr><th></th><th>ELO1</th><th>ELO2</th><th>ELO3</th><th>ELO5</th><th>ELO6</th></tr>
<tr><td>CO1</td><td>✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td>✓</td><td>✓</td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td></td><td>✓</td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td>✓</td><td></td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td></td><td>✓</td></tr>
<tr><td>CO6</td><td></td><td></td><td></td><td></td><td>✓</td></tr>
</table></td></tr>
<tr><td>Courses Description:</td><td>This course provides students with insight, knowledge, and learning experiences about the nature of technology and vocational / vocational education (VE) which includes: (1) VE foundation, (2) VE development, (3) VE role, (4) VE implementation model , (5) policies in VE, and (6) contemporary issues of VE. Lectures are carried out in the form of lectures and class and group discussions by assigning critical observations and analyzes to the practices of implementing vocational education in Indonesia</td></tr>
</table>

<table>
<tr><td>Assessments:</td><td>

1. Assessment is carried out to measure all learning achievements, namely attainment learning achievements (CO 1 & 2), knowledge (CO 3 & 4), and special skills (CO 5 & 6).
2. Attitude assessment is carried out through direct observation of each student at each lecture meeting, including: attendance, discipline, personal and interpersonal interaction. This attitude assessment categories, namely: "Very Good", "Good", and "Less Good". The minimum attitude value is included in the "Good" category. By using observation and / or self-assessment techniques using the assumption that basically every student has a good attitude. The results of this attitude assessment are used as a consideration for determining the final assessment of this course.
3. The final grade includes the results of the knowledge assessment, and the specific skills obtained from individual assignments, group assignments, presentations, quizzes, insert tests, and final semester examinations are determined as follows.

<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td rowspan="4">1</td><td rowspan="4">CO1 – CO6</td><td>Attendace</td><td>Presentation / written test</td><td>10%</td></tr>
<tr><td>Individual Assignment/Group Assignment</td><td>written test</td><td>20%</td></tr>
<tr><td>Mid</td><td>written test</td><td>30%</td></tr>
<tr><td>Final Exam</td><td>written test</td><td>40%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table>

</td></tr>
<tr><td>Forms of media:</td><td>Board, LCD Projector, Laptop/Computer</td></tr>
<tr><td>Literature:</td><td>

25. Depdiknas. 1997. Ketrampilan menjelang 2020 Untuk Era Global. Jakarta: Depdiknas.
26. Soeharsono Sagir. 1989. Membangun Manusia Karya. Jakarta: Pustaka Sinar Harapan.
27. Thompson, J.F. 1973. Foundation of Vocational Education: Social and Philosophical Concept. New Jersey: Prentice Hall.
28. Wardiman Djojonegoro. 1990. Mengembangkan manusia melalui pendidikan kejuruan. Jakarta.
29. Fink, C.R. & Crunkilton, J.R. 1999. Curriculum Development in Vocational and Technical Education: Planning, Content, and Implementation. Boston: Allyn And Bacon.

</td></tr>
</table>

	30. Maclean, R & Wilson, D. 2010. International Handbook of Educatio fot The Changing World of Work. Bridging Academic and Vocating Learning. UNESCO-UNEVOC International Center for Technical anf Vocational Education Training. Bonn: Springer. 31. Dedi, Supriadi. 2002. Sejarah Pendidikan Teknik dan Kejuruan Indonesia: Membangun manusia Produktif. Jakarta: Direktorat Pendidikan Menengah Kejuruan, Direktorat Jendral Pendidikan Dasar dan Menengah, Departemen Pendidikan Nasional.
Date of revision:	10 August 2019

UNIVERSITAS NEGERI YOGYAKARTA
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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Power Electronics Laboratory Work
Module level,if applicable:	Undergraduate
Code:	EKO6222
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	4^{th}
Module coordinator:	Dr. Istanto Wahyu Djatmiko
Lecturer(s):	1. Drs. Sunomo, MT. 2. Muhamad Ali, ST.,M.T.
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	200 minutes lectures and 240 minutes structured activities per week.
Teaching and Learning Method	Discussion, Demonstration, and Lecturing
Workload:	Total workload is 181 hours per semester which consists of 200 minutes lectures, 240 minutes structured activities, and 240 minutes self-study per week for 16 weeks.
Credit points:	2
Prerequisites course(s):	-
Expected learning outcomes:	After taking this course the students have ability to:

<table>
<tr><td></td><td>ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics
ELO2 Demonstrate nationalism, responsibility, and tolerance to both society and environmet
ELO4 Master in basic sciences and principles of electric
ELO7 Able to manage education and vocational training in the field of Electrical Engineering by utilizing information and communication technology, able to practice power electronic circuits according to their characteristics, Able to make practice reports based on practice results data, Being able to be disciplined, teamwork think critically and make the right decisions</td></tr>
<tr><td>Course Outcomes:</td><td>CO1 Devoted to God Almighty and able to practice discipline and character,
CO2 Students are proactive, responsible, and have the motivation to develop themselves,
CO3 Students are able to practice power electronic circuits according to their characteristics,
CO4 Students are able to make practice reports based on practical results data,
CO5 Have the ability of discipline, teamwork, critical thinking and make the right decisions,</td></tr>
<tr><td>ELO and CO mapping:</td><td><table>
<tr><th></th><th>ELO1</th><th>ELO2</th><th>ELO4</th><th>ELO7</th></tr>
<tr><td>CO1</td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td>✓</td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td>✓</td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td>✓</td><td>✓</td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td>✓</td></tr>
</table></td></tr>
<tr><td>Courses Description:</td><td>This course practices electronic energy-based energy conversion for the purpose of controlling large power electric equipment. Practice materials include the introduction of power electronics practice units, power electronic components, AC / DC, DC / DC conversion circuits, AC / AC, DC / AC, and drive circuits and their applications. Lectures are conducted using a learning approach at the student center with a project-based learning strategy. Competency-based assessment involves active participation in practicum, preparation, data collection, reporting of practicum results, and individual examinations.</td></tr>
</table>

<table>
<tr><td>Assessments</td><td>

Assessment is carried out to measure all learning achievements, namely attainment learning achievements, knowledge, and special skills.
Attitude assessment is carried out through direct observation of each student at each lecture meeting, including: attendance, discipline, personal and interpersonal interaction. This attitude assessment categories, namely: "Very Good", "Good", and "Less Good". The minimum attitude value is included in the "Good" category. By using observation and / or self-assessment techniques using the assumption that basically every student has a good attitude. The results of this attitude assessment are used as a consideration for determining the final assessment of this course.
The final grade includes the results of the knowledge assessment, and the specific skills obtained from individual assignments, group assignments, presentations, quizzes, insert tests, and final semester examinations are determined as follows.

<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td rowspan="5">1</td><td rowspan="5">CO1-CO5</td><td>Assignment</td><td>Practicum</td><td>10%</td></tr>
<tr><td>Practicum report</td><td>Written report</td><td>25%</td></tr>
<tr><td>Final Project Performance</td><td>Performance</td><td>30%</td></tr>
<tr><td>Final Project Report</td><td>Written report</td><td>30%</td></tr>
<tr><td>Attendance</td><td></td><td>5%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table>
</td></tr>
<tr><td>Forms of media:</td><td>Board, LCD Projector, Laptop/Computer</td></tr>
<tr><td>Literature:</td><td>

Tim Praktik Elektronika Daya. (2015). Labsheet Praktik Elektronika Daya. Yogyakarta: Jurusan Pendidikan Teknik Elektro FT UNY
Tim Praktik Elektronika Daya. (2015). Buku Laporan Praktik Elektronika Daya. Yogyakarta: Jurusan Pendidikan Teknik Elektro FT UNY.

</td></tr>
<tr><td>Date of revision</td><td>18 August 2019</td></tr>
</table>

Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP) **MODULE HANDBOOK**

Module name:	Electricity Installation Design
Module level,if applicable:	Undergraduate
Code:	EKO6223
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	4^{th}
Module coordinator:	Dr. Djoko Laras Budyo Taruno, M.Pd.
Lecturer(s):	Ir. Alex Sandria Jaya Wardhana, M.Eng.
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	100 minutes lectures, 120 minutes structured activities, and 120 minutes self-study per week.
Teaching and Learning Method	Presentation, Discussion, Question and Answer, Problem Based Learning, Problem Solving.
Workload:	Total workload is 90 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes self-study per week for 16 weeks.
Credit points:	2
Prerequisites course(s):	-
Expected Learning Outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics ELO3 Can carry out work in accordance with the professional field of expertise both individually and in teams ELO4 Mastering basic science and basic electricity

<table>
<tr><td></td><td>ELO7 Able to manage vocational education and training in the field of Electrical Engineering by utilizing information and communication technology.</td></tr>
<tr><td>Course outcomes:</td><td>CO1 Thanks to God and able to show a religious attitude and character,
CO2 Demonstrates responsibility for work in their area of expertise independently.
CO3 Students are in planning the electrical field in office buildings, hotels, industry.
CO3.1 Master the Concept of Requirement and Analysis in an electrical installation system
CO4 Knowledge of selecting and determining materials for the purposes of design and implementation of installations related to Electric Power Engineering or Industrial Automation.
CO4.1 Understand the drawings, buttons, standards, and practical theoretical basis for electrical installation planning
CO4.2 Able to design electrical systems in the field of lighting and electric power
Co4.3 Able to design electrical systems in the electronic field (Fire Alarm, CCTV, MATV, Sound System)
CO5 Knowledge of Electric Power Engineering safety systems in the context of securing equipment, health and user safety.
CO5.1 Understand the related standards and conduct of test examinations</td></tr>
<tr><td>ELO and CO mapping</td><td>
<table>
<tr><th></th><th>ELO1</th><th>ELO3</th><th>ELO4</th><th>ELO7</th></tr>
<tr><td>CO1</td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td>✓</td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td>✓</td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td>✓</td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td>✓</td></tr>
</table>
</td></tr>
<tr><td>Courses Description:</td><td>Basic planning, electrical system & installation planning, lighting, power, electrical panels, lightning protection, air conditioning / air conditioning, telecommunications, sound & MATV, CCTV & building security alarms, fire alarms, technical requirements, technical analysis, job analysis, cost analysis and budget plan, Inspections and tests.</td></tr>
</table>

<table>
<tr><td>Assessments:</td><td>

Assessment is carried out to measure all learning achievements, namely attainment learning achievements, knowledge, and special skills.
Attitude assessment is carried out through direct observation of each student at each lecture meeting, including: attendance, discipline, personal and interpersonal interaction. This attitude assessment categories, namely: "Very Good", "Good", and "Less Good". The minimum attitude value is included in the "Good" category. By using observation and / or self-assessment techniques using the assumption that basically every student has a good attitude. The results of this attitude assessment are used as a consideration for determining the final assessment of this course.
The final grade includes the results of the knowledge assessment, and the specific skills obtained from individual assignments, group assignments, presentations, quizzes, insert tests, and final semester examinations are determined as follows.

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<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td rowspan="5">1</td><td rowspan="5">CO1 – CO5</td><td>Attitude</td><td>Documentation</td><td>10%</td></tr>
<tr><td>Individual Assignment/Group Assignment</td><td>Accuracy of program results/ Written</td><td>20%</td></tr>
<tr><td>Quiz</td><td>Accuracy of program results/ Written</td><td>10%</td></tr>
<tr><td>Mid</td><td>Written test</td><td>20%</td></tr>
<tr><td>Final Exam</td><td>Written test</td><td>20%</td></tr>
<tr><td colspan="3"></td><td>Total</td><td>100%</td></tr>
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<tr><td>Forms of media:</td><td>Board, LCD Projector, Laptop/Computer</td></tr>
<tr><td>Literature:</td><td>

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WE Steward & J Watkins, Modern Wiring Practice
Muhaimin, (2001). Teknologi Pencahayaan.
Wlliam & Richard, (1997) Mechanical and Eelctrikal systems in Building.
PUIL 2000
Supreme, GAE, MG, Telemecanique Cataloges
Philips, TOA, National, Nitan, Ademco cataloges
Prasimax, (2002) Protocol TCP

</td></tr>
<tr><td>Date of revision:</td><td>08 August 2019</td></tr>
</table>

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Electricity Installation Design Laboratory Work
Module level,if applicable:	Undergraduate
Code:	EKO6224
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	4^{th}
Module coordinator:	Dr. Djoko Laras Budyo Taruno, M.Pd.
Lecturer(s):	Ir. Alex Sandria Jaya Wardhana, M.Eng.
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	200 minutes lectures, 240 minutes structured activities, and 240 minutes self-study per week.
Teaching and Learning Method	Discussion, Observation, Project Based Learning, Presentation.
Workload:	Total workload is 181 hours per semester which consists of 200 minutes lectures, 240 minutes structured activities, and 240 minutes self-study per week for 16 weeks.
Credit points:	2
Prerequisites course(s):	-
Expected Learning Outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics ELO3 Can carry out work in accordance with the professional field of expertise both individually and in teams

<table>
<tr><td></td><td>ELO5 Mastering work standards, work methods, work implementation, and testing in the field of electric power engineering and industrial automation.
ELO6 Managing laboratories and workshops in training centers, and technology and vocational education in accordance with the provisions of occupational safety and health in the field of Electrical Engineering</td></tr>
<tr><td>Course Outcomes:</td><td>CO1 Demonstrate polite, honest, good faith in lectures.
CO2 Contribute to improving the quality of life in a society, nation, state, and advancement of civilization based on Pancasila
CO4 Apply education management to schools, education and training institutions in the field of Electrical Engineering.
CO5 Managing laboratories and workshops in training centers, and technology and vocational education in accordance with the provisions of occupational safety and health in the field of Electrical Engineering</td></tr>
<tr><td>ELO and CO mapping:</td><td><table>
<tr><th></th><th>ELO1</th><th>ELO3</th><th>ELO5</th><th>ELO6</th></tr>
<tr><td>CO1</td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td>✓</td><td>✓</td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td>✓</td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td>✓</td></tr>
</table></td></tr>
<tr><td>Courses Description:</td><td>Basic planning, electrical system & installation planning, lighting, power, electrical panels, lightning protection, air conditioning / air conditioning, telecommunications, sound & MATV, CCTV & building security alarms, fire alarms, technical requirements, technical analysis, job analysis, cost analysis and budget plan, Inspections and tests.</td></tr>
<tr><td>Assessments:</td><td>1. Assessment is carried out to measure all learning achievements, namely attainment learning achievements, knowledge, and special skills.
2. Attitude assessment is carried out through direct observation of each student at each lecture meeting, including: attendance, discipline, personal and interpersonal interaction. This attitude assessment categories, namely: "Very Good", "Good", and "Less Good". The minimum attitude value is included in the "Good" category. By using observation and / or self-assessment techniques using the assumption that basically every student has a good attitude. The results of this attitude assessment are used as a consideration for determining the final assessment of this course.</td></tr>
</table>

<table>
<tr><td></td><td>

3. The final grade includes the results of the knowledge assessment, and the specific skills obtained from individual assignments, group assignments, presentations, quizzes, insert tests, and final semester examinations are determined as follows.

<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td rowspan="5">1</td><td rowspan="5">CO1 – CO5</td><td>Attitude</td><td>Documentation</td><td>10%</td></tr>
<tr><td>Individual Assignment/Group Assignment</td><td>Observation report</td><td>20%</td></tr>
<tr><td>Quiz</td><td>Accuracy of program results/ Written</td><td>20%</td></tr>
<tr><td>Mid</td><td>Practicum test</td><td>20%</td></tr>
<tr><td>Final Exam</td><td>Practicum test</td><td>30%</td></tr>
<tr><td colspan="3"></td><td>Total</td><td>100%</td></tr>
</table>

</td></tr>
<tr><td>Forms of media:</td><td>Board, LCD Projector, Laptop/Computer</td></tr>
<tr><td>Literature:</td><td>

1. Gunter G Seip, (2016). Electrical Installations Handbook
2. WE Steward & J Watkins, 2008). Modern Wiring Practice
3. Muhaimin, (2011). Teknologi Pencahayaan.
4. Wlliam & Richard, (2018) Mechanical and Eelctrikal systems in Building.
5. PUIL 2011 (2015)
6. V: Supreme, ABB, Schneider, MG, Philips, TOA, National, Nitan, Ademco, Prasimax, (2012) Protocol TCP/IP.

</td></tr>
<tr><td>Date of revision</td><td>15 August 2019</td></tr>
</table>

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Statistics
Module level,if applicable:	Undergraduate
Code:	MKU6210
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	4^{th}
Module coordinator:	Prof. Dr. Samsul Hadi, M.T.
Lecturer(s):	Team
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	100 minutes lectures and 120 minutes structured activities per week.
Teaching and Learning Method	Discussion and Lecturing
Workload:	Total workload is 91 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes self-study per week for 16 weeks.
Credit points:	2
Prerequisites course(s):	-
Expected learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics. ELO2 Demonstrate nationalism, responsibility, and tolerance to both society and environmet.

	ELO5 Master in work standards, work methods, work implementations, and testing in electric power or industrial automation expertise. ELO7 Capable to manage vocational education and training of electrical engineering expertise by utilizing information and communications technology. ELO8 Capable to apply research and scientific writing methods.
Course outcomes:	CO1 Devoted to God Almighty and able to show a regius attitude and character that is implemented in learning and learning outcomes. CO2 Students actively participate, take responsibility, discipline, be able to work together, and have the motivation to develop themselves. CO3 Describe the basic concepts of parametric and nonparametric statistics. CO4 Compare descriptive and inferential statistics. CO5 Make a frequency distribution. CO6 Make various types of graphs. CO7 Using the binomial distribution, khai-squared, normal, t, and Fisher for hypothesis testing. CO8 Analyzing data with correlation techniques, regression analysis, and ANAVA statistics. CO9 Using the SPSS program package to analyze data CO10 Interpreting the results of data analysis. CO11 Choosing the right statistical technique for a research problem.

ELO and CO mapping:

	ELO1	ELO2	ELO5	ELO7	ELO8
CO1	✓				
CO2		✓			
CO3					✓
CO4					✓
CO5			✓	✓	✓
CO6			✓	✓	✓
CO7				✓	✓
CO8				✓	✓
CO9				✓	✓
CO10				✓	✓
CO11				✓	✓

Courses Description:

This subject discusses the role of statistics in the field of research, descriptive statistics: frequency distribution, steam-leaf distribution, inferential statistics: probability theory discrete change, binomial distribution, normal continuous variable distribution, chi-square, student-t and Fisher; characteristics of the sampling distribution, hypothesis testing: a difference test of two groups with the t-opportunity distribution, different tests of more than two groups with variance analysis with assumptions and further tests; correlation and regression analysis, and usage some nonparametric statistics. The discussion includes basic concepts, applications, interpretation of data analysis results using the SPSS program package.

Assessment:

1. Assessment is carried out to measure all learning achievements, namely attainment learning achievements, knowledge, and special skills.
2. Attitude assessment is carried out through direct observation of each student at each lecture meeting, including: attendance, discipline, personal and interpersonal interaction. This attitude assessment categories, namely: "Very Good", "Good", and "Less Good". The minimum attitude value is included in the "Good" category. By using observation and / or self-assessment techniques using the assumption that basically every student has a good attitude. The results of this attitude assessment are used as a consideration for determining the final assessment of this course.
3. The final grade includes the results of the knowledge assessment, and the specific skills obtained from individual assignments, group assignments, presentations, quizzes, insert tests, and final semester examinations are determined as follows.

	<table><tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr><tr><td rowspan="5">1</td><td rowspan="5">CO1 - CO11</td><td>Attendance</td><td>Documentation</td><td>10%</td></tr><tr><td>Individual Assignment/Group Assignment</td><td>Observation report</td><td>20%</td></tr><tr><td>Quiz</td><td>Precentation</td><td>20%</td></tr><tr><td>Midterm exams</td><td>Written test</td><td>20%</td></tr><tr><td>Final exams</td><td>Written test</td><td>30%</td></tr><tr><td colspan="4">Total</td><td>100%</td></tr></table>
Forms of media:	Board, LCD Projector, Laptop/Computer
Literature:	1. Howerl, David C. (1987). Statistical methods for Psychology. Boston :Duxbury Press. 2. Pedhazur, E.J. (1982). Multiple Regresion Bihavioral Research. New York : Holt, Rinehart and Wiston.
Date of revision	13 July 2019

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Web:ft.uny.ac.id, E-mail: elektro@uny.ac.id

Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Electrical Power Protection
Module level,if applicable:	Undergraduate
Code:	EKO6225
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	4rd
Module coordinator:	Dr. Edy Supriyadi
Lecturer(s):	1. Ir.alex Sandria J. Wardhana,M.Eng 2. Totok Sukisno, S.Pd,M.Pd
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	100 minutes lectures and 120 minutes structured activities per week.
Teaching and Learning Method:	Discussion and Lecturing
Workload:	Total workload is 91 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes self-study per week for 16 weeks.
Credit points:	2
Prerequisites course(s):	-
Expected Learning Outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics ELO3 Capable to perform professional works in his/her field of expertise both individual and team works

<table>
<tr><td></td><td>ELO4 Master in basic sciences and principles of electric
ELO7 Able to manage vocational education and training in the field of electrical engineering by utilizing information and communication technology</td></tr>
<tr><td>Course Outcomes:</td><td>CO1 Devotion to God Almighty, devout worship and noble deeds.
CO3 Demonstrates responsibility for work in their area of expertise independently
CO4 Knowledge of law and the basic theory of electricity
CO7 Knowledge of the generation, distribution, use, installation and engineering of electric power automation in the business world and industry in accordance with standards and principles that are generally accepted and relevant in the field of electricity and renewable energy.</td></tr>
<tr><td>ELO and CO mapping:</td><td>
<table>
<tr><th></th><th>ELO1</th><th>ELO3</th><th>ELO4</th><th>ELO7</th></tr>
<tr><td>CO1</td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td>✓</td><td></td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td>✓</td><td></td></tr>
<tr><td>CO7</td><td></td><td></td><td></td><td>✓</td></tr>
</table>
</td></tr>
<tr><td>Courses Description:</td><td>This Electric Power Protection Practice Lectures will develop student competencies regarding the need for Overcurrent Relays, Differential Relays, Voltage Relays, Power Relays, Temperature Relays, Power Breakers; Protection at substations, Transformer Protection, Transmission Network Protection, Distribution Network Protection, Motor Protection, and Building Protection. Lectures are carried out with a variety of discussions that are appropriate to the material and potential of students, including: contextual, project-based learning, and problem-based learning that is directed at learning at the student center. The assessment is carried out on a competency basis and is aligned with the lecture activities.</td></tr>
<tr><td>Study/exam achievements:</td><td>1. Assessment is carried out to measure all learning achievements, namely attainment learning achievements, knowledge, and special skills.
2. Attitude assessment is carried out through direct observation of each student at each lecture meeting, including: attendance, discipline, personal and interpersonal interaction. This attitude assessment categories, namely: "Very Good", "Good", and "Less Good". The minimum attitude value is included in the "Good" category. By using observation and / or self-assessment techniques using the assumption that basically every student has a good attitude. The results of</td></tr>
</table>

<table>
<tr><td></td><td>
this attitude assessment are used as a consideration for determining the final assessment of this course.
3. The final grade includes the results of the knowledge assessment, and the specific skills obtained from individual assignments, group assignments, presentations, quizzes, insert tests, and final semester examinations are determined as follows.
<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td rowspan="3">1</td><td rowspan="3">CO1 – CO7</td><td>Attendance</td><td>Documentation</td><td>10%</td></tr>
<tr><td>Individual / group assignments
Midterm exam
Final exams</td><td>Assignment
Written test</td><td>45%</td></tr>
<tr><td>Individual / group assignments
Midterm exam
Final exams
Final Exam</td><td>Assignment
Written test
written test</td><td>45%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table>
</td></tr>
<tr><td>Forms of media:</td><td>Board, LCD Projector, Laptop/Computer</td></tr>
<tr><td>Literature:</td><td>
1. Bonar Pandjaitan. 2012. Praktik-Praktik Proteksi Sistem Tenaga Listrik. Yogyakarta: Andi Offset.
2. Christophe Prévé. 2006. Protection of Electrical Networks. London: ISTE,Ltd.
3. Edy Supriyadi, 2000. Sistem Proteksi Tenaga Listrik. Yogyakarta: Adi Cita.
4. Elmore Walter A. Protective Relaying Theory & Application. New York: Marcell Dekker
5. Lewis Blackburn & Thomas J. Domin. 2006. Protective Relaying: Principles and
Applications. Taylor&Francis Group,LLC.
6. PT. PLN (Persero) P3B. 2006. Materi Pelatihan O&M Relai Proteksi Jaringan. Jakarta: PLN.
7. Russel Mason. The Art & Science of Protective Relaying. General Electric
8. Scheinder electric. Sepam range Sepam 1000+ Substation Transformer Motor Busbar
</td></tr>
<tr><td>Date of revision:</td><td>31 August 2019</td></tr>
</table>

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Programmable Logic Controller Lab. Work
Module level,if applicable:	Undergraduate
Code:	EKO6327
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	4^{th}
Module coordinator:	Totok Heru Tri Maryadi, M. Pd.
Lecturer(s):	1. Sigit Yatmono, ST.,M.T. 2. Amelia Fauziah Husna,M. Pd.
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	150 minutes lectures, 180 minutes structured activities, and 180 minutes self-study per week.
Teaching and Learning Method	Presentation, Discussion, Question and Answer, Problem Based Learning, Problem Solving.
Workload:	Total workload is 136 hours per semester which consists of 150 minutes lectures, 180 minutes structured activities, and 180 minutes self-study per week for 16 weeks.
Credit points:	3
Prerequisites course(s):	-
Expected Learning Outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics ELO3 Can be handled according to the expertise of each team

	ELO5 Master in work standards, work methods, work implementations, and testing in electric power or industrial automation expertise. ELO6 Capable to make plans, implement, and evaluate learning in electric power or industrial automation expertise ELO9 Able to develop innovations in education, and publish the results of his work
Course Outcomes:	CO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics CO2 Demonstrate nationalism, responsibility, and tolerance to both society and environmet CO2.1 Understand PLC configuration CO2.2 Understand the concept of PLC, PLC type CO2.3 Understand the input and output modules CO2.4 Understanding PLC Basic Programming CO2.5 Functin Block Diagram CO2.6 Ladder Diagram CO2.7 PLC Application in Industry CO4 Students can explain boolean basic logic instructions (AND, OR, and NOT) on PLC programming, CO4.1 Understand PLC configuration CO4.2 Understand the concept of PLC, PLC type CO4.3 Understand the input and output modules CO4.4 Understanding PLC Basic Programming CO4.5 Functin Block Diagram CO4.6 Ladder Diagram CO4.7 PLC Application in Industry
ELO and CO mapping:	(see table below)
Courses Description:	This course discusses theory and practices PLC-based process control. The discussion includes component input modules, output modules, memory flags, timers, counters, arithmetic, and analog input and analog output. Practicum is carried out using

	ELO1	ELO3	ELO5	ELO6	ELO9
CO1	✓				
CO2		✓	✓		
CO4				✓	✓

<table>
<tr><td></td><td>the problem based learning approach individually or in groups using practicum worksheets. Competency-based assessment at the end of the lecture individually.</td></tr>
<tr><td>Assessments:</td><td>

Assessment is carried out to measure all learning achievements, namely attainment learning achievements, knowledge, and special skills.
Attitude assessment is carried out through direct observation of each student at each lecture meeting, including: attendance, discipline, personal and interpersonal interaction. This attitude assessment categories, namely: "Very Good", "Good", and "Less Good". The minimum attitude value is included in the "Good" category. By using observation and / or self-assessment techniques using the assumption that basically every student has a good attitude. The results of this attitude assessment are used as a consideration for determining the final assessment of this course.
The final grade includes the results of the knowledge assessment, and the specific skills obtained from individual assignments, group assignments, presentations, quizzes, insert tests, and final semester examinations are determined as follows.

<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td rowspan="4">1</td><td rowspan="4">CO1 – CO4</td><td>Attitude</td><td>Documentation</td><td>10%</td></tr>
<tr><td>Individual Assignment/Group Assignment</td><td>Presentation</td><td>20%</td></tr>
<tr><td>Mid</td><td>Practicum test</td><td>20%</td></tr>
<tr><td>Final Exam</td><td>Practicum test</td><td>40%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table>
</td></tr>
<tr><td>Forms of media:</td><td>Board, LCD Projector, Laptop/Computer</td></tr>
<tr><td>Literature:</td><td>

__________. Tth. Electropneumatics. Jakarta: Festo.
__________. Tth. Pneumatics. Jakarta: Festo.
__________. tth. Programmable Logic Controller. Jakarta: Festo.
Agfianto Eko Putra. 2004. PLC Konsep, Pemrograman, dan Aplikasi. Yogyakarta: Gava Media
Azhar Arsyad. 2011. Media Pembelajaran. Jakarta: PT Raja Grafindo Persada.

</td></tr>
</table>

	6. Brown, James. & Lewis, Richard.(1983). AV Instructional Technology Manual For Independent Study (Sixth Edition). New York : McGraw-Hill. 7. Brown, James.,Norberg & Srygley.(1975). Administering Educational Media. New-York : McGraw-Hill.
Date of revision	12 August 2019

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Industrial Electricity Installation
Module level,if applicable:	Undergraduate
Code:	EKO6228
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	4^{th}
Module coordinator:	Alex Sandria Jaya W, S.Pd
Lecturer(s):	1. Dr.Zamtinah,M.Pd 2. Dr.Ir.Djoko Laras Budiyo Taruno,M.Pd
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	100 minutes lectures and 120 minutes structured activities per week
Teaching and Learning Method:	Discussion and Lecturing
Workload:	Total workload is 91 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes self-study per week for 16 weeks.
Credit points:	2
Prerequisites course(s):	-
Expected Learning Outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics ELO2 Demonstrate nationalism, responsibility, and tolerance to both society and environmet

<table>
<tr><td></td><td>ELO3 Capable to perform professional works in his/her field of expertise both individual and team works
ELO4 Master in basic sciences and principles of electric
ELO5 Master in work standards, work methods, work implementations, and testing in electric power or industrial automation expertise.
ELO6 Capable to make plans, implement, and evaluate learning in electric power or industrial automation expertise</td></tr>
<tr><td>Course Outcomes:</td><td>CO1 Devoted to God and able to show a religious attitude and character,
CO2 Students agree to be active, responsible, and have the motivation to develop themselves,
CO3 Students can manage the operation of the power generation system from the generator to the user.
CO4 Having the ability to speak, think critically and make the right decisions</td></tr>
<tr><td>ELO and CO mapping:</td><td>
<table>
<tr><th></th><th>ELO1</th><th>ELO2</th><th>ELO3</th><th>ELO4</th><th>ELO5</th><th>ELO6</th></tr>
<tr><td>CO1</td><td>✓</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td>✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td>✓</td><td>✓</td><td>✓</td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td></td><td></td><td>✓</td></tr>
</table>
</td></tr>
<tr><td>Courses Description:</td><td>This course discusses the completion of industrial electrical installations. Coverage of materials in this course covers materials and equipment for industrial electrical installations, protection systems, installation and applicable installation requirements, wiring diagrams and single lines in industrial electrical installations, lighting and power installations in industry, setting conductor and distribution capacity, feeders and panels , medium voltage protection systems, power factor improvements and capacitor installation techniques, grounding systems and lightning rods in Indonesia as well as the commissioning test.</td></tr>
<tr><td>Study/exam achievements:</td><td>1. Assessment is carried out to measure all learning achievements, namely attainment learning achievements, knowledge, and special skills.
2. Attitude assessment is carried out through direct observation of each student at each lecture meeting, including: attendance, discipline, personal and interpersonal interaction. This attitude assessment categories, namely: "Very Good", "Good", and "Less Good". The minimum attitude value is included in the "Good" category. By using observation and / or self-</td></tr>
</table>

<table>
<tr><td></td><td>
assessment techniques using the assumption that basically every student has a good attitude. The results of this attitude assessment are used as a consideration for determining the final assessment of this course.
3. The final grade includes the results of the knowledge assessment, and the specific skills obtained from individual assignments, group assignments, presentations, quizzes, insert tests, and final semester examinations are determined as follows.
</td></tr>
</table>

No	CO	Assessment Object	Assessment Technique	Weight
1	CO1-CO4	Attendance	Documentation	10%
		Assignment	Presentation	20%
		Mid Exam	written test	30%
		Final Exam	written test	40%
			Total	100%

Forms of media:	Board, LCD Projector, Laptop/Computer
Literature:	1. Scheneider Electric Indonesia. (2002). Panduan Aplikasi Teknis. PT. Scheneider Indonesia. 2. Ir. Imam Sugandi, dkk. Panduan Instalasi Listrik Untuk Rumah. Yayasan Usaha Penunjang Tenaga Listrik: Jakarta. 3. John Wiley & Sons. (2000). Electrical Installation Handbook. Publicis MCD Verlag: Munich. 4. Robert L. Smith & Stephen L. Herman. (2002). Electrical Wiring Industrial 7^{th} Edition. Delmar. 5. Ray C. Mullin & Robert L. Smith. (2002). Electrical Wiring Commercial 7^{th} Edition. Delmar.
Date of revision:	31 August 2019

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Industrial Electricity Installation Lab. Work
Module level,if applicable:	Undergraduate
Code:	EKO6229
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	4^{th}
Module coordinator:	Alex Sandria Jaya W, S.Pd
Lecturer(s):	1. Dr.Zamtinah,M.Pd 2. Dr.Ir.Djoko Laras Budiyo Taruno,M.Pd
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	200 minutes lectures and 240 minutes structured activities per week
Teaching and Learning Method:	Discussion, Demonstration, and Lecturing
Workload:	Total workload is 181 hours per semester which consists of 200 minutes lectures, 240 minutes structured activities, and 240 minutes self-study per week for 16 weeks.
Credit points:	2
Prerequisites course(s):	-
Expected Learning Outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics ELO3 Capable to perform professional works in his/her field of expertise both individual and team works

	ELO5 Master in work standards, work methods, work implementations, and testing in electric power or industrial automation expertise. ELO7 Able to manage vocational education and training in the field of Electrical Engineering by utilizing information and communication technology
Course Outcomes:	CO1 Devoted to God and able to show a religious attitude and character. CO2 Demonstrates responsibility for work in their area of expertise independently. CO3 Knowledge of the preparation of scientific works including work reports in accordance with scientific procedures based on data and information analysis. CO3.1 Understand the characteristics and working principles of the components used in industrial electrical installations CO3.2 Mastering the concept of controlling industrial electricity loads both conventional and based on automation systems (PLCs) CO4 Apply automation techniques for the purposes of electrical and renewable energy (magnetic contactors, power electronics, PLCs, and microcontrollers). CO4.1. Assembling a 3 phase motor control system on the panel box (fwd-rev) manually and automatically CO4.2. Arranging the 3-phase motor control system on the panel box (star-delta) manually and automatically CO4.3. Creating PLC-based control programs and applying to industrial electrical installation systems. CO5 Applying the concept of electric power quality to improve the profile of electric power. CO5.1. Arranging and analyzing power factor regulators CO5.2. Arranging and analyzing Automatic Main Failure (AMF) and Automatic Transfer Switch (ATS) systems

<table>
<tr>
<td>ELO and CO mapping:</td>
<td>
<table>
<tr><th></th><th>ELO1</th><th>ELO3</th><th>ELO5</th><th>ELO7</th></tr>
<tr><td>CO1</td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td>✓</td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td>✓</td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td>✓</td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td>✓</td></tr>
</table>
</td>
</tr>
<tr>
<td>Courses Description:</td>
<td>This course practices the application of industrial electrical installations ranging from security systems to automation of electrical installations in industry. The scope of material in this course covers the complete electrical components commonly used in industry, manual and automatic 3-phase motor controllers, power factor improvements using bank capacitors with manual or automatic settings, automatic main failures as main network backup (PLN) compilation automatic and relay based shutdown, 20 kv medium voltage protection system and industrial installation based on programmable logic control (PLC).</td>
</tr>
<tr>
<td>Study/exam achievements:</td>
<td>

Assessment is carried out to measure all learning achievements, namely attainment learning achievements, knowledge, and special skills.
Attitude assessment is carried out through direct observation of each student at each lecture meeting, including: attendance, discipline, personal and interpersonal interaction. This attitude assessment categories, namely: "Very Good", "Good", and "Less Good". The minimum attitude value is included in the "Good" category. By using observation and / or self-assessment techniques using the assumption that basically every student has a good attitude. The results of this attitude assessment are used as a consideration for determining the final assessment of this course.
The final grade includes the results of the knowledge assessment, and the specific skills obtained from individual assignments, group assignments, presentations, quizzes, insert tests, and final semester examinations are determined as follows.

<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td rowspan="3">1</td><td rowspan="3">CO1 – CO5</td><td>Attitude</td><td>Documentation</td><td>10%</td></tr>
<tr><td>Individual Assignment/Group Assignment</td><td>Observation report</td><td>20%</td></tr>
<tr><td>Quiz</td><td>Accuracy of program results/</td><td>20%</td></tr>
</table>
</td>
</tr>
</table>

			Written	
		Mid	Practicum test	20%
		Final Exam	Practicum test	30%
			Total	100%

Forms of media:	Board, LCD Projector, Laptop/Computer
Literature:	1. Tim Instalasi. Jobsheet Praktik Instalasi Listrik Industri 2. Ir. Imam Sugandi, dkk. Panduan Instalasi Listrik Untuk Rumah. Yayasan Usaha Penunjang Tenaga Listrik: Jakarta. 3. John Wiley & Sons. (2000). Electrical Installation Handbook. Publicis MCD Verlag: Munich. 4. Robert L. Smith & Stephen L. Herman. (2002). Electrical Wiring Industrial 7th Edition. Delmar. 5. Ronald P. O'Riley. (1988). Electrical Grounding. Delmar Publishesrs Inc. 6. Scheneider Electric Indonesia. (2002). Panduan Aplikasi Teknis. PT. Scheneider Indonesia.
Date of revision:	31 August 2019

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Industrial Management
Module level,if applicable:	Undergraduate
Code:	EKO6230
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	4th
Module coordinator:	Muhamad Ali, M.T.
Lecturer(s):	Team
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	100 minutes lectures, 120 minutes structured activities, and 120 minutes self-study per week.
Teaching and Learning Method	Presentation, Discussion, Question and Answer, Problem Based Learning, Problem Solving.
Workload:	Total workload is 90 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes self-study per week for 16 weeks.
Credit points:	2
Prerequisites course(s):	-
Expected Learning Outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics ELO3 Can carry out work in accordance with the professional field of expertise both individually and in teams ELO4 Mastering basic science and basic electricity

	ELO7 Able to plan, implement, and evaluate learning in the field of electric power or automation
Course Outcomes	CO1 Thanks to God and able to show a religious attitude and character, CO3 Demonstrates responsibility for work in their area of expertise independently. CO4 Knowledge of the principles of industrial management relating to the work of prospective electric power engineering and automation engineering teachers CO4.1 Knowledge of law and the basic theory of electricity. CO4.2 Understand industrial management and its development. CO4.3 Understanding decision making. CO4.4 Understand operations and production management CO4.5 Understand the principles of layout and ergonomics in work in industry CO4.6 Understand quality management CO4.7 Understand human resource management CO4.8 Understanding information systems management CO4.9 Understand business development in the industrial era 4.0 CO5 Analyze and solve management problems related to electrical engineering work by applying the principles of industrial management. CO5.1 Apply mathematical principles especially in linear and differential equations to solve optimization problems in industrial management. CO5.2 Model industrial management CO4.3 Analyze the decision making process in operations and production management. CO4.4 Analyzing working procedures and ergonomics CO5.5 Analyzing quality management of electrical work CO5.6 Develop human resource management for industries in Indonesia CO5.7 Identifying problems related to industrial management

	CO6 Apply industrial management theory to organizations. CO6.1 Apply industrial management theory to work related to electrical engineering
ELO and CO mapping:	(see table below)
Courses Description:	Industrial Management is a subject supporting the competence of technicians and electrical engineering teachers to understand the conditions of the workforce and industry in general. The material covered includes management and organization, the development of management theory, decision making, management styles, industrial production processes, work procedures, work culture, quality management, human resource management and information systems management. After completing this lecture, students are expected to have insight, knowledge, skills and attitudes that can increase work effectiveness and efficiency in order to achieve organizational goals by optimizing available resources. Lectures are carried out using the student center learning approach. Competency-based assessment involves active participation, and communication of interactions between individuals and groups.
Assessments:	1. Assessment is carried out to measure all learning achievements, namely attainment learning achievements, knowledge, and special skills. 2. Attitude assessment is carried out through direct observation of each student at each lecture meeting, including: attendance, discipline, personal and interpersonal interaction. This attitude assessment categories, namely: "Very Good", "Good", and "Less Good". The minimum attitude value is included in the "Good" category. By using observation and / or self-assessment techniques using the assumption that basically every student has a good attitude. The results of this attitude assessment are used as a consideration for determining the final assessment of this course. 3. The final grade includes the results of the knowledge assessment, and the specific skills obtained from individual assignments, group assignments, presentations, quizzes,

ELO and CO mapping:

	ELO1	ELO3	ELO4	ELO7
CO1	✓			
CO2		✓		
CO3			✓	
CO4			✓	
CO5				✓
CO6				✓

<table>
<tr><td></td><td>insert tests, and final semester examinations are determined as follows.

<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td rowspan="3">1</td><td rowspan="3">CO1 – CO7</td><td>Active in class
Duty
Discussion
Presentation</td><td>Observation
Rubric
Observation
Rubric</td><td>15%</td></tr>
<tr><td>Quiz
Duty
UTS
Final exams
Presentation</td><td>Test
Rubric
Test
Test
Rubric</td><td>50%</td></tr>
<tr><td>Draw SLD
Count manually
Analyzing with software
Discussion
Presentation</td><td>Duty
Test
Duty
Rubric
Rubric</td><td>35%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table></td></tr>
<tr><td>Forms of media:</td><td>Board, LCD Projector, Laptop/Computer</td></tr>
<tr><td>Literature:</td><td>1. Hani Handoko (2012), Management, Edisi kedua, Badan Penerbitan Fakultas Ekonomi (BPFE) Universitas Gadjah Mada Yogyakarta Indonesia
2. Joan Magretta, (2012), What Management Is, CPI Group (UK) Ltd. Croydon, Great Britain
3. Koontz, H, Weinrich H (2015). Management: A Global Perspective, McGraw Hill New York
4. Muhamad Ali, (2017). Manajemen Industri 4.0 Edisi 1, UNY Press Universitas Negeri Yogyakarta, Yogyakarta Indonesia
5. Z. Sutalaksana, dkk (1997). Teknik Tata Kerja, Ganexa Exact Bandung
6. Mcleod, 2015, Sistem informasi manajemen Edisi 10, Penerbit Salemba empat, Jakarta. Indonesia
7. Aneka referensi dari paper dan Journal terkait dengan manajemen industri</td></tr>
<tr><td>Date of revision</td><td>06 July 2019</td></tr>
</table>

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Counseling Guidance
Module level,if applicable:	Undergraduate
Code:	MDK6205
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	4th
Module coordinator:	Mutaqin, M.Pd., M.T.
Lecturer(s):	1. Dr. Edy Supriyadi 2. Dr. Ketut Ima Ismara, M.Pd.,M.Kes.
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	100 minutes lectures and 120 minutes structured activities per week.
Teaching and Learning Method	Discussion
Workload:	Total workload is 91 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes self-study per week for 16 weeks.
Credit points:	2
Prerequisites course(s):	-
Expected learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics

	ELO2 Demonstrate nationalism, responsibility, and tolerance to both society and environmet ELO3 Capable to perform professional works in his/her field of expertise both individual and team works ELO4 Mastering work standards, work methods, work implementation, and testing in the field of electric power engineering or industrial automation. ELO9 Capable to develop a vocational education innovation and publish scientific paper
Course Outcomes:	CO1 Devoted to God who is almighty and capable of showing religious attitude and character, CO2 Demonstrate an attitude of nationalism, responsibility, and tolerance towards society and the environment CO2.1 Uphold the value of humanity in carrying out duties based on religion, morals, and ethics. CO3 Internalize academic values, norms and ethics. CO3.1 Mahami launches courses and the importance of Career Guidance, the meanings and functions of Career Guidance CO6 Knowledge of the preparation of scientific works including work reports in accordance with scientific procedures based on data and information analysis. CO6.1 Understand the meaning, purpose and function of career guidance and the development of career guidance phases CO6.2 Knowing the achievement of understanding of the Career Guidance material CO6.3 Having knowledge about the importance of job information CO6.4 Having information about job sources Understand labor theory and have job analysis skills CO7 Apply logical, critical, systematic, and innovative thinking in the context of developing or implementing science and / or technology in accordance with their area of expertise. CO7.1 Have an understanding of the scope of Career Guidance on the methods of implementing Career Guidance CO7.2 Knowing the factors that influence the need for Career Guidance, the pattern of implementing

	vocational guidance CO7.3 Generate book reviews related to Career Guidance CO8 Assessing the implications of the development or implementation of science, technology or art in accordance with their expertise based on rules, procedures and scientific ethics to produce solutions, ideas, designs, or art criticisms and compile scientific descriptions of the results of their studies in the form of thesis or final project report. CO8.1 Students have a dream job that is dreamed of, get a job information source CO9 Make decisions appropriately in the context of problem solving in their area of expertise, based on the results of an analysis of information and data. CO9.1 Identifying new business opportunities that can be developed CO10 Compile reports of Scientific Works in accordance with scientific procedures based on analysis, information and data and be able to interpret and communicate accurately and accountably in order to solve problems and phenomena that occur related to the profession. CO10.1 The ability to explain the profession of a counselor, can explain counseling techniques CO10.2 Having an understanding of recruitment of workers, having readiness to interview CO10.3 Ability to explain the concepts of work placement and student follow-up CO10.4 Understand the organization, administration, and evaluation of Career Guidance, able to make job applications
ELO and CO mapping	(see mapping table below)

	ELO1	**ELO2**	**ELO3**	**ELO4**	**ELO9**
CO1	✓				
CO2		✓			
CO3			✓		
CO4					
CO5			✓		
CO6				✓	
CO7					✓

<table>
<tr>
<td></td>
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<table>
<tr><td>CO8</td><td></td><td></td><td></td><td></td><td>✓</td></tr>
<tr><td>CO9</td><td></td><td></td><td></td><td></td><td>✓</td></tr>
<tr><td>CO10</td><td></td><td></td><td></td><td></td><td>✓</td></tr>
</table>
</td>
</tr>
<tr>
<td>Courses Description:</td>
<td>Guidance and Counseling, is a science and skills course. This course develops student understanding (prospective subject teachers / fields of study) about guidance and counseling in schools and the role of subject teachers / fields of study in guidance and counseling services in schools.</td>
</tr>
<tr>
<td>Assessments:</td>
<td>

Assessment is carried out to measure all learning achievements, namely attainment learning achievements, knowledge, and special skills.
Attitude assessment is carried out through direct observation of each student at each lecture meeting, including: attendance, discipline, personal and interpersonal interaction. This attitude assessment categories, namely: "Very Good", "Good", and "Less Good". The minimum attitude value is included in the "Good" category. By using observation and / or self-assessment techniques using the assumption that basically every student has a good attitude. The results of this attitude assessment are used as a consideration for determining the final assessment of this course.
The final grade includes the results of the knowledge assessment, and the specific skills obtained from individual assignments, group assignments, presentations, quizzes, insert tests, and final semester examinations are determined as follows.

<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td rowspan="5">1</td><td rowspan="5">CO1 – CO10</td><td>Presentation</td><td>Observation</td><td>10%</td></tr>
<tr><td>Assignment individual/ groups</td><td>Presentation</td><td>20%</td></tr>
<tr><td>Quiz</td><td>Accuracy of program results
Written</td><td>20%</td></tr>
<tr><td>Mid Exam</td><td>written test</td><td>20%</td></tr>
<tr><td>Final Exam</td><td>written test</td><td>30%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table>
</td>
</tr>
</table>

Forms of media:	Board, LCD Projector, Laptop/Computer
Literature:	1. Antje Barabasch, Felix Rauner. (2012). Work and Education in America. German: Universitas of Bremen 2. Dewa Ketut Sukardi. (1995). Bimbingan Karier di Sekolah-sekolah. Jakarta : Ghalia Indonesia. 3. Hoppock, Robert. (1976) Occupational Information. New York : McGraw –Hill, Book Co. 4. James A. Athanasou, Raul Van Ebroek. (2008). Internatioal Handbook of Career Guidance. Belgium: Springer 5. Mohammad Thayeb Manribu. (1988). Pengantar Bimbingan dan Konseling Kejuruan. Jakarta : P2LPTK Ditjen Dikti. 6. Stephen Billet. (2011). Vocational Education, Purposes, Traditions, and Prospects. Quiqland: Sripnger. 7. Xueeping Wu, Yiqun Ye. (2018). Technical and Vocational Education in China. Beijing: Springer 8. Valerie Cohen-Scali, Jerome Rossier, Laura Nota (2018). New Perpective on Career Counseling and Guidance in Europe, Building Careers in Changing and Diverse Sociaties. Paris: Springer. 9. Stephen Billet. (2011). Vocational Education, Purposes, Traditions, and Prospects. Quiqland: Sripnger.
Date of revision	10 August 2019

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP) **MODULE HANDBOOK**

Module name:	Electrical Power System Analysis
Module level,if applicable:	Undergraduate
Code:	EKO6231
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	4^{th}
Module coordinator:	Ir. Muhamad Ali, M.T.
Lecturer(s):	Team
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	100 minutes lectures, 120 minutes structured activities, and 120 minutes self-study per week.
Teaching and Learning Method	Presentation, Discussion, Question and Answer, Problem Based Learning, Problem Solving.
Workload:	Total workload is 90 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes self-study per week for 16 weeks.
Credit points:	2
Prerequisites course(s):	-
Expected Learning Outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics ELO4 Master in basic sciences and principles of electric ELO7 Able to manage vocational education and training in the field of Electrical Engineering by utilizing information

	and communication technology. Knowledge of the generation, distribution, use, installation and engineering of electric power automation in the business world and industry in accordance with the standards and principles that are generally accepted and relevant in the field of electricity and renewable energy.
Course Outcomes:	CO1 Thanks to God and able to show a religious attitude and character, CO2 Students actively participate, take responsibility, and have the motivation to develop themselves, CO3 Mastering knowledge about the principles of Mathematics and Physics related to the principles of electricity CO3.1 Understanding the principles of Mathematics in particular trigonometry, differentials, and integrals in electrical machines. CO3.2 Understand the principles of electricity and its relation to the operation and analysis of the electric power system. CO4 Knowledge of law and the basic theory of electricity. Understanding the components of the electric power system. CO4.1 Understanding the modeling of electric power systems with a Single Line Diagram. CO4.2 Understanding the types of interference in the electric power system CO4.3 Understanding load flow in electric power systems CO4.4 Understand short circuit interference in electric power systems CO4.5 Understand the improvement of power factors and voltage profiles in the electric power system CO4.6 Understand losses in the electric power system CO4.7 Understand the principles of electric power system optimization CO4.8 Understand the improvement of power factors and voltage profiles in the electric power system CO5 Analyze and solve technical problems related to electrical engineering by applying mathematical principles. CO5.1 Apply mathematical principles, especially

	diagrams, vectors, linear equations, and numerical calculations in electric power system problems. CO5.2 Model an electric power system in the form of a single line daigram CO5.3 Analyzing due to interference with the electric power system. CO5.4 Analyzing load flow on an electric power system. CO5.5 Analyze improvements in power factor and voltage profile on the electric power system CO5.6 Designing protection system coordination in the electric power system CO5.7 Identify power system losses and find solutions to solve them CO6 Applying the theory of electric circuits to electric power systems. CO6.1 Applying the theory of electric circuits to electric power systems, including those from generation, transmission, distribution, and utilization of electric power
ELO and CO mapping:	(see table below)
Courses Description:	Electric Power System Analysis is a theoretical course given to students to equip capabilities in the field of electric power systems and analysis to obtain a stable and optimal system. The material covered includes the basic concepts of electric power systems, electric power system components, electric power system disturbances, types of power system disturbances, short circuit fault analysis, sudden cause analysis on electric power systems, studies of electricity load flow, electric power system stability and electric power system optimization. Lectures are carried out using the student center learning approach through lecture lectures in class combined with group discussions and case studies. Competency-based

	ELO1	ELO3	ELO4	ELO7
CO1	✓			
CO2		✓		
CO3			✓	
CO4			✓	
CO5				✓
CO6				✓

	assessment involves active participation, and communication of interactions between individuals and groups.
Assessments:	1. Assessment is carried out to measure all learning achievements, namely attainment learning achievements, knowledge, and special skills. 2. Attitude assessment is carried out through direct observation of each student at each lecture meeting, including: attendance, discipline, personal and interpersonal interaction. This attitude assessment categories, namely: "Very Good", "Good", and "Less Good". The minimum attitude value is included in the "Good" category. By using observation and / or self-assessment techniques using the assumption that basically every student has a good attitude. The results of this attitude assessment are used as a consideration for determining the final assessment of this course. 3. The final grade includes the results of the knowledge assessment, and the specific skills obtained from individual assignments, group assignments, presentations, quizzes, insert tests, and final semester examinations are determined as follows.

No	CO	Assessment Object	Assessment Technique	Weight
1	CO1 – CO9	Attitude	Observation Rubric Observation Rubric	15%
		Individual Assignment/Group Assignment Mid Exam Final Exam	Test Rubric Test Test Rubric	50%
		Draw SLD Count manually Analyzing with software Discussion Presentation	Duty Test Duty Rubric Rubric	35%
			Total	100%

Forms of media:	Board, LCD Projector, Laptop/Computer
Literature:	1. Muhamad Ali, 2016, Analisis dan Optimasi Sistem Tenaga Listrik, Penerbit UNY Press, Yogyakarta 2. Stevenson, William D, 1984. Analisis Sistem Tenaga Listrik, Jakarta. Penerbit Erlangga 3. Lazaar, Irwin, 1980. Electrical System Analysis and Design for Industrial Plants. New York. McGraw - Hill Book Company. 4. Grainger John J. and Stevenson, William D 1994, Power System Analysis. Singapore. McGraw – Hill 5. S. Ramar and S. Kuruseelam, 2013, Power System Analysis, PHI Learning Private Limited, New Delhi India 6. Hemchandra Madhusudan Shertukde, 2019, Power Systems Analysis Illustrated with MATLAB and ETAP, ISBN 9781498797214, CRC Press, Taylor and Francis Group 7. Aneka referensi Jurnal Ilmiah tentang Analisis Sistem Tenaga Listrik
Date of revision	08 August 2019

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Intelligent Control System
Module level,if applicable:	Undergraduate
Code:	EKO6235
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	4^{th}
Module coordinator:	Dr. Haryanto, M.Pd., M.T.
Lecturer(s):	Team
Language:	Bahasa Indonesia
Classification within the curriculum:	~~Compulsory~~/Elective Course
Teaching format / class hours per week during the semester:	100 minutes lectures and 120 minutes structured activities per week.
Teaching and Learning Method	Discussion and Lecturing
Workload:	Total workload is 91 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes self-study per week for 16 weeks.
Credit points:	2
Prerequisites course(s):	-
Expected learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics. ELO2 Demonstrate nationalism, responsibility, and tolerance to both society and environmet.

	ELO4	Knowledge of law and the basic theory of electricity
	ELO7	Apply automation techniques for the purposes of electrical and renewable energy (magnetic contactors, power electronics, PLCs, and microcontrollers).
	ELO9	Assessing the implications of the development or implementation of science, technology or art in accordance with their expertise based on the rules, procedures and scientific ethics to produce solutions, ideas, designs, or art criticism and compile scientific descriptions of the results of their studies in the form of thesis or final project report.
Course outcomes:	CO1	Devoted to God Almighty and able to show a regius attitude and character that is implemented in learning and learning outcomes.
	CO2	Contribute to improving the quality of community, nation, and state life
	CO2.1	the progress of civilization based on Pancasila.
	CO4	Knowledge of law and the basic theory of electricity.
	CO4.1	The use of laws and theories of intelligent control systems for the process of controlling electricity.
	CO7	Using information and communication technology to develop intelligent-based automation systems with microcontrollers or microcomputers as a means.
	CO9	Apply science and technology skills to produce solutions, ideas, designs for technology and vocational education in the field of Electrical Engineering both theory and practice through the use of IT and various artificial intelligence techniques both in the form of application systems and thesis or final project reports.

ELO and CO mapping:

	ELO1	ELO2	ELO4	ELO7	ELO9
CO1	✓				
CO2		✓			
CO4			✓		
CO7				✓	
CO9					✓

<table>
<tr><td>Courses Description:</td><td>Intelligent Control System lectures to develop the ability of students to be able to develop control systems for control machines and or electronic / electrical equipment and be able to implement them for various control processes by prioritizing the principles of improving the performance of intelligent control systems based on fuzzy logic (LF), networks artificial nerves (ANN) and genetic algorithms (AG), both software and hardware-software. Lectures are carried out using the student center learning approach, with problem based and case based learning models. Competency-based assessment involves active participation, individual and group assignments, midterms and final semester exams.</td></tr>
<tr><td>Assessment:</td><td>

Assessment is carried out to measure all learning achievements, namely attainment learning achievements, knowledge, and special skills.
Attitude assessment is carried out through direct observation of each student at each lecture meeting, including: attendance, discipline, personal and interpersonal interaction. This attitude assessment categories, namely: "Very Good", "Good", and "Less Good". The minimum attitude value is included in the "Good" category. By using observation and / or self-assessment techniques using the assumption that basically every student has a good attitude. The results of this attitude assessment are used as a consideration for determining the final assessment of this course.
The final grade includes the results of the knowledge assessment, and the specific skills obtained from individual assignments, group assignments, presentations, quizzes, insert tests, and final semester examinations are determined as follows.

<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td rowspan="4">1</td><td rowspan="4">CO1 - CO4</td><td>Attendance</td><td>Documentation</td><td>10%</td></tr>
<tr><td>Assignment</td><td>Written test</td><td>20%</td></tr>
<tr><td>Midterm exams</td><td>Written test</td><td>30%</td></tr>
<tr><td>Final exams</td><td>Written test</td><td>40%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table>
</td></tr>
<tr><td>Forms of media:</td><td>Board, LCD Projector, Laptop/Computer</td></tr>
<tr><td>Literature:</td><td>

Ghalnaraghi, F., and Kuo, B. 2010. Automatic control systems, USA: John Wesley Addison.
Horváth, G. 2002. Neural networks for system modeling. Hongaria: Budapes University Press.

</td></tr>
</table>

	3. Klir, G,J., & Yuan, B. 2005. Fuzzy sets and fuzzy logic, theory and applications. NJ: PHI Inc. 4. Luger. 2005. Artificial intelligence. USA: John Wesley Addison. 5. Mitchell Melanie, M. 1999. An introduction to genetic algorithms. USA: MIT Press. 6. Nagy, Z. 2018. Artificial intelligence and machine learning fundamentals. UK: Pack Publishing. 7. Nie, J. & Linkens, D. (1995). Fuzzy-neural control: principles, algorithms and applications. New Jersey: Prentice Hall Inc. 8. Sukla, R.C. (2001). Control Systems. Delhi: Dhanpat Rai & Co. (Pvt.) Ltd.
Date of revision	13 July 2019

5th SEMESTER

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Instructional Media
Module level,if applicable:	Undergraduate
Code:	KTF6203
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	5th
Module coordinator:	Dr. Sunaryo Soenarto, M.Pd.
Lecturer(s):	Team
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	100 minutes lectures and 120 minutes structured activities per week.
Teaching and Learning Method	Discussion, Demostration, and Lecturing
Workload:	Total workload is 91 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes self-study per week for 16 weeks.

Credit points:	2
Prerequisites course(s):	-
Expected learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics. ELO2 Knowledge of the concepts of developing learning strategies, and learning media for technology and vocational education in the field of Electrical Engineering. ELO3 Able to plan, train, and study the fields of electrical or automation engineering used. ELO4 Able to manage vocational education and training in the field of Electrical Engineering by utilizing information and communication technology
Course Outcomes:	CO1 Students who are dedicated to Allah SWT and are able to show attitudes and character regius. CO1.1 Students agree to be active, responsible, and have motivation to develop themselves, CO2. Explain the relationship between communication theory, and also learning theory understanding, functions, benefits, advantages and disadvantages of learning media CO2.1 Check the taxonomies of various vocational learning media CO2.2 Analyzing the strengths and weaknesses of various learning media CO2.3 Apply the concept of developing printed teaching materials CO2.4 Applying the basic principles of photography in learning media CO2.5 Implement a learning video production program CO3 Students are able to communicate effective messages, think critically and make the right decisions,

	CO3.1 Students are able to compile a script of a video learning program CO4 Students are trained in managing electronic media and conventional media CO4.1 Students are able to work in groups in synergy in producing instructional video media,
ELO and CO mapping:	<table><tr><th></th><th>ELO1</th><th>ELO2</th><th>ELO3</th><th>ELO4</th></tr><tr><td>CO1</td><td>✓</td><td></td><td></td><td></td></tr><tr><td>CO2</td><td></td><td>✓</td><td></td><td></td></tr><tr><td>CO3</td><td></td><td></td><td>✓</td><td></td></tr><tr><td>CO4</td><td></td><td></td><td></td><td>✓</td></tr></table>
Courses Description:	This course discusses the development of contextual thinking (in accordance with study programs in the studio) and elements of learning media. The main study discusses: concept communication, learning communication, information technology, functions and benefits of instructional media, as well as conventional instructional economic media, model development, instructional design. Examining printed and electronic learning media applications such as posters, photos, videos, audio visual and multimedia. Learn the rules, structure and methods of media development (4D and ADDIE). Lectures are carried out by agreeing to student learning centers and production media independently. Competency-based assessment and sponsored performance and active communication.
Assessments:	Assessment is carried out to measure all learning achievements, namely attainment learning achievements (CO 1), general skills (CO 2), knowledge (CO 3), and special skills (CO 4 and CO 5). 1. Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using considerations on each student having a good attitude. Read more about like, good, and very good attitude. Assessment results are not a component of a student's final grade, approved as one of the graduation requirements. Students who will graduate from this course have a minimum of good attitude. Attitude assessment also considers the activeness of students following lectures.

<table>
<tr><td></td><td>
2. Final grades complete the results of knowledge, general skills, and special skills obtained from individual assignments, group assignments, Midterm Exams, presentations and final products with the following guidelines.

The final mark will be weight as follow:

<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td rowspan="4">1</td><td rowspan="4">CO3
CO4
CO5</td><td>Presentation</td><td>Observation</td><td>30%</td></tr>
<tr><td>Individual task</td><td>Accuracy of results with task criteria</td><td>25%</td></tr>
<tr><td>Group task</td><td>Accuracy of results with task criteria</td><td>25%</td></tr>
<tr><td>Mid</td><td>Written test</td><td>20%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table>
</td></tr>
<tr><td>Forms of media:</td><td>Board, LCD Projector, Laptop/Computer</td></tr>
<tr><td>Literature:</td><td>
1. Arif Sardiman. (2001). Media Pendidikan. Jakarta: Pustekkom Diknas.
2. Azhar Arsyad. (2003). Media Pembelajaran.Jakarta PT. Raja Grafindo Persada.
3. Chapman, Nigel and Jenny Chapman.(2004). Digital Multimedia. England: John Wiley & Sons Ltd.
4. Heinrich,R., Molenda,M. and Russel. (1982). Instructional Media. New York: John Willey & Sons.
5. Nana Sudjana dan Ahmad Rivai. (1997). Media Pengajaran, Bandung: Sinar Baru
6. Smaldino, E. Sharon et.al (2012). Instructional Technology and Media For Learning, New Jersey: Merril Prentice Hall
7. Sunaryo Soenarto dkk. (2012). Media Pembelajaran Teknologi dan Kejuruan, Yogyakarta: FT UNY.
</td></tr>
</table>

	8. Yunardi. (2002). Belajar Sendiri Adobe Photoshop 6,0. Surabaya: Indah.
Date of revision	30 August 2018

UNIVERSITAS NEGERI YOGYAKARTA
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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Curriculum and Instructional of Vocational
Module level,if applicable:	Undergraduate
Code:	KTF6201
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	5^{th}
Module coordinator:	Dr. Sunaryo Soenarto, M.Pd.
Lecturer(s):	1. Dr. Istanto Wahyu Djatmiko 2. Dr. Edy Supriyadi, M.Pd.
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	100 minutes lectures and 120 minutes structured activities per week.
Teaching and Learning Method	Discussion, Observation, and Lecturing
Workload:	Total workload is 91 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes self-study per week for 16 weeks.

Credit points:	2
Prerequisites course(s):	-
Expected learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics ELO3 Can carry out work in accordance with the professional field of expertise both individually and in teams ELO8 Able to apply research methods and compile Scientific work
Course Outcomes:	CO1 Devotion to God Almighty and able to show religious attitude CO2 Demonstrates a responsible and independent attitude towards the assigned work CO3 Demonstrates responsibility for work in their area of expertise independently CO4 Understand comprehensively the concepts of planning, implementing, and evaluating curriculum and being able to apply it in the development of vocational education curriculum.
ELO and CO mapping	<table><tr><th></th><th>ELO1</th><th>ELO3</th><th>ELO8</th></tr><tr><td>CO1</td><td>✓</td><td></td><td></td></tr><tr><td>CO2</td><td>✓</td><td></td><td></td></tr><tr><td>CO3</td><td></td><td>✓</td><td></td></tr><tr><td>CO4</td><td></td><td></td><td>✓</td></tr></table>
Courses Description:	This course equips students with the ability to comprehensively understand the concepts of planning, implementing, and evaluating curriculum and being able to apply it in the development of vocational education curriculum. The course generally contains material about the definition, dimensions, functions, and role of the curriculum; foundation of curriculum development; curriculum development components; principles of curriculum development; curriculum development and organization models; vocational learning approaches,

<table>
<tr><td></td><td>strategies and models. Lectures are carried out both with lectures, class and group discussions which are equipped with the assignment of observations and critical analysis of the practices of vocational education curriculum development.</td></tr>
<tr><td>Assessment:</td><td>
The assessment is carried out to measure all learning outcomes, namely learning outcomes related to Attitudes, Knowledge, General Skills and Special Skills.
Attitude assessment is carried out integrated in learning at each meeting using observation techniques. Basically every student has a good attitude. The student is given the value of a very good attitude or not good if it shows significantly better or less good attitude compared to the attitude of students in general. The results of the attitude assessment are not a component of the student's final grade, but rather as one of the graduation requirements. Students will graduate from this course if at least have a good attitude. Attitude assessment also considers the activeness of students following lectures
The final mark will be weight as follow:
<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td rowspan="5">1</td><td rowspan="5">CO1 - CO4</td><td>Attendance</td><td>Presentation</td><td>10%</td></tr>
<tr><td>Individual Assignment</td><td>observation</td><td>20%</td></tr>
<tr><td>Group Assignment</td><td>assignment</td><td>20%</td></tr>
<tr><td>MID</td><td>Written test</td><td>25%</td></tr>
<tr><td>Final Exam</td><td>Written Test</td><td>25%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table>
</td></tr>
<tr><td>Forms of media:</td><td>Board, LCD Projector, Laptop/Computer</td></tr>
<tr><td>Literature:</td><td>

Finch, C.R & Crunkilton, J.R. (1999). Curriculum Development in Vocational and Technical Education (fifth edition). Massachusetts: Allyn and Bacon
Olive, P.F. (1992). Developing the Curriculum (third edition). New York: Harper Collins Publishers

</td></tr>
</table>

	3. Bean, J.A., Toefr, C.F., & Alessi, S.J. (1986). Curriculum Planning and Development. Massachusetts: Allyn and Bacon 4. Thompson, J.F. (1993). Foundation of Vocational Education. New Jersey: Prentice Hall 5. Sukamto. (1988). Perencanaan & Pengembangan Kurikulum Pendidikan Teknologi dan Kejuruan. Jakarta: Dikti 6. Sukamto. (2001). Perubahan Karakteristik Dunia Kerja dan Revitalisasi Pembelajaran dalam Kurikulum Pendidikan Kejuruan. Pidato Pengukuhan Guru Besar. Yogyakarta: UNY 7. Ella Yulaelawati. (2004). Kurikulum dan Pembelajaran. Jakarta: Pakar Raya 8. Pardjono, Wardan Suyanto, dan Satunggalno. (2003). Pendidikan Kejuruan dengan Kurikulum Berbasis Kompetensi Berorientasi Kecakapan Hidup. Makalah. Disampaikan dalam Lokakarya Pembelajaran dengan KBK Berorientasi Kecakapan Hidup tanggal 29 dan 30 April 2003 di Fakultas Tekik Universitas Negeri Yogyakarta 9. CD Bahan Sosialisasi Kurikulum Berbasis Kompetensi 10. CD Sosialisasi Kurikulum Tingkat Satuan Pendidikan 11. CD Sosialisasi Kurikulum 2013 12. Handout
Date of revision	18 August 2018

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Electrical Power Protection Lab. Work
Module level,if applicable:	Undergraduate
Code:	EKO6226
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	5^{th}
Module coordinator:	Dr. Edy Supriyadi
Lecturer(s):	1. Toto Sukisno, M.Pd.
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	200 minutes lectures and 240 minutes structured activities per week.
Teaching and Learning Method	Discussion
Workload:	Total workload is 181 hours per semester which consists of 200 minutes lectures, 240 minutes structured activities, and 240 minutes self-study per week for 16 weeks.

<table>
<tr><td>Credit points:</td><td>2</td></tr>
<tr><td>Prerequisites course(s):</td><td>-</td></tr>
<tr><td>Expected Learning outcomes:</td><td>After taking this course the students have ability to:
ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics
ELO3 Can carry out work in accordance with the professional field of expertise both individually and in teams
ELO4 Master in basic sciences and principles of electric
ELO7 Able to manage vocational education and training in the field of electrical engineering by utilizing information and communication technology</td></tr>
<tr><td>Course outcomes:</td><td>CO1 Devoted to God Almighty and able to show a regius attitude and character,
CO1.1 Demonstrate polite, honest, good faith in lectures.
CO2 Students actively participate, take responsibility, and have the motivation to develop themselves,
CO3 Can carry out work in accordance with the professional field of expertise both individually and in teams
CO3.1 Behave according to academic values, norms and ethics
CO4 Knowledge of law and the basic theory of electricity
CO4.1 Apply the basic laws of electricity to determine the value of the protection component</td></tr>
<tr><td>ELO and CO mapping</td><td><table>
<tr><th></th><th>ELO1</th><th>ELO3</th><th>ELO4</th><th>ELO7</th></tr>
<tr><th>CO1</th><td>✓</td><td></td><td></td><td></td></tr>
<tr><th>CO2</th><td></td><td>✓</td><td></td><td></td></tr>
<tr><th>CO3</th><td></td><td></td><td>✓</td><td></td></tr>
<tr><th>CO4</th><td></td><td></td><td></td><td>✓</td></tr>
</table></td></tr>
<tr><td>Courses Description:</td><td>Electric Power Protection Lectures develop student competencies about the Protection Philosophy, which includes rational, understanding and protection functions, types of disturbances and their prevention, primary and reserve safety; Protection relays, including the understanding, functions and</td></tr>
</table>

<table>
<tr><td></td><td>requirements of relays, static and mechanical relays; Overcurrent Relays; understanding, working principle, type, configuration, usage; Distance relays, including, working principle, type, configuration, usage; Differential relays, including, working principle, type, configuration, usage; Voltage Relays, including, working principle, type, configuration, usage; Power Relays, including, working principle, type, configuration, usage; Direction Relay, including, working principle, type, configuration, usage; Power Breakers; Generator Protection, covering type of disturbance, protection devices, configuration & work system; Transformer Protection, covering type of disturbance, protection devices, configuration & work system; Transmission Network Protection, covering type of interference, protection devices, configuration & work system; Distribution Network Protection, covering types of interference, protection devices, configuration & work systems; Motor protection, including the type of interference, protection devices, configuration & work systems. Lectures are carried out with various approaches that are relevant to the context of the material and the potential of students, including: contextual, project based learning, and problem base learning that leads to student center learning. Continuous assessment is carried out on a competency basis and harmonized with lecture activities.</td></tr>
<tr><td>Assessments:</td><td>The assessment is carried out to measure all learning outcomes, namely learning outcomes related to Attitudes, Knowledge, General Skills and Special Skills.

Attitude assessment is carried out integrated in learning at each meeting using observation techniques. Basically every student has a good attitude. The student is given the value of a very good attitude or not good if it shows significantly better or less good attitude compared to the attitude of students in general. The results of the attitude assessment are not a component of the student's final grade, but rather as one of the graduation requirements. Students will graduate from this course if at least have a good attitude. Attitude assessment also considers the activeness of students following lectures.The final mark will be weight as follow:

<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">CO1 - CO4</td><td>Presence</td><td>Observation</td><td>10%</td></tr>
<tr><td>Individual Assignment</td><td>Presentation</td><td>15%</td></tr>
</table>
</td></tr>
</table>

<table>
<tr>
<td></td>
<td>
<table>
<tr><td></td><td></td><td>Group Assignment</td><td>Presentation</td><td>20%</td></tr>
<tr><td></td><td></td><td>Mid</td><td>Written test</td><td>25%</td></tr>
<tr><td></td><td></td><td>Final Exam</td><td>Written test</td><td>30%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table>
</td>
</tr>
<tr><td>Forms of media:</td><td>Board, LCD Projector, Laptop/Computer</td></tr>
<tr><td>Literature:</td><td>1. Bonar Pandjaitan. 2012. Praktik-Praktik Proteksi Sistem Tenaga Listrik. Yogyakarta: Andi Offset.
2. Christophe Prévé. 2006. Protection of Electrical Networks. London: ISTE,Ltd.
3. Edy Supriyadi, 2000. Sistem Proteksi Tenaga Listrik. Yogyakarta: Adi Cita.
4. Elmore Walter A. Protective Relaying Theory & Application. New York: Marcell Dekker
5. Lewis Blackburn & Thomas J. Domin. 2006. Protective Relaying: Principles and Applications. Taylor&Francis Group,LLC.
6. PT. PLN (Persero) P3B. 2006. Materi Pelatihan O&M Relai Proteksi Jaringan. Jakarta: PLN.
7. Russel Mason. The Art & Science of Protective Relaying. General Electric</td></tr>
<tr><td>Date of revision</td><td>18 August 2018</td></tr>
</table>

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Vocational Instruction Strategic
Module level,if applicable:	Undergraduate
Code:	TKF6202
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	5^{th}
Module coordinator:	Dr. Haryanto, M.Pd., M.T
Lecturer(s):	1. Dr. phil. Nurhening Yuniarti, M.T.
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	100 minutes lectures and 120 minutes structured activities per week.
Teaching and Learning Method	Discussion and Lecturing
Workload:	Total workload is 91 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes self-study per week for 16 weeks.
Credit points:	2
Prerequisites course(s):	-
Expected learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics ELO3 Can do work in accordance with professional expertise, both individually and in teams

<table>
<tr>
<td></td>
<td>ELO5 Mastering work standards, work methods, carrying out work, and testing in the field of electric power engineering or industrial automation.
ELO6 Able to plan, implement, and evaluate learning in the field of electric power or automation techniques used
ELO9 Able to develop innovations in the field of education, and publish the results of his work</td>
</tr>
<tr>
<td>Course Outcomes</td>
<td>CO1 Demonstrate polite, honest, good faith in lectures.
CO2 Demonstrates responsibility for work in their area of expertise independently.
CO3 Knowledge of the preparation of scientific papers including work reports in accordance with scientific procedures based on data and information analysis.
CO3.1 Understand the scope of the Learning Strategy Course
CO3.2 Belief in the Objectives, Targets, and Learning Process of Vocational Education
CO3.3 Understanding Student-centered learning
CO3.4 Understand the basic concepts of work-based learning
CO3.5 Understanding Competency-based Learning
CO3.6 Understanding Learning Theory
CO3.7 Understanding Pedagogy - Vocational Andragogy
CO3.8 Understanding Process Standards
CO3.9 Learning approaches, methods and models
CO4 Apply education management to schools, education and training institutions in the field of Electrical Engineering
CO4.1 Using Learning Approaches, Methods, and Models
CO5 Apply logical, critical, systematic, and innovative thinking in the context of developing or implementing science and / or technology in accordance with their area of expertise.
CO5.1 Developing Theory Learning Tools, Practices, and Field Practices</td>
</tr>
<tr>
<td>ELO and CO mapping</td>
<td>
<table>
<tr><th></th><th>ELO1</th><th>ELO3</th><th>ELO5</th><th>ELO6</th><th>ELO9</th></tr>
<tr><td>CO1</td><td>✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td>✓</td><td></td><td>✓</td></tr>
<tr><td>CO4</td><td></td><td></td><td>✓</td><td></td><td></td></tr>
<tr><td>CO5</td><td></td><td></td><td>✓</td><td></td><td></td></tr>
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</table>

<table>
<tr>
<td>Courses Description:</td>
<td>Vocational Learning Strategy courses are programmed for all undergraduate study program students at FT UNY. The implementation of the Vocational Learning Strategy course is intended to provide learning experiences to students as prospective teachers / instructors of vocational / vocational education and training in order to be able to develop teaching strategies for creative, structured, measurable, and reasonable education according to vocational education and training needs. This course discusses the goals and objectives of vocational learning, vocational pedagogy and andragogy, learning theory, work-based learning, competency-based learning, student-centered contextual learning, cooperative learning, learning methods and models, learning components, theoretical learning tools, devices practical learning, learning tools in the industry, and educational process standards. In the learning process students are able to learn independently by using various learning and multimedia resources through the internet network.</td>
</tr>
<tr>
<td>Assessments:</td>
<td>

Assessment is carried out to measure all learning outcomes, namely attainment learning attitudes, general skills, knowledge, and special skills.
Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude compared to the attitude of students in general. The results of the attitude assessment are not a component of the student's final grade, but rather as one of the graduation requirements. Students will graduate from this course if at least have a good attitude. Attitude assessment also considers the activeness of students following lectures.
Final grades include the results of an assessment of knowledge, general skills, and special skills obtained from individual assignments, group assignments, presentations, quizzes, Insertion Exams, and Final Semester Exams with the following guidelines.
The final mark will be weight as follow:

<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td rowspan="6">1</td><td rowspan="6">CO2
CO3
CO4
CO5</td><td>Presentation</td><td>Presentation</td><td>10%</td></tr>
<tr><td>Individual Assignment</td><td>Accuracy of program results</td><td>10%</td></tr>
<tr><td>Group Assignment</td><td>Written test</td><td>10%</td></tr>
<tr><td>Quiz</td><td>Written test</td><td>20%</td></tr>
<tr><td>MID</td><td>Written test</td><td>20%</td></tr>
<tr><td>Final Exam</td><td>Written test</td><td>30%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table>
</td>
</tr>
</table>

Forms of media:	Board, LCD Projector, Laptop/Computer
Literature:	1. Billet, S. (2011). Vocational Education Purposes, Traditions and Prospects. New York: Springer Science+Business Media B.V. 2. Blank, W.E. (1982). *Handbook for Developing Competency-Based Training Programs*. London : Prentice-Hall,Inc. 3. Cuningham, I., Dawe, G., Bennett, B. (2004) *The Handbook of Work Based Learning.* Burlington: Gower Publishing Company. 4. Hill, W.F. (2011). *Teori-teori Pembelajaran: Konsepsi, komparasi, dan Signifikasni*. Bandung: Nusamedia 5. Jonassen D.H. (2004). *Learning to Solve Problems an Instructional Desig Guide*. San Francisco: Pfeiffer. 6. Jonassen D.H. (2004). *Learning to Solve Problems a Handbook for Desinging Problem-Solving Learning Environments*. San Francisco: Pfeiffer. 7. Koper, R. & Tatterasal, C. (2005). *Learning Design A Handbooks on Modelling and Delivering Networked Education Training*. New York: Springer. 8. Leighbody, G.B. (1966). *Methods of teaching shops and technocal subjects*. New York: Delmar Publisher. 9. Lucas.B., Spencer.,E., Claxton.G. 2012. *How To Teach Vocational Education, A Theory Of Vocational Pedagogy.* London: Centre for Skills Development 10. Maclean, R. (2007). *Learning and Teaching for the Twenty-First Century.* New York: Springer 11. Tan, O.S. (2003) *Problem-Based Learning, Innovation Using Problems to Power Learning in the 21st Century*: Singapore: Cengage Learning 12. Anderson, Lorin W. (1989). *The effective teacher: Studi guide and readings*. New York: McGraw-Hill Publishing Co. 13. Atwi Suparman (2001). *Disain instructional*. Jakarta: PAU Depdiknas. 14. Harris, R., Guthrie, H., Hobart, B. (1995). *Competency based education and training.* MacMillan Education Australia Ltd. 15. Millls, H.R. (1977). *Teaching and training: A handbook for instructors*. London: The MacMillan Press, Ltd. 16. Klein, Stephen B. (2002). *Learning: Principles and application*. New York: McGraww-Hill Publishing Company. 17. Cheng, Y.C. (2005). *New Paradigm For Re-Engineering Education, Globalization, Localization and Individualization*. Dordrecht: Springer 18. Pavlova, M. (2009). *Technology and Vocational Education for Sustainable Development Empowering Individuals for the Future.* Queensland: Springer Science Business Media B.V. 19. Piirto, J. (2011). *Creativity for 21st Century Skills How To Embed Creativity Into The Curriculum.* Rotterdam: Sense Publishers 20. Staron, M. 2011. *Life-Based Learning Model – A Model For Strengt-Based Approaches To Capability Development and Implications for Personal Development Planning.* Australian Government Department for Education Science and Training and TAFE NSW Available on-line

	at:http://learningtobeprofessional.pbworks.com/w/page/32893040/Life-based-learning Accessed 21/12/2014 21. Staron, M., Jasinski, M and Weatherley, R. 2006. *Life-Based Learning: A Strength-Based Approach For Capability Development In Vocational And Technical Education.* Australian Government Department for Education Science and Training and TAFE NSW Available on-line at:http://learningtobeprofessional.pbworks.com/w/page/32893040/Life-based-learning Accessed 21/12/2014 22. Wardiman Djojonegoro. (1998). *Pengembangan Sumberdaya Manusia melalui SMK.* Jakarta : PT. Jayakarta Agung Offset.
Date of revision	30 August 2018

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Vocational Learning Assessment
Module level,if applicable:	Undergraduate
Code:	KFT6204
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	5^{th}
Module coordinator:	Dr. Edy Supriyadi, M.Pd.
Lecturer(s):	1. Dr. Haryanto, M.Pd. M.T. 2. Prof. Dr. Samsul Hadi, M.Pd., M.T.
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	100 minutes lectures and 120 minutes structured activities per week.
Teaching and Learning Method	Discussion and Lecturing.
Workload:	Total workload is 91 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes self-study per week for 16 weeks.

Credit points:	2
Prerequisites course(s):	-
Expected learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics ELO2 Contribute to improving the quality of community, nation, and state life the progress of civilization based on Pancasila. ELO3 Demonstrates responsibility for work in their area of expertise independently. ELO5 Knowledge of the preparation of scientific works including work reports in accordance with scientific procedures based on data analysis and information related to learning assessment. ELO6 Apply information and communication technology in carrying out the duties of educators and education personnel. ELO8 Implement strategies, media, teaching materials, and evaluation of learning in technology and vocational education in the field of Electrical Engineering. ELO9 Assessing the implications of the development or implementation of science, technology or art in accordance with their expertise based on the rules, procedures and scientific ethics to produce solutions, ideas, designs, or art criticism and compile scientific descriptions of the results of their studies in the form of thesis or final project report.
Course Outcomes:	CO1 Devoted to God YME and able to show a religious attitude and character CO2 Uphold the confidentiality of his work, honest and fair in carrying out duties based on religion, morals, and ethics. CO3 Show a professional attitude in carrying out their duties with full responsibility and high dedication. CO4 Knowledge of the preparation of scientific works including work reports in accordance with scientific procedures based on data and information analysis. CO5 Preparation of work reports qualitatively and quantitatively in accordance with scientific procedures based on data analysis and information related to learning

assessment.

CO6 Use information and communication technology to compile, process / analyze data and information on measurement results and in making reports related to learning evaluation and assessment tasks.

CO6.1 Solve the problem of evaluation and assessment of learning by developing test and non-test instruments and analyzing data and information on measurement results, then interpreting the results as outlined in the report of learning outcomes.

CO7 Implement strategies, media, teaching materials, and evaluation of learning in technology and vocational education in the field of Electrical Engineering.

CO8 Applying assessment skills to learning technology and vocational education in the field of Electrical Engineering both theory and practice through the use of IT and various measurement techniques using test and non-test instruments that have been developed.

CO9 Provide assessment technique skills for learning technology and vocational education in the field of Electrical Engineering both theory and practice through the use of IT to produce ideas for evaluation and assessment that are solutive, effective and efficient.

ELO and CO mapping

	ELO1	**ELO2**	**ELO3**	**ELO5**	**ELO6**	**ELO8**	**ELO9**
CO1	✓						
CO2		✓					
CO3			✓				
CO4				✓			
CO5				✓			
CO6					✓		
CO7						✓	
CO8						✓	
CO9							✓

<table>
<tr><td>Courses Description:</td><td>This course develops student competencies in order to be able to apply evaluation and assessment of learning outcomes, develop test and non-test instruments, analyze test and non-test items, describe the results of analysis of test items and non-tests, and make evaluation and assessment reports of student learning outcomes.</td></tr>
<tr><td>Assessments:</td><td>
1. Assessment is carried out to measure all learning achievements, namely attitudes learning achievements (CO 1, 2, 3), knowledge (CO 5), and special skills (CO 6), general skills (CO 8, 9).
2. Attitude assessment is carried out at each meeting using observation techniques and / or peer assessment by using the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude compared to the attitude of students in general. The results of attitude assessment are not a component of the student's final grade, but rather as one of the graduation requirements (10%). Students will graduate from this course if at least have a good attitude. Attitude assessment also considers the activeness of students following lectures.
3. Final grades include the results of the assessment of knowledge, special skills and general skills, obtained from individual assignments, group assignments, presentations, quizzes, Midterm Exams, and Final Semester Exams with the following guidelines.
<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td rowspan="7">1</td><td rowspan="7">CO1
CO2
CO3
CO5
CO6
CO8
CO9</td><td>Presentation</td><td>Observation</td><td>10%</td></tr>
<tr><td>individual Assignment</td><td>Presentation</td><td>20%</td></tr>
<tr><td>Group Assignment</td><td>Presentation</td><td>20%</td></tr>
<tr><td>quiz</td><td>Written test</td><td>20%</td></tr>
<tr><td>MID</td><td>Written test</td><td>20%</td></tr>
<tr><td>Final Exam</td><td>Written test</td><td>30</td></tr>
<tr><td colspan="2">Total</td><td>100%</td></tr>
</table>
</td></tr>
</table>

Forms of media:	Board, LCD Projector, Laptop/Computer
Literature:	1. Cohen−Swerdlik (2009). *Psychological Testing and Assessment: An Introduction to Tests and Measurement 7th Edition*. USA: Mc. Graw Hill Company. 2. Groth, G. & Marnat. (2003). *Handbook of psychological assessment fourth edition*. Canada: John Wiley & Sons, Inc. 3. Higher Education Commission. (2012). *Classroom Assessment*. USA: Columbia University Press 4. Lester, P.E., Inman, D., & Bishop, L. 2014. *Handbook of tests and measurement in education and the social sciences third edition.* USA: The Rowman & Littlefield Publishing Group, Inc. 5. Phye, G.D. (1997). *Handbook of classroom assessment learning, achievement, and adjustment*. USA: Academic Press. 6. Scheerens, J., Glas, C., & Thomas, S.M., 2003. *Educational evaluation, assessment, and monitoring*. Netherland: Swets & Zeitlinger B.V., Lisse, The Netherlands. 7. Timothy R. Vansickle, T.R. & Vansickle, K.J. (1988). Vocational assessment handbook. Texas: Texas University Press. 8. van den Akker, J., Gravemeijer, K., Susan McKenney, S., & Nienke Nieveen, N. (2006). Educational Design Research The Design, Development and Evaluation of Programs, Processes and Products. Canada: Taylor & Francis.
Date of revision	28 August 2018

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Industrial Internship
Module level,if applicable:	Undergraduate
Code:	KTF6309
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	5th
Module coordinator:	Moh. Khairudin, M.T.,Ph.D.
Lecturer(s):	1. Bambang sulistyo,S.Pd.,M.Eng. 2. Mohamad Ali,MT 3. Muslikhin,M.Pd. 4. Yosep efendi, M.Pd. 5. Arif Marwanto,M.Pd. 6. Didik Purwantoro,M.Eng. 7. Moh. Adem Yerusalem, Ph.D. 8. Dewi Eka Murniati, S.E.,M.M. 9. Dra. Yuswati,M.P.d. 10. Dra. Sari Puspita 11. Joko Santosa
Language:	Bahasa Indonesia

Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	300 minutes lectures and 360 minutes structured activities per week.
Teaching and Learning Method:	Discussion, Demonstration, and Lecturing
Workload:	Total workload is 272 hours per semester which consists of 300 minutes lectures, 360 minutes structured activities, and 360 minutes self-study per week for 16 weeks.
Credit points:	3
Prerequisites course(s):	-
Expected Learning Outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics ELO2 Demonstrate nationalism, responsibility, and tolerance to both society and environmet ELO3 Capable to perform professional works in his/her field of expertise both individual and team works ELO4 Master in basic sciences and principles of electric ELO5 Master in work standards, work methods, work implementations, and testing in electric power or industrial automation expertise. ELO6 Capable to make plans, implement, and evaluate learning in electric power or industrial automation expertise ELO7 Capable to manage vocational education and training of electrical engineering expertise by utilizing information and communications technology ELO8 Capable to apply research and scientific writing methods ELO9 Capable to develop a vocational education innovation and publish scientific paper
Course outcomes:	CO1 Devotion to God Almighty, devout worship and noble deeds. CO2 Students agree to be active, responsible, and have the motivation to develop themselves, CO3 So students can add insight into knowledge and technology Through Activities Direct experience in the industry / company / workshop occupied. In addition,

students can learn aspects of entrepreneurship related to the industry occupied, so that it can bring experience practice industry into his duties after graduation.

CO4 Explain industrial management and required labor competencies industry, according to the industry / company / workshop occupied.

CO5 Help carry out the tasks and activities of the production process and / or process services in the industry / company / workshop occupied.

CO6 Find a case when implementing Industry Practices and analyze it in depth as outlined in the Industry Practice report. If possible, the case can be appointed as a Final Project and or Thesis.

CO7 Having entrepreneurial competence as indicated by making proposals establishing a business (specifically for PI entrepreneur participants). Even if allows, a study of proposals to establish a business can be raised become the Final Project and or Thesis.

ELO and CO mapping:

	ELO1	ELO2	ELO3	ELO4	ELO5	ELO6	ELO7	ELO8	ELO9
CO1	✓								
CO2		✓							
CO3			✓	✓	✓	✓	✓	✓	✓
CO4			✓	✓	✓	✓	✓	✓	✓
CO5			✓	✓	✓	✓	✓	✓	✓
CO6			✓	✓	✓	✓	✓	✓	✓
CO7			✓	✓	✓	✓	✓	✓	✓

Courses Description:

The Industrial Practice Program is a hallmark of FT UNY which it continues to run perfected. With a credit weight of 3 SKS, this activity is a curricular program which must be taken by FT UNY students. Implementation of at least 256 hours or for 2 (two) months with a block system in odd semester, even semester special semester. Industrial Practice Program that is involved with industries that are

<table>
<tr><td></td><td>Meet the requirements and relevant to existing study programs at FT UNY. Therefore in searching, selecting and selecting students for Industrial Practices well organized through planning, coordination, implementation, control and careful evaluation, so as to achieve effective and efficient goals. In order to support the smooth running of the Industrial Practice program, governance is needed Administrative arrangements and administration are regulated in the industry practice manual.</td></tr>
<tr><td>Study/exam achievements:</td><td>
1. Assessment is carried out to measure all learning achievements, namely attitudes learning achievements, knowledge, and special skills, general skills.
2. Attitude assessment is carried out at each meeting using observation techniques and / or peer assessment by using the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude compared to the attitude of students in general. The results of attitude assessment are not a component of the student's final grade, but rather as one of the graduation requirements (10%). Students will graduate from this course if at least have a good attitude. Attitude assessment also considers the activeness of students following lectures.
3. Final grades include the results of the assessment of knowledge, special skills and general skills, obtained from individual assignments, group assignments, presentations, quizzes, Midterm Exams, and Final Semester Exams with the following guidelines.
<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">CO1
-CO7</td><td>Industrial Valuation
f. Work discipline
g. Work attitude
h. Creativity
i. Work quality</td><td>Observation/ Documentation</td><td>15%
15%
15%
15%</td></tr>
<tr><td>Faculty assessment</td><td>Written test</td><td>40%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table>
</td></tr>
<tr><td>Forms of media:</td><td>Board, LCD Projector, Laptop/Computer</td></tr>
<tr><td>Literature:</td><td>Industrial Practice Guidelines Faculty of Engineering Yogyakarta State University - Industrial Practice Team</td></tr>
<tr><td>Date of revision</td><td>31 August 2018</td></tr>
</table>

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Education Multimedia Design Lab. Work
Module level,if applicable:	Undergraduate
Code:	EKO6336
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	5^{th}
Module coordinator:	Dr, Sunaryo Soenarto, M.Pd.
Lecturer(s):	Team
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	200 minutes lectures and 240 minutes structured activities per week.
Teaching and Learning Method	Demonstration, Simulation.
Workload:	Total workload is 181 hours per semester which consists of 200 minutes lectures, 240 minutes structured activities, and 240 minutes self-study per week for 16 weeks.
Credit points:	2
Prerequisites course(s):	-
Expected learning outcomes:	After taking this course the students have ability to:

	ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics ELO3 Can carry out work in accordance with the professional field of expertise both individually and in teams ELO5 Mastering work standards, work methods, work implementation, and testing in the field of electric power engineering or industrial automation. ELO6 Able to plan, implement, and evaluate learning in the field of electric power or automation ELO7 Able to manage vocational education and training in the field of Electrical Engineering by utilizing information and communication technology
Course Outcomes	CO1 Explain the concepts and characteristics of interactive learning multimedia CO2 Internalize academic values, norms and ethics CO3 Demonstrates responsibility for work in their area of expertise independently. CO4 Knowledge of the preparation of scientific works including work reports in accordance with scientific procedures based on data and information analysis. CO4.1 Explain the description of this course in general, the concept of multimedia and learning media. Development of learning multimedia as the final project of the course. CO5 Apply information and communication technology in carrying out the duties of educators and education personnel CO5.1 Students can understand and be able to apply the stages of analysis after finding the object of a class in a particular school. CO5.2 Operate an application program to design animations CO5.3 Producing Interactive MP courses / subjects taught CO5.4 Prepare skills for image editing, audio editing, video editing. CO5.5 Make progress reports and presentations CO5.6 Fundamentals of animation techniques.

	CO5.7 Advanced animation techniques CO5.8 Stages of evaluation, implementation and functionality testing of the work of students about multimedia learning CO6 Implement new technology to design, analyze and apply measurement systems related to the Quantity and Quality of Electric Power Engineering or Industrial Automation to meet the needs of the community in a professional and ethical manner CO6.1 Introduction to Augmented Reality and Virtual Reality technologies for learning media.
ELO and CO mapping	(see table below)
Courses Description:	This subject is a compulsory subject which is a continuation and / or development of the Media Education (Theory) course. As a practical course (2 credits), in principle this course discusses the basic concepts and implementation of the stages of multimedia-based learning design (Multimedia-based Instructional Design) with the approach of Analysis, Design, Development, Implementation and Evaluation. Stages of analysis emphasize the need assessment and front-end analysis activities in the scope of learning in a classroom. Followed by the design of instructional media, then the development and implementation stages and ending with testing the learning media. Introducing the latest learning multimedia such as Augmented Reality and virtual reality.
Assessments	1. Assessment is carried out to measure all learning achievements, namely attainment learning achievements (CO 1), general skills (CO 2), knowledge (CO 3), and special skills (CO 4 and CO 5).

ELO and CO mapping:

	ELO1	ELO3	ELO5	ELO6	ELO7
CO1	✓				
CO2		✓			
CO3			✓	✓	✓
CO4			✓	✓	✓
CO5			✓	✓	✓
CO6			✓	✓	✓

2. Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude compared to the attitude of students in general. The results of the attitude assessment are not a component of the student's final grade, but rather as one of the graduation requirements. Students will graduate from this course if at least have a good attitude. Attitude assessment also considers the activeness of students following lectures.

3. Final grades include the results of the assessment of knowledge, general skills, and special skills obtained from individual assignments, group assignments, presentations, quizzes, insert tests, and final semester examinations with the following guidelines:

No	CO	Assessment Object	Assessment Technique	Weight
1	CO1-CO6	Attitude	a. Active in class b. assignment c. Discussion d. Presentation	15%
		Knowledge	a. Quiz b. Assignment c. MID d. Final exams e. Presentation	50%
		Skills	a. Image, audio, video editing b. Animation programming c. Script programming d. Discussion e. Presentation	40%
			Total	100%

Forms of media:	Board, LCD Projector, Laptop/Computer
Literature:	1. Renee R. & Julie R. 2014. *Digital Thinking and Mobile Teaching*. Bookboon.com 2. Robert M. Branch (2009). *Instructional Design: The ADDIE Approach*. Springer New York. 3. Stephen M.Alessi & Stanley R.T. (2001). *Multimedia for Learning Methods and Development 3rd Edition*. Allyn and Bacon, A Pearson Education Company 4. Stephen Weinstein. 2005. *The Multimedia internet*. Springer. 5. William Lee (2002). *Multimedia-Based Instructional Desain*. Prentice-Hall Company.
Date of revision	18 August 2018

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Transmission and Distribution
Module level,if applicable:	Undergraduate
Code:	EKO6237
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	5^{th}
Module coordinator:	Dr. Giri Wiyono, M.T
Lecturer(s):	1. Dr. Zamtinah 2. Faranita Surwi, M.T.
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	100 minutes lectures and 120 minutes structured activities per week.
Teaching and Learning Method	Discussion
Workload:	Total workload is 91 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes self-study per week for 16 weeks.
Credit points:	2
Prerequisites course(s):	-

Expected Learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics ELO4 Mastering basic science and basic electricity ELO5 Mastering work standards, work methods, work implementation, and testing in the field of electric power engineering or industrial automation. ELO6 Able to plan, implement, and evaluate learning in the field of electric power or automation
Course outcomes:	CO1 Devoted to God Almighty and able to show a religious attitude and character. CO2 Knowledge of law and the basic theory of electricity. C02.1 Understanding modeling of single line diagrams and impedance diagrams. CO2.2 Calculate the parameters of the electric power transmission line. CO2.3 Analyzing the relationship of current and voltage on the electric power transmission line CO2.4 Analyzing the construction of high voltage transmission air ducts CO2.5 Understand the characteristics and design of power distribution channels CO2.6 Understanding the characteristics of air ducts and underground cables in the power distribution channel CO2.7 Understanding the characteristics of electrical loads. CO2.8 Understand the application of electric power distribution transformers. CO2.9 Calculates voltage drop and power loss. CO2.10 Understand the application of capacitors in power distribution channels.

<table>
<tr><td>ELO and CO mapping</td><td>
<table>
<tr><th></th><th>ELO1</th><th>ELO4</th><th>ELO5</th><th>ELO6</th></tr>
<tr><td>CO1</td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td>✓</td><td>✓</td><td>✓</td></tr>
</table>
</td></tr>
<tr><td>Courses Description:</td><td>This course deals with the analysis of operations in the Electric Power Transmission and Distribution System which includes: Model single line diagrams and impedance diagrams on the Electric Power System, Parameters of Electric Power Transmission Lines, Current and Voltage Relations on Electric Power Transmission Lines, Analysis of Air Line Transmission Construction High Voltage, Characteristics and design of Electric Power Distribution Channels, Characteristics of air ducts and underground cables on Electric Power Distribution Channels, Characteristics of electric loads, Application of electric power distribution transformers, Voltage drop and power loss calculations, Application of capacitors on Electric Power Distribution Channels.</td></tr>
<tr><td>Assesements:</td><td>
Assessment is carried out to measure all learning achievements, namely attainment learning achievements (CO 1 and CO2), knowledge (CO1 and CO2), and special skills (CO2).
1. Attitude assessment is carried out at each meeting by using the method of observation and / or self-assessment with the assumption that basically every student has a good attitude. The student is given a rating of a very good or unfavorable attitude if the student shows significantly better or less good attitude compared to the student's attitude in general. Attitude assessment results are not a major component of a student's final grade, but rather as one of the graduation requirements. Students are declared to graduate from this course if at least have a good attitude. Attitude assessment also considers the activeness of students in attending lectures.
2. Final scores include the results of the assessment of attitudes, knowledge, skills obtained from individual assignments, group assignments, presentations, tests (quizzes), Midterm Exams (UTS), and Final Semester Exams (UAS)
The final mark will be weight as follow:
<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td>1</td><td>CO1 -</td><td>Presence</td><td>Observation</td><td>10%</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><td></td><td><table>
<tr><td rowspan="5"></td><td rowspan="5">CO2</td><td>Individual Assignment</td><td>Presentation</td><td>10%</td></tr>
<tr><td>Group Assignment</td><td>Presentation</td><td>10%</td></tr>
<tr><td>Quiz</td><td>Written test</td><td>15%</td></tr>
<tr><td>Mid</td><td>Written test</td><td>25%</td></tr>
<tr><td>Final Exam</td><td>Written test</td><td>30%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table></td></tr>
<tr><td>Forms of media:</td><td>Board, LCD Projector, Laptop/Computer</td></tr>
<tr><td>Literature:</td><td>1. Burke, James J. 1994. Power Distribution Engineering, Fundamentals and Applications. New York: Marcel Dekker.
2. Gonen, Turan. 1988. Electric Power Transmission System Engineering: Analysis and Design. Singapore: John Wiley & Sons.
3. Gonen, Turan. 2014. Electric Power Distribution Engineering Third Edition. New York: CRC Press.
4. Pabla, AS. 1981. Sistem Distribusi Daya Listrik. Jakarta: Erlangga.
5. Saadat, Hadi. 1999. Power System Analysis. Boston: Mc Graw-Hill.
6. Williem, Stevenson. 1997. Electrical Power Analysis. Singapore: Mc Graw-Hill.</td></tr>
<tr><td>Date of revision</td><td>11 August 2018</td></tr>
</table>

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Electrical Maintenance and Services Lab. Work
Module level,if applicable:	Undergraduate
Code:	EKO6238
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	5^{th}
Module coordinator:	Toto Sukisno, S.Pd.,M.Eng
Lecturer(s):	1. Totok Heru Tri Maryadi,M. Pd. 2. Eko Swi Darmawan, M. Pd.
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	200 minutes lectures, 240 minutes structured activities, and 240 minutes self-study per week.
Teaching and Learning Method	Discussion, Observation,
Workload:	Total workload is 181 hours per semester which consists of 200 minutes lectures, 240 minutes structured activities, and 240 minutes self-study per week for 16 weeks.
Credit points:	2
Prerequisites course(s):	-

Expected Learning Outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics ELO3 Can carry out work in accordance with the professional field of expertise both individually and in teams ELO4 Master in basic sciences and principles of electric ELO7 Able to manage vocational education and training in the field of Electrical Engineering by utilizing information and communication technology
Course Outcomes:	CO1 Devoted to God and able to show a religious attitude and character. CO2 Demonstrates responsibility for work in their area of expertise independently. CO3 Knowledge of law and the basic theory of electricity. CO3.1 Identifying the components of the electric power system CO4 Knowledge of the preparation of scientific works including work reports in accordance with scientific procedures based on data and information analysis. CO4.1 Explain the standard of testing the insulation resistance of electric power system components CO4.2 Explain the preparation of practice reports in accordance with scientific procedures CO4.3 Explain the preparation of reports and recommendations for inspection and testing work in the electric power system CO5 Apply the theory of measurement and measurement of electrical parameters. C05.1 Measure and test insulation resistance on synchronous generators CO5.2 Measure and test insulation resistance in power installations CO5.3 Measure and test insulation resistance in lighting installations

<table>
<tr><td></td><td>CO5.4 Measure and test the insulation resistance on a power transformer

CO5.5 Measure and test grounding resistance for lightning suppliers

CO5.6 Measure and test insulation resistance on 1 phase induction motors

CO6 Apply maintenance and repair methods for electric power systems or industrial automation.

CO6.1 Conduct rewinding 1 phase induction motor rewinding

CO6.2 Conduct rewinding 3-phase induction motor rewinding</td></tr>
<tr><td>ELO and CO mapping:</td><td>
<table>
<tr><th></th><th>ELO1</th><th>ELO3</th><th>ELO4</th><th>ELO7</th></tr>
<tr><td>CO1</td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td>✓</td><td>✓</td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td>✓</td><td>✓</td></tr>
<tr><td>CO5</td><td></td><td></td><td>✓</td><td>✓</td></tr>
<tr><td>CO6</td><td></td><td></td><td>✓</td><td>✓</td></tr>
</table>
</td></tr>
<tr><td>Courses Description:</td><td>This course discusses the management of maintenance and repair of electrical systems ranging from existing components in the generating sub-system to the utilization sub-system. The scope of this course material includes: examinations and tests on power plants, checks and tests on power transformers, checks and tests on lighting installations, checks and tests on power installations, checks and tests on lightning distribution systems, rewinding 1 phase electric motors, rewinding 3 phase electric motors, and preparing reports and recommendations on the results of inspection and testing activities.</td></tr>
</table>

<table>
<tr><td>Assessments:</td><td>
Assessment is carried out to measure all learning achievements, namely attainment learning achievements, knowledge, and special skills.
1. Attitude assessment is carried out at each meeting by using the method of observation and / or self-assessment with the assumption that basically every student has a good attitude. The student is given a rating of a very good or unfavorable attitude if the student shows significantly better or less good attitude compared to the student's attitude in general. Attitude assessment results are not a major component of a student's final grade, but rather as one of the graduation requirements. Students are declared to graduate from this course if at least have a good attitude. Attitude assessment also considers the activeness of students in attending lectures.
2. Final scores include the results of the assessment of attitudes, knowledge, skills obtained from individual assignments, group assignments, presentations, tests (quizzes), Midterm Exams (UTS), and Final Semester Exams (UAS)
The final mark will be weight as follow:
<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td rowspan="5">1</td><td rowspan="5">CO1 – CO6</td><td>Quiz</td><td>knowladge</td><td>10%</td></tr>
<tr><td>Discussion rubric</td><td>Knowledge and attitude</td><td>10%</td></tr>
<tr><td>Observation</td><td>active</td><td>10%</td></tr>
<tr><td>Assessment of practice</td><td>skills</td><td>50%</td></tr>
<tr><td>practice report</td><td>knowladge</td><td>15%</td></tr>
<tr><td colspan="3"></td><td>Total</td><td>100%</td></tr>
</table>
</td></tr>
<tr><td>Forms of media:</td><td>Board, LCD Projector, Laptop/Computer</td></tr>
<tr><td>Literature:</td><td>

Tim. (2015). Panduan Praktik Pemeliharaan dan Perbaikan Kelistrikan. Tidak Diterbitkan.
Theraja, B. L., & Theraja, A. K. (2017). Textbook of Electrical Technology Volume I IN SI System of Units. S. Chand.
Sumanto, M. A. (1993). Motor Listrik Arus Bolak-Balik. Edisi Pertama, Penerbit Andi Offset, Yogyakarta.

</td></tr>
<tr><td>Date of revision</td><td>28 August 2018</td></tr>
</table>

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Professional Ethics
Module level,if applicable:	Undergraduate
Code:	EKO6254
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	5th
Module coordinator:	Dr. phil. Nurhening Yuniarti, M.T.
Lecturer(s):	Dr. Istanto Wahyu Djatmiko, M.Pd. Dr. Edy Supriyadi, M.Pd. Dr. Drs. Haryanto, M.Pd.,M.T.
Language:	Bahasa Indonesia
Classification within the curriculum:	~~Compulsory~~/Elective Course
Teaching format / class hours per week during the semester:	The form of learning is in the form of lectures, which consist of 100 minutes of face-to-face activities per week per semester; (2) structured assignment activities 120 minutes per week per semester; and (3) 120 minutes of independent activities per week per semester.
Teaching and Learning Method	Demonstration, Simulation, and Discussion
Workload:	Total workload is 26 hours 40 minutes of face-to-face activities per semester
Credit points:	2
Prerequisites course(s):	-
Expected learning outcomes:	After taking this course the students have ability to:

<table>
<tr><td></td><td>ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics
ELO3 Can carry out work in accordance with the professional field of expertise both individually and in teams.
ELO4 Mastering work standards, work methods, work implementation, and testing in the field of electric power engineering or industrial automation.
ELO6 Able to manage vocational education and training in the field of Electrical Engineering by utilizing information and communication technology</td></tr>
<tr><td>Course Outcomes</td><td>CO1 Showing polite, disciplined, and honest attitude during lectures.
CO2 Can carry out the tasks of the Professional Ethics course both independently and in groups.
CO3 Mastering the concept of professional ethics and professional code of ethics of the teacher.
CO4 Able to apply the concept of professional ethics and code of ethics in carrying out duties as a professional teacher in the field of electrical engineering education.
CO5 Being able to analyze anti-corruption as part of professional ethics.
CO6 Being able to analyze the importance of Intellectual Property Rights (IPR) for the teaching profession.</td></tr>
<tr><td>ELO and CO mapping</td><td><table>
<tr><th></th><th>ELO1</th><th>ELO3</th><th>ELO4</th><th>ELO6</th></tr>
<tr><td>CO1</td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td>✓</td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td>✓</td><td>✓</td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td>✓</td><td></td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td>✓</td></tr>
<tr><td>CO6</td><td></td><td></td><td></td><td>✓</td></tr>
</table></td></tr>
<tr><td>Courses Description:</td><td>Providing knowledge about ethics, ethical awareness and ethical behavior in carrying out the vocational teacher profession in the field of electrical engineering which covers various spectrums of thought in ethics, description of ethics and the teaching profession, ethical issues in the profession, and its implementation and development in the practice of the technical vocational teacher profession. Lectures are carried out using the student center learning approach with problem based learning strategies. Competency-based assessment involves active participation in lectures, quizzes, midterm and</td></tr>
</table>

<table>
<tr><td></td><td>end semester exams, and final semester exams.</td></tr>
<tr><td>Assessments</td><td>
Assessment is carried out to measure all learning achievements, namely attitudes of learning achievement (CO 1 & 2), knowledge (CO 3 & 4), and special skills (CO 5 & 6).

1. Attitude assessment is done through direct observation of each student in each lecture meeting, including: attendance, discipline, personal and interpersonal interaction. This attitude assessment category, namely: "Very Good", "Good", and "Less Good". The minimum attitude value is included in the "Good" category. By using observation and / or self-assessment techniques using the assumption that basically every student has a good attitude. The results of this attitude assessment are used as consideration to determine the final assessment of this course.
2. The final grades include the results of the knowledge assessment, and the specific skills obtained from individual assignments, group assignments, presentations, quizzes, insert tests, and final semester examinations are determined as follows.The final mark will be weight as follow:

<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td rowspan="7">1</td><td rowspan="7">CO1
CO3
CO4
CO5
CO6</td><td>Attendance</td><td>documentation</td><td>5%</td></tr>
<tr><td>Individual assigment</td><td>observation</td><td>10&</td></tr>
<tr><td>Group assigment</td><td>Written test</td><td>5%</td></tr>
<tr><td>quiz</td><td>Written test</td><td>15%</td></tr>
<tr><td>MID</td><td>Written test</td><td>20%</td></tr>
<tr><td>MID 2</td><td>Written test</td><td>20%</td></tr>
<tr><td>Final Exam</td><td>Written test</td><td>20%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table>
</td></tr>
<tr><td>Forms of media:</td><td>Board, LCD Projector, Laptop/Computer</td></tr>
<tr><td>Literature:</td><td>
1. Naagarazan, R.S. (2006). A Texbook on Professional Ethics and Human Values. New Delhi: New Age International (P) Limited, Publishers
2. Kultgen, J.H. (1988). Ethics and Professionalism. Philadelphia: University of Pennsylvania Press
3. Soetjipto dan Raflis Kosasi. 1999.Profesi Keguruan. Jakarta: Rineka Cipta
3. Dit.PSMK. (2017). Konseptual Model Pengembangan Kompetensi Guru Produktif SMK Berbasis Industri. Jakarta:
</td></tr>
</table>

	Direktorat Jenderal Pendidikan Dasar dan Menengah, Kementerian Pendidikan dan Kebudayaan. 4. Nanang T. Puspito, NT, dkk, (Ed). (2011). Pendidikan Anti-Korupsi Untuk Perguruan Tinggi. Jakarta: Direktorat Jenderal Pendidikan Tinggi, Kementerian Pendidikan dan Kebudayaan. 5. Banindro, B.S. (2015). Implementasi Hak Kekayaan Intelektual (Hak Cipta, Merek, Paten, Desain Industri), Bidang: Seni Rupa, Kriya, Desain Grafis, Desain Produk. Yogyakarta: Badan Penerbit ISI Yogyakarta, Institut Seni Indonesia 1. 7. Oey-Gardiner, M., dkk. (2017). Era Disrupsi : Peluang dan Tantangan Pendidikan Tinggi Indonesia. Jakarta: Akademi Ilmu Pengetahuan Indonesia
Date of revision	18 August 2018

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Energy Management
Module level,if applicable:	Undergraduate
Code:	EKO6239
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	5th
Module coordinator:	Dr. Giri Wiyono, M.T
Lecturer(s):	Team
Language:	Bahasa Indonesia
Classification within the curriculum:	~~Compulsory~~/Elective Course
Teaching format / class hours per week during the semester:	200 minutes lectures and 240 minutes structured activities per week.
Teaching and Learning Method	Demonstration, Simulation,
Workload:	Total workload is 181 hours per semester which consists of 200 minutes lectures, 240 minutes structured activities, and 240 minutes self-study per week for 16 weeks.
Credit points:	2
Prerequisites course(s):	-

Expexted Learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics ELO4 Mastering basic science and basic electricity ELO5 Mastering work standards, work methods, work implementation, and testing in the field of electric power engineering or industrial automation. ELO6 Able to plan, implement, and evaluate learning in the field of electric power or automation
Course outcomes:	CO1 Students devoted to God Almighty and able to show attitudes and behavior that have a noble character, CO2 Students have personal skills in the form of: honesty, communication, responsibility, creative, and independent), CO2.1 Understand the basic principles of energy management. CO2.2 Understand energy management planning. CO2.3 Understanding energy audit procedures. CO2.4 Understand basic electricity tariff policies and economic calculations. CO2.5 Analyze installed power capacity. CO2.6 Analyzing the quality of electrical power. CO2.7 Apply energy management techniques to lighting loads. CO2.8 Apply energy management techniques to electric motor loads. CO2.9 Apply energy management techniques to HVAC (Heating, Ventilation, and Air Conditioning) loads. CO2.10 Implement building control and management systems.

<table>
<tr>
<td>ELO and CO mapping</td>
<td>
<table>
<tr><th></th><th>ELO1</th><th>ELO4</th><th>ELO5</th><th>ELO6</th></tr>
<tr><td>CO1</td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td>✓</td><td>✓</td><td>✓</td></tr>
</table>
</td>
</tr>
<tr>
<td>Courses Description:</td>
<td>This Energy Management course develops contextual thinking about managing electrical energy on the load side and provides knowledge and skills in conducting electrical energy audits on various types of industrial loads in accordance with applicable procedures and standard requirements and is able to utilize technology as a source of learning. The main studies in this course include: Basic principles of energy management, energy management planning, energy audit procedures, basic electricity tariff policies and economic calculations, installed power capacity analysis, electric power quality, energy management at lighting loads, energy management at electric motor loads , Energy management in HVAC (Heating, Ventilation, and Air Conditioning) loads, Control and building management systems. This lecture is carried out using student centered learning strategies (student center learning). Assessment of lectures uses three elements, namely: active participation in the classroom, communication of interactions in presentations, and competency tests individually and in groups.</td>
</tr>
<tr>
<td>Assesments:</td>
<td>1. Assessment is carried out to measure all learning achievements, namely attainment learning achievements (CO 1 and CO2), knowledge (CO1 and CO2), and special skills (CO 2).

2. Attitude assessment is carried out at each meeting by using the method of observation and / or self-assessment with the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if the student shows significantly better or less good attitude compared to the attitude of students in general. The results of the attitude assessment do not become a major component of the student's final grade, but rather as one of the graduation requirements. Students are declared to graduate from this course if at least have a good attitude. Attitude assessment also considers the activeness of students in attending lectures.

3. Final scores include the results of the assessment of attitudes, knowledge, skills obtained from individual assignments, group assignments, presentations, tests (quizzes), Midterm Exams (MID), and Final Semester Exams (FSE) with the following guidelines.</td>
</tr>
</table>

<table>
<tr><td></td><td>
<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td rowspan="3">1</td><td rowspan="3">CO1 – CO2</td><td>Individual Assignment</td><td>Presentation</td><td>20%</td></tr>
<tr><td>Group Assignment</td><td>Presentation</td><td>20%</td></tr>
<tr><td>Final Exam</td><td>Written test</td><td>60%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table>
</td></tr>
<tr><td>Forms of media:</td><td>Board, LCD Projector, Laptop/Computer</td></tr>
<tr><td>Literature:</td><td>
1. Albert Thumann and William J. Younger. (2008). Handbook of Energy Audits, Seventh Edition. New York, USA: The Fairmont Press.
2. Douglas J. Harris. (2012). A Guide to Energy Management in Buildings. New York: Spon Press.
3. Frank Kreith and D. Yogi Goswami. (2008). Energy Management and Conservation Handbook, New York: CRC Press.
4. Giri Wiyono. (2016). Manajemen Energi Listrik, Yogyakarta: UNY Press.
5. Smith, Craigh B. (1981). Energy Management Principles. New York: Pergamon Press.
6. Steve Doty and Wayne C. Turner. (2009). Energy Management Handbook, Seventh Edition. New York: The Fairmont Press.
</td></tr>
<tr><td>Date of revision</td><td>10 August 2018</td></tr>
</table>

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Electrical Power System Simulation Lab. Work
Module level,if applicable:	Undergraduate
Code:	EKO6240
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	5rth
Module coordinator:	Dr. Giri Wiyono, M.T.
Lecturer(s):	Team
Language:	Bahasa Indonesia
Classification within the curriculum:	~~Compulsory~~/Elective Course
Teaching format / class hours per week during the semester:	200 minutes lectures and 240 minutes structured activities per week.
Teaching and Learning Method	Demonstration, Simulation
Workload:	Total workload is 181 hours per semester which consists of 200 minutes lectures, 240 minutes structured activities, and 240 minutes self-study per week for 16 weeks.
Credit points:	2
Prerequisites course(s):	-

Expected Learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics ELO3 Can carry out work in accordance with the professional field of expertise both individually and in teams ELO5 Mastering work standards, work methods, work implementation, and testing in the field of electric power engineering or industrial automation. ELO6 Able to plan, implement, and evaluate learning in the field of electric power or automation ELO9 Able to develop innovations in education, and publish the results of his work
Course outcomes:	CO1 Students devoted to God Almighty and able to show attitudes and behavior that have a noble character, CO2 Demonstrates responsibility for work in their area of expertise independently. CO2.1 Understand the basic concepts of electric power systems CO2.2 Understand electric power system configurations CO2.3 Understand the phenomena and consequences of interruptions in the electric power system CO2.4 Understand the security settings in the electric power system CO2.5 Understanding safety coordination in the electric power system CO2.6 Understand the stability of generators operating in synchronous systems CO2.7 Understand the power requirements needed in an electric power system to operate safely, reliably and economically CO3 Students have social skills in the form of collaboration, and synergy, CO4 Facilitating, evaluating, implementing learning and learning outcomes in a professional manner, as well as community partnerships within the framework of vocational education in carrying out duties as a teaching profession CO4.1 Communicate the basic concepts of an electric power system

<table>
<tr><td></td><td>
CO4.2 Explain the configuration of the electric power system

CO4.3 Explain the phenomena and consequences of disturbances in the electrical power system

CO4.4 Explain the phenomenon of power loss in electric power systems

CO4.5 Explain the phenomenon of voltage fluctuations in electric power systems

CO4.6 Explain the process of analyzing the stability of generators operating in synchronous systems

CO4.7 Designing the power requirements needed in an electric power system to operate safely, reliably and economically

CO4.8 Apply logical, critical, systematic, and innovative thinking in the context of developing or implementing science and / or technology in accordance with their area of expertise
</td></tr>
<tr><td>ELO and CO mapping</td><td>
<table>
<tr><th></th><th>ELO1</th><th>ELO3</th><th>ELO5</th><th>ELO6</th><th>ELO9</th></tr>
<tr><td>CO1</td><td>✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>CO4</td><td></td><td></td><td>✓</td><td>✓</td><td>✓</td></tr>
</table>
</td></tr>
<tr><td>Courses Description:</td><td>These skin eyes provide knowledge and skills in conducting power system simulations, both under normal and disruption conditions using the ETAP Power Station computer program. The main studies include: electric power system modeling, electric power system analysis, electric power system simulation principles, introduction of ETAP Power Station, short circuit analysis, load flow analysis, contingency study), motor starting study, harmonic analysis</td></tr>
</table>

<table>
<tr><td>Assessments:</td><td>
The assessment was conducted to measure all learning outcomes, namely attainment learning achievements (CO 1 and CO 2), knowledge (CO 3), and special skills (CO 4).
1. Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude compared to the attitude of students in general. Attitude assessment also considers the activeness of students following lectures.
2. Final scores include the results of the assessment of attitudes, knowledge, and skills obtained from individual assignments, group assignments, presentations, quizzes, Midterm Exams, and End Semester Exams with the following guidelines:
<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td rowspan="6">1</td><td rowspan="6">CO1 – CO4</td><td>Attitude</td><td>observation</td><td>10%</td></tr>
<tr><td>presentation</td><td>Presentation</td><td>10%</td></tr>
<tr><td>Individual assignment</td><td>observation</td><td>10%</td></tr>
<tr><td>Group assignment</td><td>Written test</td><td>10%</td></tr>
<tr><td>MID</td><td>Written test</td><td>20%</td></tr>
<tr><td>Final Exam</td><td>Written test</td><td>40%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table>
</td></tr>
<tr><td>Forms of media:</td><td>Board, LCD Projector, Laptop/Computer</td></tr>
<tr><td>Literature:</td><td>
5. Giri Wiyono. (2014). Modul Simulasi Sistem Tenaga Listrik menggunakan ETAP Power Station. Yogyakarta; Jurusan Pendidikan Teknik Elektro FT UNY
6. Giri Wiyono. (2015). Jobsheet Praktik Simulasi Sistem Tenaga Listrik dengan ETAP Power Station, Yogyakarta: Jurusan Pendidikan Teknik Elektro FT UNY
7. Glenn W. Stagg and Ahmed H. El-Abiad. (1988). Computer Methods in Power Systems Analysis. Singapore: McGraw-Hill Inc.
8. Hadi Saadat. (1999). Power System Analysis. Singapore: McGraw-Hill Book Co.
</td></tr>
</table>

	9. MA Pai. (1979). *Computer Techniques in Power System Analysis*. New Delhi: Tata McGraw-Hill Publishing Company Limited. 10. Ramasamy Natarajan.. (2002). *Computer-Aided Power System Abnalysis*. New York: Marcel Dekker Inc. 11. R.N. Dhar. (1982). *Computer Aided Power System Operation and Analysis*. New Delhi: Tata McGraw-Hill Publishing Company Limited.
Date of revision	10 August 2018

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP) **MODULE HANDBOOK**

Module name:	Laboratorium Management
Module level,if applicable:	Undergraduate
Code:	EKO6241
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	5th
Module coordinator:	Mutaqin, M.Pd., M.T.
Lecturer(s):	Team
Language:	Bahasa Indonesia
Classification within the curriculum:	~~Compulsory~~/Elective Course
Teaching format / class hours per week during the semester:	100 minutes lectures and 120 minutes structured activities per week.
Teaching and Learning Method:	Discussion
Workload:	Total workload is 91 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes self-study per week for 16 weeks.
Credit points:	2
Prerequisites course(s):	-
Expected learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics ELO3 Can carry out work in accordance with the professional field of expertise both individually and in teams

	ELO4 Mastering basic science and basic electricity ELO6 Able to plan, implement, and evaluate learning in the field of electric power or automation ELO7 Able to manage vocational education and training in the field of Electrical Engineering by utilizing information and communication technology
Course outcomes:	CO1 Students devoted to God Almighty, obedient to worship and show a special attitude, tawadlu, and istiqomah, CO2 Demonstrates responsibility for work in their area of expertise independently. CO3 Knowledge of laboratory management principles relating to the work of prospective electric power engineering and automation techniques CO3.1 Know, understand and apply the principles of laboratory management in supporting work CO4 Analyze and solve technical problems related to electrical engineering by applying laboratory management principles. CO4.1 Apply the principles of laboratory management to the work in the field of engineering CO4.2 Analyzing the problem of work in the field of engineering with the principles of laboratory management CO4.3 Evaluating the problem of work in the field of engineering with the principles of laboratory management CO4.4 Creating work problems in the field of engineering with the principles of laboratory management
ELO and CO mapping:	see table below
Courses Description:	Electric Power System Analysis (STL) is a theoretical course given to students to equip capabilities in the field of resource management in the organization of classes, and electrical engineering laboratories, as well as possessing skills in managing resources and activities that cover class management, and laboratories in a comprehensive manner . The material to be taught includes an introduction to laboratory management, laboratory processes, various kinds of electrical

	ELO1	ELO3	ELO4	ELO6	ELO7
CO1	✓				
CO2		✓			
CO3			✓		
CO4			✓	✓	✓

<table>
<tr><td></td><td>engineering laboratories, electrical engineering facilities and infrastructure standards, structuring laboratories with 5S principles, occupational safety and health in laboratories, laboratory management information systems, laboratory developments and trends in electrical engineering in the industrial era 4.0 and laboratory optimization.</td></tr>
<tr><td>Assesments:</td><td>
The assessment is carried out to measure all learning outcomes, namely attitudes learning achievements (CO 1), general skills (CO 2), knowledge, and special skills.
1. Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude compared to the attitude of students in general. The results of the attitude assessment are not a component of the student's final grade, but rather as one of the graduation requirements. Students will graduate from this course if at least have a good attitude. Attitude assessment also considers the activeness of students following lectures.
2. Final grades include the results of the assessment of knowledge, general skills, and special skills obtained from individual assignments, group assignments, presentations, quizzes, Insertion Exams, and Final Semester Exams with the following guidelines:
<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td rowspan="3">1</td><td rowspan="3">CO1 – CO4</td><td>Attitude</td><td>a. Active in class
b. Assignment
c. Discussion
d. Presentation</td><td>15%</td></tr>
<tr><td>Knowledge</td><td>a. Quiz
b. Duty
c. Assignment
d. Final exams
e. Presentation</td><td>50%</td></tr>
<tr><td>Skills</td><td>a. Draw SLD
b. Count manually
c. Analyzing with software
d. Discussion
e. Presentation</td><td>35%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table>
</td></tr>
</table>

Forms of media:	Board, LCD Projector, Laptop/Computer
Literature:	1. Muhamad Ali, et al (2012). Vocational High School Laboratory Management Training Module, Yogyakarta State University, Yogyakarta Indonesia 2. Muhamad Ali, (2017). Industrial Management 4.0 Issue 1, UNY Press Yogyakarta State University, Yogyakarta Indonesia 3. Fred Grover and Peter Wallace (1979), Laboratory Organization and Management, Butterworth & Co. (publisher) Ltd, London. 4. G.L. Squires (1986), Practical Physics, J.W. Arrowsmith Ltd, Bristol. 5. Hani Handoko (2012), Management, Second Edition, Faculty of Economics Publishing (BPFE) Universitas Gadjah Mada Yogyakarta Indonesia 6. Koontz, H, Weinrich H (2015). Management: A Global Perspective, McGraw Hill New York 7. Permendiknas No. 28 of 2008 concerning School Facilities and Prassas Standards including laboratory standards for Vocational High School (SMK) and Vocational Al-Madrasah (MAK) 8. Permendiknas No. 27 of 2007 concerning School Facilities and Prassas Standards including Elementary School (SD) and Middle School (SMP / MTS and SMA / MA) laboratory standards 9. Mcleod, 2015, Management information system Issue 10, Salemba fourth Publisher, Jakarta. Indonesia 10. Other relevant sources.
Date of revision	10 August 2018

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Interfacing Laboratory Work
Module level,if applicable:	Undergraduate
Code:	EKO6242
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	5^{th}
Module coordinator:	Ariadie Chandra Nugraha, M.T
Lecturer(s):	1. Didik Hariyanto, M.T. 2. Rustam Asnawi, ST., MT., PhD.
Language:	Bahasa Indonesia
Classification within the curriculum:	~~Compulsory~~/Elective Course
Teaching format / class hours per week during the semester:	200 minutes lectures and 240 minutes structured activities per week.
Teaching and Learning Method	Discussion and Lecturing
Workload:	Total workload is 161 hours per semester which consists of 200 minutes lectures, 240 minutes structured activities, and 240 minutes self-study per week for 16 weeks.
Credit points:	2
Prerequisites course(s):	-

Expected learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics ELO3 Can carry out work in accordance with the professional field of expertise both individually and in teams ELO4 Mastering basic science and basic electricity. ELO5 Mastering work standards, work methods, work implementation, and testing in the field of electric power engineering or industrial automation. ELO6 Able to plan, implement, and evaluate learning in the field of electric power or automation.
Course Outcomes:	CO1 Devoted to God and able to show a religious attitude and character. CO2 Demonstrates responsibility for work in their area of expertise independently. CO3 Knowledge of law and the basic theory of electricity. CO3.1 Explain the basic concepts of interfaces and their types, as well as explain in general the interface standards that are widely used. CO4 Knowledge of the preparation of scientific works including work reports in accordance with scientific procedures based on data and information analysis. CO4.1 Explains the IEEE 1284 standard for reading input data and sending output data from / to simple devices. CO4.2 Explains the RS-232 standard for reading input data and sending output data from / to simple devices. CO4.3 Explains the USB standard for reading input data and sending output data from / to simple devices. CO4.4 Explain the I2C standard for reading input data and sending output data from / to simple devices. CO4.5 Explain the RFID standard for reading input data. CO4.6 Explains the Bluetooth standard for reading input data and sending output data from / to simple devices. CO5 Apply information and communication technology in carrying out the duties of educators and education

<table>
<tr><td></td><td>personnel.

CO5.1 Use the IEEE 1284 standard to read input data and send output data from / to simple devices.

CO5.2 Using Explain RS-232 standard for reading input data and sending output data from / to simple devices.

CO5.3 Use the USB standard to read input data and send output data from / to simple devices.

CO5.4 Use the I2C standard to read input data and send output data from / to simple devices.

CO5.5 Uses RFID standards to read input data.

CO5.6 Use the Bluetooth standard to read input data and send output data from / to simple devices.</td></tr>
<tr><td>ELO and CO mapping</td><td>
<table>
<tr><th></th><th>ELO1</th><th>ELO3</th><th>ELO4</th><th>ELO5</th><th>ELO6</th></tr>
<tr><td>CO1</td><td>✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>CO4</td><td></td><td></td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>CO5</td><td></td><td></td><td>✓</td><td>✓</td><td>✓</td></tr>
</table>
</td></tr>
<tr><td>Courses Description:</td><td>Interface Engineering Practice is a practical course that aims for students who take this course to have competence to implement commonly used interface protocols, namely IEEE 1284 (Parallel), RS232 (Serial), USB, I2C, Bluetooth and RFID to read input data from the sensor and write data or output commands to the actuator.</td></tr>
</table>

<table>
<tr>
<td>Assessments:</td>
<td>
The assessment was carried out to measure all learning outcomes, namely attainment learning achievements (CO 1 and CO 2), knowledge (CO 3 and CO 4), and special skills (CO 5).
1. Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude than the attitude of students in general. Attitude assessment also considers the activeness of students following lectures.
2. Final grades include the results of the attitude, knowledge and skills assessment obtained from individual assignments, group assignments, presentations, quizzes, Midterm Examinations, and Final Semester Exams with the following guidelines.
The final mark will be weight as follow:
<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td rowspan="5">1</td><td rowspan="5">CO1 – CO5</td><td>Attendance</td><td>Documentation</td><td>10%</td></tr>
<tr><td>Practicum report</td><td>Written report</td><td>30%</td></tr>
<tr><td>Practicum skills</td><td>Observation</td><td>15%</td></tr>
<tr><td>Quiz</td><td>Written test</td><td>10%</td></tr>
<tr><td>Final Exam</td><td>Practicum</td><td>35%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table>
</td>
</tr>
<tr><td>Forms of media:</td><td>Board, LCD Projector, Laptop/Computer</td></tr>
<tr><td>Literature:</td><td>1. Labsheet (lembar kerja praktikum) Praktik Teknik Antarmuka
2. Axelson, J., & Research, L. (2007). Serial Port Complete: COM Ports, USB Virtual COM Ports, and Ports for Embedded Systems 2nd Edition.
3. Axelson, J., & Research, L. (2009). USB Complete: The Developer’s Guide Fourth Edition.</td></tr>
<tr><td>Date of revision</td><td>18 August 2018</td></tr>
</table>

UNIVERSITAS NEGERI YOGYAKARTA
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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Sensor and Transducer lab. Work
Module level,if applicable:	Undergraduate
Code:	EKO6243
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	5th
Module coordinator:	Amelia Fauziah Husna, M.Pd.
Lecturer(s):	1. Herlambang Sigit Pramono, S.T., M.Cs.
Language:	Bahasa Indonesia
Classification within the curriculum:	~~Compulsory~~/Elective Course
Teaching format / class hours per week during the semester:	200 minutes lectures and 240 minutes structured activities per week.
Teaching and Learning Method	Discussion, Demonstration, and Lecturing
Workload:	Total workload is 181 hours per semester which consists of 200 minutes lectures, 240 minutes structured activities, and 240 minutes self-study per week for 16 weeks.
Credit points:	2
Prerequisites course(s):	-
Expected learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics ELO3 Can carry out work in accordance with the professional field of expertise both individually and in teams

	ELO4 Mastering basic science and basic electricity ELO5 Mastering work standards, work methods, work implementation, and testing in the field of electric power engineering or industrial automation. ELO6 Able to plan, implement, and evaluate learning in the field of electric power or automation.
Course Outcomes:	CO1 Devoted to God Almighty and able to show a regius attitude and character, CO2 Internalize academic values, norms and ethics. CO3 Demonstrates responsibility for work in their area of expertise independently. CO4 Knowledge of law and the basic theory of electricity. CO5 Knowledge of the preparation of scientific works including work reports in accordance with scientific procedures based on data and information analysis. CO5.1 Compile a joystick sensor practice report CO5.2 Prepare reedswitch censorship practice reports CO5.3 Compile flame sensor practice report CO5.4 Prepare a practice report for the MQ-7 sensor CO5.5 Prepare a report on the practice of the microphone sound sensor CO5.6 Prepare a PIR censorship practice report CO5.7 Prepare reports on soil humidity sensor practices CO5.8 Prepare a water level sensor practice report CO5.9 Compile a photovoltaic sensor practice report CO5.10 Compile reports related to the working principle of systems that use sensors and transducers CO6 Manage laboratories and workshops in training centers, and technology and vocational education in accordance with the provisions of occupational health and safety in the Electrical Engineering field CO6.1 Identify the types and components of sensors and transducers CO6.2 Assemble the joystick sensor CO6.3 Assemble the reedswitch sensor. CO6.4 Assemble the flame sensor. CO6.5 Assemble the MQ-7 sensor.

<table>
<tr><td></td><td>CO6.6 Assemble the microphone sound sensor.
CO6.7 Assemble a PIR sensor.
CO6.8 Assemble a soil moisture sensor.
CO6.9 Assemble a water level sensor
CO6.10 Assemble photovoltaic sensors
CO6.11 Apply sensors and transducers to a work system.</td></tr>
<tr><td>ELO and CO mapping</td><td>
<table>
<tr><th></th><th>ELO1</th><th>ELO3</th><th>ELO4</th><th>ELO5</th><th>ELO6</th></tr>
<tr><td>CO1</td><td>✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td>✓</td><td></td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td>✓</td><td>✓</td><td></td></tr>
<tr><td>CO5</td><td></td><td></td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>CO6</td><td></td><td></td><td>✓</td><td>✓</td><td>✓</td></tr>
</table>
</td></tr>
<tr><td>Courses Description:</td><td>This Sensor and Transducer Practice Lecture discusses the introduction and application of sensors in the fields of electro, machinery, and mechatronics. This course examines a variety of sensors, such as sensors for light, sound, fire, gas, humidity, magnetism, distance, and solar. This course also learns how to apply and use it in a series. Lectures are carried out using the student center learning approach. The assessment uses an attitude, performance and performance assessment.
This subject is a concentration course for the concentration of industrial automation.</td></tr>
<tr><td>Assessments:</td><td>Assessment is carried out to measure all learning achievements, namely attainment learning achievement (CO 1 (A.1.1) and CO 2 (A.1.3)), knowledge (CO 4 (K.1.2) and CO 5 (K.2.1)),and skills (CO 6 (S.1.2)).
1. Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude than the attitude of students in general. Attitude assessment also considers the activeness of students following lectures.
2. Final grades include the results of an assessment of knowledge, general skills, and special skills obtained from individual assignments, group assignments, presentations, quizzes, Insertion Exams, and Final Semester Exams with the following guidelines.
The final mark will be weight as follow:</td></tr>
</table>

No	CO	Assessment Object	Assessment Technique	Weight
1	CO – CO6	Work Attitude	Observation	10%
		Project Performance	Performance	60%
		Final Project Performance	Practicum	30%
			Total	100%

Forms of media:	Board, LCD Projector, Laptop/Computer
Literature:	1. -. 2018. Modul Praktik Sensor Joystick, Reedswitch, dan MQ-7. Yogyakarta: UNY 2. -. 2018. Modul Praktik Sensor Flame, Sound Activation, dan Pressure. Yogyakarta: UNY 3. -. 2019. Modul Praktik Sensor PIR, Waterlevel, Fotovoltaik. Yogyakarta: UNY 4. -. 2018. Modul Praktik Sensor Huminity, Load Cell, dan Sharp GP. Yogyakarta: UNY
Date of revision	28 August 2018

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Digital Control
Module level,if applicable:	Undergraduate
Code:	EKO6244
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	5^{th}
Module coordinator:	Dr. Moh. Khairudin
Lecturer(s):	1. Sigit Yatmono, ST.,M.T.
Language:	Bahasa Indonesia
Classification within the curriculum:	~~Compulsory~~/Elective Course
Teaching format / class hours per week during the semester:	200 minutes lectures and 240 minutes structured activities per week.
Teaching and Learning Method	Discussion, Simulation, and lecturing
Workload:	Total workload is 181 hours per semester which consists of 200 minutes lectures, 240 minutes structured activities, and 240 minutes self-study per week for 16 weeks.
Credit points:	2
Prerequisites course(s):	-

Expected learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics ELO3 Can carry out work in accordance with the professional field of expertise both individually and in teams. ELO4 Mastering basic science and basic electricity. ELO5 Mastering work standards, work methods, work implementation, and testing in the field of electric power engineering or industrial automation. ELO7 Able to manage vocational education and training in the field of Electrical Engineering by utilizing information and communication technology.
Course outcomes:	CO1 Devoted to God Almighty and able to show the attitude and character regius CO2 Demonstrates responsibility for work in their area of expertise independently. CO3 Knowledge of law and the basic theory of electricity. CO4 Knowledge of the preparation of scientific papers including work reports in accordance with scientific procedures based on data and information analysis. CO5 Knowledge of identifying, formulating and solving control systems in Electric Power Engineering or Industrial Automation CO6 Identifying and solving current and future problems in Electric Power Engineering or Industrial Automation using the laws and basic theories of electricity within a broader application framework. CO7 Apply automation techniques for electrical and renewable energy (magnetic contactors, power electronics, PLCs, and microcontrollers).

ELO and CO mapping

	ELO1	ELO3	ELO4	ELO5	ELO7
CO1	✓				
CO2		✓			
CO3			✓	✓	
CO4			✓	✓	✓
CO5			✓	✓	✓
CO6			✓	✓	✓
CO7			✓	✓	✓

Courses Description:

This course discusses general configuration of digital control systems, other terms, a little history of the development of digital control systems, hardware configurations, various digital controllers, analog / digital conversion, sampling, continuous signaling and discrete time, anchoring zero-order (ZOH), the basics of Transformation Z, switching ratio modeling, digital PID controllers, state-space modeling, signal flow diagrams, state equation solutions, stability analysis, digital filters.

Assessments:

Assessment is carried out to measure all learning achievements, namely attainment learning achievement, knowledge,and skills.

1. Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude than the attitude of students in general. Attitude assessment also considers the activeness of students following lectures.

2. Final grades include the results of an assessment of knowledge, general skills, and special skills obtained from individual assignments, group assignments, presentations, quizzes, Insertion Exams, and Final Semester Exams with the following guidelines.

The final mark will be weight as follow:

No	CO	Assessment Object	Assessment Technique	Weight
1	CO1 – CO7	Attendance	Documentation	5%

	<table><tr><td></td><td></td><td>Assignment 1,2,3, and 4</td><td>Presentation</td><td>20%</td></tr><tr><td></td><td></td><td>Assignment 5</td><td>Project Performance</td><td>15%</td></tr><tr><td></td><td></td><td>Quiz</td><td>Written test</td><td>20%</td></tr><tr><td></td><td></td><td>Mid</td><td>Written test</td><td>20%</td></tr><tr><td></td><td></td><td>Final Exam</td><td>Written test</td><td>20%</td></tr><tr><td colspan="4">Total</td><td>100%</td></tr></table>
Forms of media:	Board, LCD Projector, Laptop/Computer
Literature:	1. **Astrom**, Karl J. and Bjorn **Wittenmark**,(1996) "*Computer-controlled Systems*", Prentice Hall, Inc, Englewood Cliffs, NJ 2. **Kuo**, Benjamin C.,(1980) "*Digital Control Systems*", Holt, Rinehart and Winston, Inc., NY. 3. **Franklin**, Gene F., et.al., (1997) "*Digital Control of Dynamic Systems*", Addison Wesley Publishing Company, Reading, MA. 4. **Phillips**, Charles L.. and H. Troy **Nagle**, (2014) "*Digital Control Systems: Analysis and Design*", Prentice Hall, Inc, Englewood Cliffs, NJ
Date of revision	28 August 2018

6^{th} SEMESTER

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP) **MODULE HANDBOOK**

Module name:	Sociocultural Education
Module level,if applicable:	Undergraduate
Code:	MKU6214
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	6th
Module coordinator:	Prof. Dr. Siti Irene Astuti D, M.Si.
Lecturer(s):	1. Drs. Nurhadi, M.Si.
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	100 minutes lectures and 120 minutes structured activities per week.
Teaching and Learning Method	Discussion and Lecturing
Workload:	Total workload is 91 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes self-study per week for 16 weeks.
Credit points:	2
Prerequisites course(s):	-
Expected learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrates devotion to YME God, the practice of values, norms, and academic ethics. ELO2 Demonstrate an attitude of nationalism, responsibility, and tolerance towards society and the environment.

<table>
<tr><td></td><td>ELO3 Can carry out work in accordance with the professional field of expertise both individually and in teams.</td></tr>
<tr><td>Course Outcomes:</td><td>CO1 Fear God Almighty and be able to show a religious attitude, honest and patient.
CO2 Respect the diversity of cultures, views, religions, and beliefs, as well as other people's original opinions or findings.
CO2.1 Describe the relevance between education and society and culture.
CO2.2 Understand humans as cultured, ethical, and aesthetic creatures.
CO3 Work together and have social sensitivity and care for the community, and the environment.
CO3.1 Understand human nature and civilization.
CO3.2 Understand the nature of humans as individual beings and social beings.
CO4 Develop and maintain a network of supervisors, colleagues, colleagues both inside and outside the institution.
CO4.1 Identify social capital and cultural capital that determine the success and failure of education.</td></tr>
<tr><td>ELO and CO mapping</td><td>
<table>
<tr><th></th><th>ELO1</th><th>ELO2</th><th>ELO3</th></tr>
<tr><td>CO1</td><td>✓</td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td>✓</td><td></td></tr>
<tr><td>CO3</td><td></td><td>✓</td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td>✓</td></tr>
</table>
</td></tr>
<tr><td>Courses Description:</td><td>At the end of the lecture helps students grow the importance of education in encouraging: critical power, creative power, appreciation, and sensitivity of students to social and cultural values in order to establish their personality as a provision for community life as individuals and social beings who: (a) are democratic, civilized, and uphold human values, dignity and care for the preservation of natural resources and the environment, (b) have the ability to master the basics of science, technology and art, (c) have the ability to master basic knowledge about human concepts , culture, values, morals and law, science, technology and art and the environment, and (d) play a role in finding solutions for socio-cultural and environmental solutions wisely and wisely.</td></tr>
</table>

<table>
<tr><td>Assessments:</td><td>

1. The assessment is carried out to measure all learning outcomes, namely attainment learning achievements (CO 1), (CO 2), and (CO 3) (CO 4).
2. Final grades include the results of general knowledge assessment obtained from individual assignments, group assignments, presentations, quizzes, Insert Tests, and Final Examinations with the following guidelines.

The final mark will be weight as follow:

<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td>1</td><td>CO2</td><td>Attitude (presence, activity, discipline, honesty)</td><td>Observation</td><td>10%</td></tr>
<tr><td>2</td><td>CO3 dan CO4</td><td>a. Individual assignments
b. Group assignments
c. Midterm exam
d. Final exams</td><td>a. Article
b. Presentations and Papers
c. Written test
d. Written test</td><td>15%
15%
20%
40%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table>

</td></tr>
<tr><td>Forms of media:</td><td>Board, LCD Projector, Laptop/Computer</td></tr>
<tr><td>Literature:</td><td>

1. Siti Irene Astuti D. 2016. *Pendidikan Sosial Budaya*. Yogyakarta: UNY Press.
2. Koentjaraningrat. 1993. *Kebudayaan, Mentalitas, dan pembangunan*. Jakarta: Gramedia Pustaka Utama.
3. Soejono Soekanto. 2000. *Sosiologi Suatu Pengantar*. Jakarta: Raja Grafindo Persada.
4. Sudjarwo. 2015. *Proses Sosial dan Interaksi Sosial dalam Pendidikan*. Bandung: Mandar Maju.

</td></tr>
<tr><td>Date of revision</td><td>19 August 2018</td></tr>
</table>

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Educational Research Method
Module level,if applicable:	Undergraduate
Code:	MKP6301
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	6th
Module coordinator:	Dr. Ketut Ima Ismara, M.Pd.,M.Kes.
Lecturer(s):	Team
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	150 minutes lectures and 180 minutes structured activities per week.
Teaching and Learning Method	Discussion, Brain Storming, Student Centered Learning, and Lecturing, Computer Based Learning.
Workload:	Total workload is 136 hours per semester which consists of 150 minutes lectures, 180 minutes structured activities, and 180 minutes self-study per week for 16 weeks.
Credit points:	3
Prerequisites course(s):	-
Expected learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrates devotion to YME God, the practice of values, norms, and academic ethics ELO2 Demonstrate an attitude of nationalism, responsibility, and tolerance towards society and the environment. ELO3 Can carry out work in accordance with the professional field of expertise both individually and in teams

	ELO4 Mastering work standards, work methods, work implementation, and testing in the field of electric power engineering or industrial automation. ELO5 Mastering work standards, work methods, work implementation, and testing in the field of electric power engineering and industrial automation. ELO6 Able to manage vocational education and training in the field of Electrical Engineering by utilizing information and communication technology ELO9 Able to develop innovations in education, and publish the results of his work
Course Outcome:	CO1 Demonstrate polite, honest, good faith in lectures. CO2 Contribute to improving the quality of life in a society, nation, state, and advancement of civilization based on Pancasila CO3 Knowledge of the preparation of scientific papers including work reports in accordance with scientific procedures based on data and information analysis. CO4 Apply logical, critical, systematic, and innovative thinking in the context of developing or implementing science and / or technology in accordance with their area of expertise. CO5 Assessing the implications of the development or implementation of science, technology or art in accordance with their expertise based on the rules, procedures and scientific ethics to produce solutions, ideas, designs, or art criticism and compile scientific descriptions of the results of their studies in the form of thesis or final project report. CO6 Make decisions appropriately in the context of problem solving in their area of expertise, based on the results of an analysis of information and data. CO7 Compile reports of Scientific Works in accordance with scientific procedures based on analysis, information and data and be able to interpret and communicate accurately and accountably in order to solve problems and phenomena that occur related to the profession.

<table>
<tr><td>ELO and CO mapping</td><td>
<table>
<tr><th></th><th>ELO1</th><th>ELO2</th><th>ELO5</th><th>ELO9</th></tr>
<tr><td>CO1</td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td>✓</td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td>✓</td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td>✓</td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td>✓</td></tr>
<tr><td>CO6</td><td></td><td></td><td></td><td>✓</td></tr>
<tr><td>CO7</td><td></td><td></td><td></td><td>✓</td></tr>
</table>
</td></tr>
<tr><td>Courses Description:</td><td>This course discusses the knowledge, understanding and application of various research methods in the context of preparing the final project. In lectures discussed various types of research, steps of scientific research ranging from determining the topic, identifying problems, reviewing the literature, determining the focus of the problem, determining the variables, design and design, data collection techniques, analysis and conclusion drawing. Learning activities include lectures with various approaches and methods that involve students, such as discussions, field observations to learn to identify problems and practice making research proposals.</td></tr>
<tr><td>Assessments</td><td>The assessment was conducted to measure all learning achievements, namely attainment learning achievements (CO 1), general skills (CO 2), knowledge (CO 3), and special skills (CO 4 and CO 5).

1. Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude than the attitude of students in general. The results of the attitude assessment are not a component of the student's final grade, but rather as one of the graduation requirements. Students will graduate from this course if at least have a good attitude. Attitude assessment also considers the activeness of students following lectures.

2. Final grades include the results of an assessment of knowledge, general skills, and special skills obtained from individual assignments, group assignments, presentations, quizzes, insert tests, and final semester examinations with the following guidelines.</td></tr>
</table>

<table>
<tr><td></td><td>The final mark will be weight as follow:
<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td>1</td><td>CO2</td><td>Presentation</td><td>Observation</td><td>10%</td></tr>
<tr><td>2</td><td>CO3 dan CO5</td><td>a. Individual assignments
b. Group assignments
c. Quiz
d. Final exams</td><td>a. Accuracy of program results
b. Writen</td><td>20%
20%
20%
30%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table></td></tr>
<tr><td>Forms of media:</td><td>Board, LCD Projector, Laptop/Computer</td></tr>
<tr><td>Literature:</td><td>9. Arikunto, S. 2006. Penelitian Tindakan Kelas. Jakarta : Rineka Cipta.
10. Sugiyono. 2006. Metode Penelitian Kuantitatif Kualitatif dan R&D. Bandung: Alfabeta.
11. Sachari, Agus (2003). Pengantar Metode Penelitian. Bandung: Erlangga.
12. Arikunto, S. (2016). Prosedur Penelitian Suatu Pendekatan Praktik. Jakarta: Rineka Cipta.
13. Emzir. (2010). Metodologi Penelitian Pendidikan:Kuantitatif dan Kualitatif. Jakarta: Rajawali Pers.
14. Tim Tugas Akhir Skripsi(2013). Pedoman Penyusunan Tugas Akhir Skripsi. Yogyakarta.</td></tr>
<tr><td>Date of revision</td><td>30 August 2018</td></tr>
</table>

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Entrepreneurship
Module level,if applicable:	Undergraduate
Code:	MKU6212
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	6rd
Module coordinator:	Mutaqin, M.Pd.,M.T.
Lecturer(s):	Team
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	100 minutes lectures and 120 minutes structured activities per week.
Teaching and Learning Method:	Discussion and Lecturing
Workload:	Total workload is 91 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes self-study per week for 16 weeks.
Credit points:	2
Prerequisites course(s):	-
Expected Learning Outcomes:	After taking this course the students have ability to: ELO1 Demonstrates devotion to YME God, the practice of values, norms, and academic ethics ELO2 Demonstrate an attitude of nationalism, responsibility, and tolerance towards society and the environment

	ELO3 Can carry out work in accordance with the professional field of expertise both individually and in teams. ELO4 Mastering work standards, work methods, work implementation, and testing in the field of electric power engineering or industrial automation. ELO9 Able to develop innovations in education, and publish the results of his work
Course outcomes:	CO1 Demonstrate polite, honest, good faith in lectures. CO2 Uphold the value of humanity in carrying out duties based on religion, morals, and ethics. CO3 Internalize academic values, norms and ethics. CO3.1 Understanding of course orientation, entrepreneurship concepts, and unemployment CO4 Respect the diversity of cultures, views, religions, and beliefs, as well as other people's original opinions or findings. CO5 Contribute to improving the quality of life in a society, nation, state and the advancement of civilization based on Pancasila. CO6 Work together and have social sensitivity and care for the community, and the environment. CO6.1 Understand the concept of achievement motivation and determination. CO7 Internalize the spirit of independence, struggle, and entrepreneurship. CO7.1 Understand Ethics and social responsibility in business. CO8 Demonstrates responsibility for work in their area of expertise independently. CO9 Knowledge of the preparation of scientific works including work reports in accordance with scientific procedures based on data and information analysis. CO9.1 Demonstrate the ability to think creatively, by thinking about orientation to action. CO9.2 Understand the concept of risk, potential risk and its management. CO10 Apply logical, critical, systematic, and innovative thinking in the context of developing or implementing science and / or technology in accordance with their area of expertise.

CO10.1	Able to construct the entrepreneur's character and mindset
CO10.2	Have achievement motivation in entrepreneurial activities and the ability to work synergistically in teams
CO10.3	Get to know the character of successful entrepreneurs, conduct interviews with successful entrepreneurs and present interview activities
CO11	Assessing the implications of the development or implementation of science, technology or art in accordance with their expertise based on the rules, procedures and scientific ethics to produce solutions, ideas, designs, or art criticism and compile scientific descriptions of the results of their studies in the form of thesis or final project report.
CO11.1	Having the ability to create a business plan to open new business opportunities.
CO12	Make decisions appropriately in the context of problem solving in their area of expertise, based on the results of an analysis of information and data.
CO12.1	Identifying new business opportunities that can be developed.
CO13	Compile reports of Scientific Works in accordance with scientific procedures based on analysis, information and data and be able to interpret and communicate accurately and accountably in order to solve problems and phenomena that occur related to the profession.
CO13.1	Having the ability to implement business planning, preparing reports on new business activities

ELO and CO mapping:

	ELO1	ELO2	ELO3	ELO4	ELO9
CO1	✓				
CO2	✓				
CO3	✓				
CO4		✓			
CO5		✓			
CO6		✓			
CO7			✓		
CO8			✓		
CO9				✓	

CO10					✓
CO11					✓
CO12					✓
CO13					✓

Courses Description:

This course will equip students to be able to build an entrepreneur's spirit / soul and character, understand the concept of entrepreneurship, and practice entrepreneurial skills / skills. The scope of this course material includes: developing spirit / soul and character of entrepreneurship, achievement motivation, entrepreneurial nature, business ethics and social responsibility, production management, finance, marketing and human resources, business opportunities, business plans, and entrepreneurial practices / learning projects.

The learning strategy uses the student center approach with methods including: lectures, discussions, games, assignments, simulations, and field practice and presentations. Evaluation of evaluation uses the assignment model, presentation and written test.

Assessment:

1. The assessment is carried out to measure all learning outcomes, namely attainment of learning attitudes, general skills, knowledge, and special skills.
2. Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude compared to the attitude of students in general. The results of the attitude assessment are not a component of the student's final grade, but rather as one of the graduation requirements. Students will graduate from this course if at least have a good attitude. Attitude assessment also considers the activeness of students following lectures.
3. Final grades include the results of an assessment of knowledge, general skills, and special skills obtained from individual assignments, group assignments, presentations, quizzes, insert tests, and final semester examinations with the following guidelines.
4. The final mark will be weight as follow:

No	CO	Assessment Object	Assessment Technique	Weight
1	CO11 and	Presentation	Observation	10%

	CO13			
2	CO3, CO4, CO5, and CO6	a. Individual assignments b. Group assignments c. Quiz d. Midterm exam e. Final exams	a. Accuracy of program results b. Writen	10% 10% 20% 20% 30%
			Total	100%

Forms of media:	Board, LCD Projector, Laptop/Computer
Literature:	1. Abdullah Gymnastiar. (2006). Melipatgandakan Kekayaan dengan Kecerdasan Spiritual. Bandung. Solusi Qalbu. 2. Alain Fayolle. (2007).Handbook of Research in Entrepreneurship Education, Volume 2. Belgium: Edward Elgar Publishing Limited 3. Buchari Alma. (2006). Kewirausahaan. Edisi kesepuluh. Bandung: Alfabeta 4. Gerben Blaauw, Peter van der Sijde ,Christoph Diensberg (2008). Teaching Entrepreneurship, Cases for Education and Training. Netherlands: A Springer Company 5. Geoffrey G. Meredith dkk. (1996) Kewirausahaan, Teori dan Praktek. Edisi kelima. Jakarta: PT Pustaka Binaman Pressindo. 6. Justin G. Longenecker dkk.(2001). Kewirausahaan Manajemen Usaha Kecil. Jakarta: PT. Salemba Empat Patria. 7. Lynn M. Pearce. (2010). Business Plans Handbook, Volume 16. New York: Farmington Hills, 8. Rusman Hakim. (1998). Kiat Sukses Berwiraswasta. Edisi Kedua. Jakarta: PT Elex Media Media Komputindo.
Date of revision:	30 August 2018

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Indonesian Language
Module level,if applicable:	Undergraduate
Code:	MKU6209
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	6rd
Module coordinator:	Zamtinah, M.Pd.
Lecturer(s):	Team
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	100 minutes lectures and 120 minutes structured activities per week.
Teaching and Learning Method:	Discussion and Lecturing
Workload:	Total workload is 91 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes self-study per week for 16 weeks.
Credit points:	2
Prerequisites course(s):	-
Expected Learning Outcomes:	After taking this course the students have ability to: ELO2 Demonstrate nationalism, responsibility, and tolerance to both society and environmet ELO3 Capable to perform professional works in his/her field of expertise both individual and team works ELO8 Capable to apply research and scientific writing methods

Course outcomes:	CO1 Contributing to the improvement of the quality of life in the community, the nation, the state, and the advancement of civilization based on Pancasila. CO2 Demonstrating responsibility on the respective profession of expertise in an independent manner. CO2.1 Able to explain the concepts, functions, types, and tunings of the Indonesian language CO2.2 Able to apply ethical writing and prevent acts of plagiarism CO3 Implement strategies, media,learning materials, and learning assessment on technology and vocational education in the field of electrical engineering CO3.1 Describe education that is suitable for multicultural Indonesian society CO3.2 Able to compile scientific papers CO3.3 Able to compile and present research proposals
ELO and CO mapping:	(see table below)
Courses Description:	Indonesian language skills are an absolute requirement for Indonesian students to be able to express their thoughts to other parties effectively. Courses Indonesian is expected to make students have high communication skills in the scientific realm. Based on the mastery of functions language and variety and barrel, reading spelling skills, sentences, paragraphs, and types of discourse, as well as reproducing texts from various sources, students expected to be able to write and speak well in Indonesian scientific barrel. Students are expected to understand aspects of scientific papers including definitions and types of scientific papers, and able to compile scientific papers both popular, semi-formal and formal. Students are able to implement ethics authorship and refraining from actions including plagiarism.

ELO and CO mapping:

	ELO2	ELO3	ELO8
CO1	✓		
CO2		✓	
CO3			✓

<table>
<tr>
<td>Assessment:</td>
<td>

Assessment is carried out to measure all learning achievements, namely attainment learning achievements (CO 1) and (CO 2) General knowledge (CO 3).
Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude compared to the attitude of students in general. The results of the attitude assessment are not a component of the student's final grade, but rather as one of the graduation requirements. Students will graduate from this course if at least have a good attitude. Attitude assessment also considers the activeness of students following lectures.
Final grades include the results of general knowledge assessments obtained from individual assignments, group assignments, presentations, quizzes, Insert Exams, and Final Examinations with the following guidelines.

<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td>1</td><td>CO1 and CO2</td><td>Attitude (presence, activity, discipline, honesty)</td><td>Observation</td><td>10%</td></tr>
<tr><td rowspan="4">2</td><td rowspan="4">CO3</td><td>Individual assignments</td><td>Article</td><td>15%</td></tr>
<tr><td>Group assignments</td><td>Presentations and Papers</td><td>15%</td></tr>
<tr><td>Midterm exam</td><td>Written test</td><td>20%</td></tr>
<tr><td>Final exams</td><td>TAS proposal</td><td>40%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table>
</td>
</tr>
<tr>
<td>Forms of media:</td>
<td>Board, LCD Projector, Laptop/Computer</td>
</tr>
<tr>
<td>Literature:</td>
<td>

Amien, M. (1995) Pedoman penulisa karya ilmiah. Yogyakarta: Program Pasca Sarjana UNY
Andi Baso Mappatoto (1993) Teknik penulisan feature (Karangan Khas). Jakarta: Gramedia
Brotowijoyo, Mukayat D. (2002). Penulisan Karangan Ilmiah. Jakarta: Akademika Pressindo
Dirjen Dikti Kemdikbud RI (2013) Materi Kuliah Bahasa Indonesia
______ (1990) Bahan Penataran Penelitian Dasar dan Penulisan Karya Ilmiah bagi Dosen Muda FPTK IKIP Yogyakarta.
Daniel Samad (1997) Dasar-dasar meresensi buku. Jakarta: PT Gramedia Widiasarana Indonesia

</td>
</tr>
</table>

	7. Edy Zaqeus (2005) Resep cespleng menulis buku best seller: Jurus jitu menulis buku laris untuk orang sibuk seperti anda. Yogyakarta: Gradien Books 8. Haryanto, AG. (1993) Seluk beluk penyusunan karya ilmiah. Jakarta: Hipokrates. 9. Isnani, AS. Suryono. (2008) Plagiarisme. Pengembangan Wwaasan Redaksi. Media Aesculapius Departemen Farmakologi FKUI. 10. Kamus Besar Bahasa Indonesia (2001). Pusat Bahasa Depdiknas. Jakarta: Balai Pustaka 11. Keraf, Gorys. 1997. Komposisi, sebuah PengantarKamahiran Bahasa. Ende: Penerbit Nusa Indah. 12. Kuncoro, Mudrajat. (2009) Mahir menulis. Kiat jitu menulis artikel opini, kolom, dan resensi buku. Jakarta: Penerbit Erlangga 13. Permendiknas No. 17 Tahun 2010 tentang Pencegahan dan Penanggulangan Plagiat di Perguruan Tinggi. 14. Ramlan, M. dkk. (1994) Bahasa Indonesia yang salah dan yang benar. Yogyakarta: Andi Offset. 15. Soekamto, dkk (1995) Pedoman penelitian. Lembaga Penelitian IKIP Yogyakarta 16. Sriyana, Jaka (2012) Kode etik penulis dan etika kepenulisan karya ilmiah. 17. Sugiyono (2005) Metode penelitian administrasi. Bandumg : Alfabeta 18. ______ (2006) Statistika untuk penelitian. Bandung : Alfabeta 19. ________(2013) Cara mudah menyusun: skripsi, tesis, dan disertasi. Bandung: Alfabeta 20. Suharsimi Arikunto (1989) Prosedur penelitian suatu pendekatan praktik. Bandung : Bina Aksara 21. Wahyu Wibowo (2002) 6 langkah jitu agar tulisan anda makin hidup dan enak dibaca. Jakarta : Gramedia Pustaka Utama 22. Undang-Undang No. 12 Tahun 2010 tentang Pendidikan Tinggi
Date of revision:	31 August 2018

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Transmission and Distribution lab. Work
Module level,if applicable:	Undergraduate
Code:	EKO6245
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	6th
Module coordinator:	Dr. Giri Wiyono, M.T
Lecturer(s):	1. Dr. Zamtinah 2. Faranita Surwi, M.T.
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	200 minutes lectures and 240 minutes structured activities per week.
Teaching and Learning Method	Demonstration, Simulation.
Workload:	Total workload is 181 hours per semester which consists of 200 minutes lectures, 240 minutes structured activities, and 240 minutes self-study per week for 16 weeks.
Credit points:	2
Prerequisites course(s):	-
Expected Learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics ELO3 Capable to perform professional works in his/her field of expertise both individual and team works

	ELO4 Master in basic sciences and principles of electric ELO5 Master in work standards, work methods, work implementations, and testing in electric power or industrial automation expertise. ELO7 Capable to manage vocational education and training of electrical engineering expertise by utilizing information and communications technology
Course outcomes:	CO1 Being pious to God Almighty and able to demonstrate religiousness, honesty, and patience. CO2 Demonstrating responsibility on the respective profession of expertise in an independent manner. CO3 Knowledge on the law and basic theories of electricity. CO3.1 Analyze the load characteristics of R, L and C on DC and AC sources CO4 Knowledge on developing scientific paper, including work report that is in line with scientific procedure based on the analysis, information, and data, and the ability to interpret and communicate in an accurate and accountable manner in order to solve problems and phenomena related to the occupation. CO4.1 Conduct analysis and compile reports based on the results of practices implemented. CO5 Knowledge on the power plant, distribution, use, installation, and electrical automation engineering in businesses and industry according to the standards and principles that apply generally and are relevant with electrical power and renewable energy. CO5.1 Determine the phase sequence method, Analyze parameters that affect the real and reactive power flow, Evaluate the stability of the transition in the power system CO6 Have full understanding and mastery on the transmission theory and electrical power distribution. CO6.1 Identifying the main and supporting components in transmission and distribution channels CO6.2 Analyzing the amount of electricity in the transmission line CO6.3 Analyze the mounting characteristics of synchronous capacitors on long channels

ELO and CO mapping	<table><tr><th></th><th>ELO1</th><th>ELO3</th><th>ELO4</th><th>ELO5</th><th>ELO7</th></tr><tr><td>CO1</td><td>✓</td><td></td><td></td><td></td><td></td></tr><tr><td>CO2</td><td></td><td>✓</td><td></td><td></td><td></td></tr><tr><td>CO3</td><td></td><td></td><td>✓</td><td></td><td></td></tr><tr><td>CO4</td><td></td><td></td><td></td><td>✓</td><td></td></tr><tr><td>CO5</td><td></td><td></td><td></td><td></td><td>✓</td></tr><tr><td>CO6</td><td></td><td></td><td></td><td></td><td>✓</td></tr></table>
Courses Description:	This course practices the phenomena that occur in the process of transmitting and distributing electric power from generators to users. The scope of this course material includes: load characteristics of R, L and C at DC and AC sources, phase sequence checking, voltage regulation and power flow on a simple transmission line, simulation of voltage drop and phase angle on the transmission line, parameters that affect the flow real and reactive power, use of transformers to increase power transfer capacity, alternators, synchronous motors, long lines and synchronous capacitors, synchronous motor operations at low loads, and the stability of power system switching
Assesments:	1. Assessment is carried out to measure all learning achievements, namely attainment learning achievements (CO 1), general skills (CO 2), knowledge (CO 3 and CO 4), and special skills (CO 5 and CO 6). 2. Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude compared to the attitude of students in general. The results of the attitude assessment are not a component of the student's final grade, but rather as one of the graduation requirements. Students will graduate from this course if at least have a good attitude. Attitude assessment also considers the activeness of students following lectures. 3. Final grades include the results of the assessment of knowledge, general skills, and special skills obtained from individual assignments, group assignments, presentations, quizzes, insert tests, and final semester examinations with the following guidelines.

<table>
<tr><td></td><td>
<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td>1</td><td>CO2</td><td>Presentation</td><td>Observation</td><td>10%</td></tr>
<tr><td rowspan="5">2</td><td rowspan="5">CO3, CO4, CO5, and CO6</td><td>Individual Assignment</td><td rowspan="5">1. Accuracy of program results
2. Written</td><td>10%</td></tr>
<tr><td>Group Assignment</td><td>10%</td></tr>
<tr><td>Quiz</td><td>20%</td></tr>
<tr><td>Midterm Exam</td><td>20%</td></tr>
<tr><td>Final Exam</td><td>30%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table>
</td></tr>
<tr><td>Forms of media:</td><td>Board, LCD Projector, Laptop/Computer</td></tr>
<tr><td>Literature:</td><td>1. Hutauruk. (1993). Transmisi Daya Listrik. Jakarta: Penerbit Erlangga
2. Gupta, JR. (1981). A Course In Electrical Power. India: Katson Publishing House.
3. Pansini, Anthony J. (2006). Electrical Distribution Engineering. USA: Taylor & Francis Ltd.
4. Sadaat, Hadi. (1999). Power System Analysis.Singapore: Mc Graw Hill</td></tr>
<tr><td>Date of revision</td><td>10 August 2018</td></tr>
</table>

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Micro Teaching
Module level,if applicable:	Undergraduate
Code:	EKO 6246
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	6^{th}
Module coordinator:	Dr. phil. Nurhening Yuniarti, M.T.
Lecturer(s):	Dr. Istanto Wahyu Djatmiko, M.Pd. Dr. Edy Supriyadi, M.Pd. Dr. Drs. Haryanto, M.Pd.,M.T. Dr. Sunaryo Soenarto,MPd.
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	The form of learning is in the form of lectures, which consist of: (1) 150 minutes of face-to-face activities per week per semester; (2) structured assignment activities 120 minutes per week per semester; and (3) 120 minutes of independent activities per week per semester.
Teaching and Learning Method	Discussion, Demonstration, and *Lecturing*
Workload:	Total workload is 40 hours of face-to-face activities per semester
Credit points:	3
Prerequisites course(s):	-
Expected learning outcomes:	After taking this course the students have ability to:

	ELO1 Demonstrates devotion to YME God, the practice of values, norms, and academic ethics ELO2 Uphold the value of humanity in carrying out duties based on religion, morals, and ethics. ELO5 Mastering work standards, work methods, work implementation, and testing in the field of electric power engineering or industrial automation. ELO6 Able to plan, implement, and evaluate learning in the field of electric power or automation. ELO8 Able to apply research methods and preparation of scientific works
Course Outcomes	CO1 Students fear God and be able to show a religious attitude and character, CO2 Uphold the confidentiality of his work, honest and fair in carrying out duties based on religion, morals, and ethics. CO3 Knowledge of the preparation of scientific works including work reports in accordance with scientific procedures based on data and information analysis. CO3.1 Understand the basics of Vocational Learning Management. CO3.2 Develop a Micro Teaching Learning Plan (RPP). CO3.3 Understand 8 basic learning skills CO4 Implement innovative learning models that are relevant to the characteristics of students. CO4.1 Practicing basic teaching skills is limited. CO4.2 Practice the basic skills of integrated teaching in learning theory. CO4.3 Practice basic integrated teaching skills in practical learning in the laboratory. CO4.4 Practice the basic skills of integrated teaching in practical learning in the workshop. CO5 Facilitating, evaluating, implementing learning and learning outcomes professionally, as well as community partnerships within the framework of vocational education in carrying out their duties as a teaching profession. CO5.1 Skillfully simulates 8 basic teaching skills.

<table>
<tr><td>ELO and CO mapping</td><td>
<table>
<tr><th></th><th>ELO1</th><th>ELO2</th><th>ELO5</th><th>ELO6</th><th>ELO8</th></tr>
<tr><td>CO1</td><td>✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td>✓</td><td></td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td></td><td>✓</td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td>✓</td><td></td></tr>
</table>
</td></tr>
<tr><td>Courses Description:</td><td>Micro Learning Courses form and provide provisions for students to have pegagogical competencies, professional competencies, personality competencies, and social competencies through: understanding basic teaching skills, preparation of lesson plans, practice of basic teaching skills limited, practice of basic teaching skills integrated, both in learning theory, practice in the laboratory, as well as in the workshop.</td></tr>
<tr><td>Assessments</td><td>The assessment was conducted to measure all learning achievements, namely attainment learning achievements (CO 1), general skills (CO 2), knowledge (CO 3), and special skills (CO 4 and CO 5).

Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using the assumption that basically every student has a good attitude. The student is given the attitude rating: not good, good enough, good, and very good. The results of the attitude assessment are not a component of the student's final grade, but rather as one of the graduation requirements. Students will graduate from this course if at least have a good attitude. Attitude assessment also considers the activeness of students following lectures.
The final grade includes the accumulation of assessments for each meeting as referred to by the weight of the assessment.

The final mark will be weight as follow:
<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td rowspan="4">1</td><td rowspan="4">CO1 – CO7</td><td>Understand the fundamentals of Micro Teaching.</td><td>Written test</td><td>10%</td></tr>
<tr><td>Field observation</td><td>Assignment</td><td>10%</td></tr>
<tr><td>Compose of syllabus</td><td>Assignment</td><td>10%</td></tr>
<tr><td>Compose of</td><td>Assignment</td><td></td></tr>
</table>
</td></tr>
</table>

			learning implementation plan		15%
			Practicing the limited of basic teaching skills	Performing Test	10%
			Practicing the basic skills of integrated teaching in learning theory.	Performing Test	10%
			Practice basic integrated teaching skills in practical learning in the laboratory.	Performing Test	15%
			Practice the basic skills of integrated teaching in practical learning in the workshop.	Performing Test	20%
				Total	100%

Forms of media:	Board, LCD Projector, Laptop/Computer
Literature:	15. Barnawi & M. Arifin (2012). Teori & praktik pengajaran yg efektif & Kreatif. Bandung: Ar- Ruzz Media 16. Dewa Ayu Eka Agustini, Luh Putu Artini, Ni Nyoman Padmadewi. (2010) Pengantar Micro Teaching. Jakarta: Balai Pustaka 17. Arif Sardiman. (2001). Media Pendidikan. Jakarta: Pustekkom Diknas.
Date of revision	30 August 2018

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Electrical Power Plant
Module level,if applicable:	Undergraduate
Code:	EKO6247
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	6th
Module coordinator:	Dr. phil. Nurhening Yuniarti, M.T
Lecturer(s):	1. Muhfizaturrahmah, S.T., M.Eng 2. Eko Swi Darmawan, M.Pd. 3. Eko Prianto, M.Eng.
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	100 minutes lectures and 120 minutes structured activities per week.
Teaching and Learning Method	Discussion
Workload:	Total workload is 91 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes self-study per week for 16 weeks.
Credit points:	2
Prerequisites course(s):	-
Expected Learning Outcomes:	After taking this course the students have ability to ELO1 Demonstrates devotion to YME God, the practice of values, norms, and academic ethics. ELO3 Can carry out work in accordance with the professional field of expertise both individually and in teams.

<table>
<tr><td></td><td>ELO4 Mastering basic science and basic electricity.
ELO5 Mastering work standards, work methods, work implementation, and testing in the field of electric power engineering or industrial automation.
ELO7 Able to manage vocational education and training in the field of Electrical Engineering by utilizing information and communication technology.</td></tr>
<tr><td>Course Outcomes:</td><td>CO1 Fear God Almighty and be able to show a religious attitude, honest and patient.
CO2 Demonstrates responsibility for work in their area of expertise independently.
CO3 Knowledge of law and the basic theory of electricity.
CO4 Knowledge of the preparation of scientific papers including work reports in accordance with scientific procedures based on data and information analysis.
CO5 Knowledge of the generation, distribution, use, installation and engineering of electric power automation in the business world and industry in accordance with the standards and principles that are generally accepted and relevant in the field of electricity and renewable energy.
CO6 Analyzing the application of materials related to Electric Power Engineering or Industrial Automation for the development of renewable energy development.
CO7 Apply the theory of electricity generation in general and energy efficiency in the field of generation.</td></tr>
<tr><td>ELO and CO mapping</td><td><table>
<tr><th></th><th>ELO1</th><th>ELO3</th><th>ELO4</th><th>ELO5</th><th>ELO7</th></tr>
<tr><td>CO1</td><td>✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td>✓</td><td></td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td>✓</td><td></td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td></td><td>✓</td></tr>
<tr><td>CO6</td><td></td><td></td><td></td><td></td><td>✓</td></tr>
<tr><td>CO7</td><td></td><td></td><td></td><td></td><td>✓</td></tr>
</table></td></tr>
<tr><td>Courses Description:</td><td>This course studies the working principles of Steam Power Plants (PLTU), PLTG, PLTA, PLTN and other alternative power plants such as micro hydro, solar, wind, and wave power plants. In addition, studies are also related to initial movers and electrical equipment in power plants; cable or grid lines from the generator to the transformer and substation; plant operation; parallel generator; control system at the plant; and</td></tr>
</table>

<table>
<tr><td></td><td>interconnection systems in generation. Students are taught to carry out disturbance analysis and generator recovery processes; power change analysis and power plant optimization; and cost analysis and generation management.</td></tr>
<tr><td>Assessments:</td><td>
The assessment was conducted to measure all learning outcomes, namely attainment learning achievements (CO 1 (A.1.1) and (CO 2 (A.3.2)); knowledge (CO 3 (K.1.2) and CO 4 (K.2.1)); and skills (CO 5 (S.2.2), CO 6 (S.2.9), and (CO 7 (S.2.10)).
1. Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude than the attitude of students in general. The results of the attitude assessment are not a component of the student's final grade, but rather as one of the graduation requirements. Students will graduate from this course if at least have a good attitude. Attitude assessment also considers the activeness of students following lectures.
2. Final grades include the results of an assessment of knowledge, general skills, and special skills obtained from individual assignments, group assignments, Inserts Exams, and Final Semester Exams with the following guidelines.
The final mark will be weight as follow:
<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td>1</td><td>CO1 dan CO2</td><td>Attitude (presence, activity, discipline, honesty)</td><td>Observation</td><td>10%</td></tr>
<tr><td>2</td><td>CO3, CO4, CO5, CO6, dan CO7</td><td>a. Individual assignments
b. Group assignments
c. Midterm exam
d. Final exams</td><td>Written test</td><td>15%
15%
20%
40%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table>
</td></tr>
<tr><td>Forms of media:</td><td>Board, LCD Projector, Laptop/Computer</td></tr>
<tr><td>Literature:</td><td>
1. Breeze, Paul. (2005). Power Generation Technologies. Hongkong: Newnes.
2. Dandekar. (1991). Pembangkir Listrik Tenaga Air. Jakarta: UI- Press.
3. Djiteng Marsudi. (2005). Pembangkit Energi Listrik. Jakarta: Erlangga.
</td></tr>
</table>

	4. El Wakil. (1992). *Instalasi Pembangkit Daya Jilid I*. Jakarta: Erlangga. 5. Grigsby, Leonard L. (2007). *Electric Power Generation, Transmission, and Distribution (Electric Power Engineering Handbook)*. New York: CRC. 6. Keljik,.Jeffrey J. (2008). *Electricity 3: Power Generation and Delivery.* Singapore: Delmar Cengage Learning. 7. Mahon, L.L.J. (1992). *Diesel Generator Handbook*. New York: Butterworth. 8. Pansini, Anthony J. & Smalling, K. D. (2005). *Guide to Electric Power Generation*. Texas: Fairmont Press. 9. PLN. (2002). *Pembangkit Tenaga Listrik*. Jakarta: PLN. 10. Sigalingging, K. (1994). *Pembangkit Listrik Tenaga Surya*. Bandung: Tarsito. 11. Singh, S. N. (2004). *Electric Power Generation Transmission and Distribution*. New Delhi: Prentice-Hall of India Pvt. Ltd. 12. Soelaiman. (2004). *Pembangkitan Energi Elektrik.* Bandung: Lab Konversi Energi Elektrik Jurusan Teknik Elektro ITB. 13. Willis, H. Lee. (2000). *Distributed Power Generation: Planning and Evaluation*. New York; CRC. 14. Wood, Allen J. dan Wollenberg, Bruce F. (2001). *Power Generation, Operation, and Control.* New Yersey: Wiley-Interscience.
Date of revision	30 August 2018

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Electrical Power Plant Lab. Work
Module level,if applicable:	Undergraduate
Code:	EKO6247
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	6th
Module coordinator:	Dr. phil. Nurhening Yuniarti, M.T
Lecturer(s):	1. Muhfizaturrahmah, S.T., M.Eng 2. Eko Swi Darmawan, M.Pd. 3. Eko Prianto, M.Eng.
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	200 minutes lectures and 240 minutes structured activities per week.
Teaching and Learning Method	Demonstration, Simulation.
Workload:	Total workload is 181 hours per semester which consists of 200 minutes lectures, 240 minutes structured activities, and 240 minutes self-study per week for 16 weeks.
Credit points:	2
Prerequisites course(s):	-
Expected learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrates devotion to YME God, the practice of values, norms, and academic ethics.

	ELO3 Can carry out work in accordance with the professional field of expertise both individually and in teams. ELO4 Mastering basic science and basic electricity. ELO5 Mastering work standards, work methods, work implementation, and testing in the field of electric power engineering or industrial automation. ELO7 Able to manage vocational education and training in the field of Electrical Engineering by utilizing information and communication technology.
Course Outcomes	CO1 Fear God Almighty and be able to show a religious attitude, honest and patient. CO2 Demonstrates responsibility for work in their area of expertise independently. CO3 Knowledge of law and the basic theory of electricity. CO4 Knowledge of the preparation of scientific papers including work reports in accordance with scientific procedures based on data and information analysis. CO5 Knowledge of the generation, distribution, use, installation and engineering of electric power automation in the business world and industry in accordance with the standards and principles that are generally accepted and relevant in the field of electricity and renewable energy. CO6 Analyzing the application of materials related to Electric Power Engineering or Industrial Automation for the development of renewable energy development. CO7 Apply the theory of electricity generation in general and energy efficiency in the field of generation.
ELO and CO mapping	(see mapping table below)
Courses Description:	This subject studies and practices the working principle of PLTU, PLTA, PLTG and PLTN simulation. Students are taught to learn the characteristics of alternators; paralleling generato; PLTS installation and operation; installation and operation of

ELO and CO mapping:

	ELO1	ELO3	ELO4	ELO5	ELO7
CO1	✓				
CO2		✓			
CO3			✓		
CO4				✓	
CO5					✓
CO6					✓
CO7					✓

<table>
<tr><td></td><td>wind power plants; microhydro installation and operation; operation, maintenance and repair of generators; Diesel power generation equipment (PLTD); operation, maintenance and repair of PLTD. In addition, this course also studies the simulation of Load frequency control of power stations using LQR and Robbust methods, and conducts field studies on power plants.</td></tr>
<tr><td>Assessments</td><td>The assessment was conducted to measure all learning outcomes, namely attainment learning achievements (CO 1 (A.1.1) and (CO 2 (A.3.2)); knowledge (CO 3 (K.1.2) and CO 4 (K.2.1)); and skills (CO 5 (S.2.2), CO 6 (S.2.9), and (CO 7 (S.2.10)).

1. Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude than the attitude of students in general. The results of the attitude assessment are not a component of the student's final grade, but rather as one of the graduation requirements. Students will graduate from this course if at least have a good attitude. Attitude assessment also considers the activeness of students following lectures.

2. Final grades include the results of an assessment of knowledge, general skills, and special skills obtained from individual assignments, group assignments, Inserts Exams, and Final Semester Exams with the following guidelines.

The final mark will be weight as follow:
<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td>1</td><td>CO1 dan CO2</td><td>Attitude (presence, activity, discipline, honesty)</td><td>Observation</td><td>10%</td></tr>
<tr><td>2</td><td>CO3, CO4, CO5, CO6, dan CO7</td><td>a. Individual assignments
b. Group assignments
c. Midterm exam
d. Final exams</td><td>Written test</td><td>15%
15%
20%
40%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table></td></tr>
<tr><td>Forms of media:</td><td>Board, LCD Projector, Laptop/Computer</td></tr>
<tr><td>Literature:</td><td>1. Breeze, Paul. (2005). Power Generation Technologies. Hongkong: Newnes.</td></tr>
</table>

	2. Dandekar. (1991). *Pembangkir Listrik Tenaga Air*. Jakarta: UI- Press. 3. Djiteng Marsudi. (2005). *Pembangkit Energi Listrik*. Jakarta: Erlangga. 4. El Wakil. (1992). *Instalasi Pembangkit Daya Jilid I*. Jakarta: Erlangga. 5. Grigsby, Leonard L. (2007). *Electric Power Generation, Transmission, and Distribution (Electric Power Engineering Handbook)*. New York: CRC. 6. Keljik,.Jeffrey J. (2008). *Electricity 3: Power Generation and Delivery.* Singapore: Delmar Cengage Learning. 7. Mahon, L.L.J. (1992). *Diesel Generator Handbook*. New York: Butterworth. 8. Pansini, Anthony J. & Smalling, K. D. (2005). *Guide to Electric Power Generation*. Texas: Fairmont Press. 9. PLN. (2002). *Pembangkit Tenaga Listrik*. Jakarta: PLN. 10. Sigalingging, K. (1994). *Pembangkit Listrik Tenaga Surya*. Bandung: Tarsito. 11. Singh, S. N. (2004). *Electric Power Generation Transmission and Distribution*. New Delhi: Prentice-Hall of India Pvt. Ltd. 12. Soelaiman. (2004). *Pembangkitan Energi Elektrik.* Bandung: Lab Konversi Energi Elektrik Jurusan Teknik Elektro ITB. 13. Willis, H. Lee. (2000). *Distributed Power Generation: Planning and Evaluation*. New York; CRC. 14. Wood, Allen J. dan Wollenberg, Bruce F. (2001). *Power Generation, Operation, and Control.* New Yersey: Wiley-Interscience.
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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Vocational Guidance
Module level,if applicable:	Undergraduate
Code:	KTF6210
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	6th
Module coordinator:	Mutaqin, M.Pd.,M.T.
Lecturer(s):	Dr. Nurhening Yuniarti, M.T.
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory/~~Elective~~ Course
Teaching format / class hours per week during the semester:	The form of learning is in the form of lectures, which consist of 100 minutes of face-to-face activities per week per semester; (2) structured assignment activities 120 minutes per week per semester; and (3) 120 minutes of independent activities per week per semester.
Teaching and Learning Method	Discussion, Demonstration, and *Lecturing*
Workload:	Total workload is 91 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes self-study per week for 16 weeks.
Credit points:	2
Prerequisites course(s):	-
Expected learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrates devotion to YME God, the practice of values, norms, and academic ethics

	ELO2 Demonstrate an attitude of nationalism, responsibility, and tolerance towards society and the environment ELO3 Can carry out work in accordance with the professional field of expertise both individually and in teams. ELO4 Mastering work standards, work methods, work implementation, and testing in the field of electric power engineering or industrial automation. ELO9 Able to develop innovations in education, and publish the results of his work
Course Outcomes	CO1 Demonstrate polite, honest, good faith in lectures. CO2 Uphold the value of humanity in carrying out duties based on religion, morals, and ethics. CO3 Internalize academic values, norms and ethics. CO3.1 Understand course orientation and the importance of vocational guidance, the scope of meaning and function of vocational guidance CO4 Demonstrates responsibility for work in their area of expertise independently. CO5 Knowledge of the preparation of scientific works including work reports in accordance with scientific procedures based on data and information analysis. CO5.1 Understand the meaning, purpose and function of career guidance and the development of career guidance phases CO5.2 Knowing the achievement of understanding of vocational guidance material CO5.3 Having knowledge about the importance of job information CO5.4 Having information about job sources CO5.5 Understand labor theory and have job analysis skills CO6 Apply logical, critical, systematic, and innovative thinking in the context of developing or implementing science and / or technology in accordance with their area of expertise. CO6.1 Have an understanding of the scope of vocational guidance methods for implementing vocational guidance CO6.2 Knowing the factors that influence the need for vocational guidance, the pattern of implementing vocational guidance CO6.3 Producing book reviews related to vocational

	guidance CO7 Assessing the implications of the development or implementation of science, technology or art in accordance with their expertise based on the rules, procedures and scientific ethics to produce solutions, ideas, designs, or art criticism and compile scientific descriptions of the results of their studies in the form of thesis or final project report. CO7.1 Students have a dream job that is dreamed of, get a job information source CO8 Make decisions appropriately in the context of problem solving in their area of expertise, based on the results of an analysis of information and data. CO8.1 Identifying new business opportunities that can be developed CO9 Compile reports of Scientific Works in accordance with scientific procedures based on analysis, information and data and be able to interpret and communicate accurately and accountably in order to solve problems and phenomena that occur related to the profession. CO9.1 The ability to explain the profession of a counselor, can explain counseling techniques CO9.2 Having an understanding of recruitment of workers, having readiness to interview CO9.3 Ability to explain the concepts of work placement and student follow-up CO9.4 Understand the organization, administration, and evaluation of Vocational guidance, able to make job applications
ELO and CO mapping	(see table below)

	ELO1	ELO2	ELO3	ELO4	ELO9
CO1	✓				
CO2	✓				
CO3	✓				
CO4			✓		
CO5				✓	
CO6					✓
CO7					✓
CO8					✓
CO9					✓

<table>
<tr>
<td>Courses Description:</td>
<td>This course will address the meaning, function, purpose and scope of Vocational Guidance in general, the factors that influence the need for Vocational Guidance, the basic assumptions and principles of Vocational Guidance, information which includes job information, work information sources, methods for presenting job information, selection theory employment and career development, counseling techniques, work placement and follow-up, organization-administration-evaluation of vocational guidance, and techniques for making applications / further study.</td>
</tr>
<tr>
<td>Assessments</td>
<td>
The assessment is carried out to measure all learning outcomes, namely attainment of learning attitudes, general skills, knowledge, and special skills.
1. Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude compared to the attitude of students in general. The results of the attitude assessment are not a component of the student's final grade, but rather as one of the graduation requirements. Students will graduate from this course if at least have a good attitude. Attitude assessment also considers the activeness of students following lectures.
2. Final grades include the results of an assessment of knowledge, general skills, and special skills obtained from individual assignments, group assignments, presentations, quizzes, insert tests, and final semester examinations with the following guidelines.
The final mark will be weight as follow:
<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td>1</td><td>CO6 and CO7</td><td>Presentation</td><td>Observation</td><td>10%</td></tr>
<tr><td>2</td><td>CO3, CO4, CO5, and CO6</td><td>a. Individual assignments
b. Group assignments
c. Quiz
d. Midterm exam
e. Final exams</td><td>a. Accuracy of program results
b. Writen</td><td>10%
10%
20%
20%
30%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table>
</td>
</tr>
</table>

Forms of media:	Board, LCD Projector, Laptop/Computer
Literature:	1. Paul C. Green. 1999. *Building Robust Competencies: Linking Human Resources System to Organizational Strategis*. San-Fransisco: Jossey-Bass Publisher. 2. Frans Poeles. 2003. *Job Evaluation and Remuneration Strategies*. Jakarta: Gramedia. 3. Nick boulter, Murray Dalziel, Jackie. 2003. *People and Competencies*. Jakarta: Gramedia. 4. Peter Sheal. 2003. *The Staff Development Handbook*. Jakarta: Gramedia. 5. Margaret Dale. 2003. *Succesful Recruitment and Selection*. Jakarta: Gramedia. 6. David Clutterbuck & Susan Kernaghan. 2003. *The Power of Empowerment*. Jakarta: Gramedia.
Date of revision	31 August 2018

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Flexible Manufacturing System Lab. Work
Module level,if applicable:	Undergraduate
Code:	EKO6255
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	6^{th}
Module coordinator:	Totok Heru Tri Maryadi, M. Pd.
Lecturer(s):	1. Amelia Fauziah Husna, M. Pd. 2. -
Language:	Bahasa Indonesia
Classification within the curriculum:	~~Compulsory~~/Elective Course
Teaching format / class hours per week during the semester:	200 minutes lectures, 240 minutes structured activities, and 240 minutes self-study per week.
Teaching and Learning Method	Demonstration, Lecture, Eksperimen, Discussion.
Workload:	Total workload is 181 hours per semester which consists of 200 minutes lectures, 240 minutes structured activities, and 240 minutes self-study per week for 16 weeks.
Credit points:	2
Prerequisites course(s):	-
Expected Learning Outcomes:	After taking this course the students have ability to: ELO1 Demonstrates devotion to YME God, the practice of values, norms, and academic ethics ELO2 Demonstrate an attitude of nationalism, responsibility, and tolerance towards society and the environment

	ELO4 Mastering basic science and basic electricity ELO5 Mastering work standards, work methods, work implementation, and testing in the field of electric power engineering or industrial automation. ELO6 Able to plan, implement, and evaluate learning in the field of electric power or automation.
Course Outcomes:	CO1 Fear God Almighty and be able to show a religious attitude, honest and patient. CO2 Internalize academic values, norms and ethics. CO3 Obey the law and discipline in social and state life CO4 Work together and have social sensitivity and care for the community, and the environment. CO5 Knowledge of law and the basic theory of electricity. CO5.1 Application of electrical systems in flexible manufacturing systems CO5.2 Identifying components and input / output addresses in a flexible manufacturing system (MPS-500) CO5.3 Introduction to programming using Simatic Manager CO6 Knowledge of the preparation of scientific works including work reports in accordance with scientific procedures based on data and information analysis. CO6.1 Prepare reports on the practice of manual station programming CO6.2 Compile station automatic programming practice reports CO6.3 Prepare reports on communication practices between stations CO7 Manage laboratories and workshops in training centers, and technology and vocational education in accordance with the provisions of occupational health and safety in the Electrical Engineering field CO7.1 Memrogram manual station MPS-500 CO7.2 Automatically programming the MPS-500 station CO7.3 Mengkomunikasikan antar station

ELO and CO mapping:

	ELO1	ELO2	ELO4	ELO5	ELO6
CO1	✓				
CO2	✓				
CO3		✓			
CO4		✓			
CO5			✓		
CO6				✓	
CO7					✓

Courses Description:

Flexible Manufacturing System Practices are practical activities of identifying equipment, analyzing system processes, programming systems and designing flexible manufacturing systems. Practicum is carried out using the student center learning approach. Competency-based assessment involves active participation, and communication of interactions between individuals and groups. This subject is a concentration course for the concentration of industrial automation.

Assessments:

1. The assessment was conducted to measure all learning achievements, namely attainment learning achievements (CO 1 (A.1.1) and CO 2 (A.1.3)), knowledge (CO 5 (K.1.2) and CO 6 (K.2.1)), and skills (CO 7 (S.1.2)).
2. Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude compared to the attitude of students in general. Attitude assessment also considers the activeness of students following lectures.
3. Final grades include the results of an assessment of knowledge, general skills, and special skills obtained from individual assignments, group assignments, presentations, quizzes, insert tests, and final semester examinations with the following guidelines.

The final mark will be weight as follow:

No	CO	Assessment Object	Assessment Technique	Weight
1	CO5, CO6, and CO7	a. Practice Performance of each topic b. Final Project Performance	The performance Performance	60% 40%
			Total	100%

Forms of media:	Board, LCD Projector, Laptop/Computer.
Literature:	1. Crosser, P. 1994. Pneumatic. Indonesia: Didactic Festo 2. Bolton, William. 2003. Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering. London: Pearson Education Limited. 3. Festo Didactic. Learning System for Automation: Fundamentals of Mechatronics. 4. Totok Heru TM. 2013. Labsheet Manufacturing Practice Flexible System. Yogyakarta: Faculty of Engineering UNY
Date of revision	30 August 2018

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Refrigerant and Air Conditioning Lab Work
Module level,if applicable:	Undergraduate
Code:	EKO6250
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	6th
Module coordinator:	Dr. Djoko Laras BT
Lecturer(s):	Team
Language:	Bahasa Indonesia
Classification within the curriculum:	~~Compulsory~~/Elective Course
Teaching format / class hours per week during the semester:	200 minutes lectures and 240 minutes structured activities per week.
Teaching and Learning Method	Discussion, Demonstration, and *Lecturing*
Workload:	Total workload is 161 hours per semester which consists of 200 minutes lectures, 240 minutes structured activities, and 240 minutes self-study per week for 16 weeks.
Credit points:	2
Prerequisites course(s):	-
Expected learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics ELO3 Capable to perform professional works in his/her field of expertise both individual and team works ELO4 Master in basic sciences and principles of electric

	ELO7 Capable to manage vocational education and training in the field of Electrical Engineering by utilizing information and communication technology
Course Outcomes	CO1 Being pious to God Almighty and able to demonstrate religiousness, honesty, and patience. CO2 Demonstrating responsibility on the respective profession of expertise in an independent manner. CO3 Knowledge on the principles of Mathematics and Physics in relation to the principles of electrical power CO3.1 Understanding mathematical principles in cooling techniques CO3.2 Understanding the principles of physics in cooling techniques CO4 Knowledge on the law and basic theories of electricity. CO4.1 Explain the cooling system and air system CO4.2 Perform cooling load calculations CO4.3 Determine the distribution of air conditioning and air conditioning CO4.4 Explain the mechanical systems of cooling and air conditioning CO4.5 Explain the electrical system cooling and air conditioning CO5 Have full mastery on the concept of electrical power quality and how to conduct repairmen of electrical power profile. CO5.1 Designing cooling and air conditioning pipelines CO5.2 Piping cooling and air conditioning CO5.3 Installing the engine cooling and air conditioning CO5.4 Emptying refrigerant material CO5.5 Refilling refractory material CO6 Apply electrical power engineering safety system for safety of the equipment as well as user health and safety. CO6.1 Conduct analysis on engine maintenance and air conditioning CO6.2 Perform maintenance and repair of engine coolants and air conditioning CO6.3 Conduct engine and air conditioning checks

<table>
<tr><td></td><td>CO6.4 Conduct engine and air conditioning testing</td></tr>
<tr><td>ELO and CO mapping</td><td>
<table>
<tr><th></th><th>ELO1</th><th>ELO3</th><th>ELO4</th><th>ELO7</th></tr>
<tr><td>CO1</td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td>✓</td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td>✓</td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td>✓</td><td></td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td>✓</td></tr>
<tr><td>CO6</td><td></td><td></td><td></td><td>✓</td></tr>
</table>
</td></tr>
<tr><td>Courses Description:</td><td>The Refrigerant and Air Conditioning course is a practical course that studies the symbols of refrigeration and ac systems, the basis of refrigeration engines, refrigeration systems and ac. Understanding and practice of work systems or operation of cooling machines, mechanical & electrical systems of cooling machines. Calculation and selection of engine coolant components, cooling loads, air distribution, electricity, maintenance repairs, inspections, and test commissioning of coolant engines.</td></tr>
<tr><td>Assessments</td><td>

The assessment was conducted to measure all learning achievements, namely attainment learning achievements (CO 1 (A.1.1) and CO 2 (A.3.2)), knowledge (CO 3 (K.1.1) and CO 4 (K.1.2)), and skills (CO 5 (S.2.15) and CO 6 (S.2.18).
Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude compared to the attitude of students in general. Attitude assessment also considers the activeness of students following lectures.
Final grades include the results of an assessment of knowledge, general skills, and special skills obtained from individual assignments, group assignments, presentations, quizzes, insert tests, and final semester examinations with the following guidelines.

<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td rowspan="4">1</td><td rowspan="4">CO1, CO2, CO3, CO4, CO5, and</td><td>Quiz (essay questions)</td><td>Knowledge</td><td>5%</td></tr>
<tr><td>UTS (Essay Questions)</td><td>Knowledge</td><td>10%</td></tr>
<tr><td>UAS (Essay Question)</td><td>Knowledge</td><td>15%</td></tr>
<tr><td>Presentation</td><td>Knowledge</td><td>5%</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><td></td><td><table>
<tr><td rowspan="4"></td><td rowspan="4">CO6</td><td></td><td>and attitude</td><td></td></tr>
<tr><td>Observation of learning processes and attitudes</td><td>Liveliness and attitude</td><td>5%</td></tr>
<tr><td>Assessment of practice (observation of process and results)</td><td>Special skills and attitudes</td><td>50%</td></tr>
<tr><td>Practice report</td><td>Special Knowledge & Skills</td><td>10%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table></td></tr>
<tr><td>Forms of media:</td><td>Board, LCD Projector, Laptop/Computer</td></tr>
<tr><td>Literature:</td><td>1. Althouse, AD (1975). Modern Refrigeration and Air Conditioning. Holland: The Goodheart-Willcox Company Inc.
2. BSN. (2000). PUIL 2000, Badan Standar National.
3. Carrier AC company (1965). Handbook of Air Conditioning system Design. New York: McGraw-Hill Book Company.
4. Daikin (1989). Service Manual “ Air Conditioning and Refrigeration Equipment. Japan: Daikin.
5. McQuay. (1999). High Static Direct Expansion Fan Coil Units, McQuay Air Conditioning.
6. Schneider, (2010). Katalog Produk, Jakarta. Schneider Electric
7. Smacna. (2013). HVAC Sysytems Duct Design. Virginia: Smacna Inc.
8. Stoecker, WF and Jones, JW (1982). Refrigeration and Air Conditioning. Singapore: McGraw-Hill Book Company.
9. Sucaco, PT. (2011). Low Voltge PVC Insulated Cable Jakarta: Supreme Cable Manufactoring Corp. Tbk..
10. Traister, JE. (2009). Electrical Applications Guidebook. Virginia: Reston Publishing Campany.</td></tr>
<tr><td>Date of revision</td><td>18 August 2018</td></tr>
</table>

UNIVERSITAS NEGERI YOGYAKARTA
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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Electrical Power System Operation
Module level,if applicable:	Undergraduate
Code:	EKO6251
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	6^{th}
Module coordinator:	Toto Sukisno, M.Pd.
Lecturer(s):	1. Ir. Muhamad Ali, M.T.
Language:	Bahasa Indonesia
Classification within the curriculum:	~~Compulsory~~/Elective Course
Teaching format / class hours per week during the semester:	100 minutes lectures and 120 minutes structured activities per week.
Teaching and Learning Method	Discussion
Workload:	Total workload is 91 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes self-study per week for 16 weeks.
Credit points:	2
Prerequisites course(s):	-
Expected Learning outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics ELO3 Capable to perform professional works in his/her field of expertise both individual and team works

	ELO5 Master in work standards, work methods, work implementations, and testing in electric power or industrial automation expertise. ELO6 Capable to make plans, implement, and evaluate learning in electric power or industrial automation expertise ELO9 Capable to develop a vocational education innovation and publish scientific paper
Course outcomes:	CO1 Being pious to God Almighty and able to demonstrate religiousness, honesty, and patience. CO2 Demonstrating responsibility on the respective profession of expertise in an independent manner. CO3 Knowledge on developing scientific paper, including work report that is in line with scientific procedure based on the analysis, information, and data, and the ability to interpret and communicate in an accurate and accountable manner in order to solve problems and phenomena related to the occupation. CO3.1 Understand the problems in the electric power system CO3.2 Understand the problems in loading plants CO3.3 Understand the process of frequency regulation in the operation of power plants CO3.4 Understand the determination of voltage and reactive power settings in plant operation CO3.5 Understand the determination of the power generated in thermal plants to operate economically CO3.6 Understand the operating constraints on the electric power system CO3.7 Understand the stability of generators operating in synchronous systems CO4 Facilitate, assess, and implement the learning process and learning results in a professional manner, as well as building community partnership in the scope of vocational education in conducting duties of the teacher profession CO4.1 Communicating problems in the electric power system CO4.2 Explain the problem in loading plants CO4.3 Explain the process of regulating the frequency in the operation of power plants CO4.4 Explain the determination of voltage regulation and reactive power in the operation of generators

<table>
<tr><td></td><td>
CO4.5 Explain the determination of the power generated in thermal plants to operate economically

CO4.6 Explain the operating constraints on the electric power system

CO4.7 Determine the stability of the power plant that operates in the electric power system

CO5 Apply logical, critical, systematic, and innovative thinking in the context of knowledge and/or technology development or implementation based on the respective field.
</td></tr>
<tr><td>ELO and CO mapping</td><td>
<table>
<tr><th></th><th>ELO1</th><th>ELO3</th><th>ELO5</th><th>ELO6</th><th>ELO9</th></tr>
<tr><td>CO1</td><td>✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td>✓</td><td></td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td>✓</td><td></td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td></td><td>✓</td></tr>
</table>
</td></tr>
<tr><td>Courses Description:</td><td>This course discusses the operation of the electric power system, starting from the generating sub-system to the utilizing sub-system. The scope of this course material includes: introduction to the electric power system, the imposition of generating units, frequency regulation, economic operations in thermal plants, constraints and disturbances in the operation of the electric power system, implementation and control of electric power system operations, voltage regulation and reactive power allocation, analysis and evaluating the operation of the electric power system</td></tr>
<tr><td>Assesements:</td><td>The assessment was conducted to measure all learning outcomes, namely attainment learning achievements (CO 1 and CO 2), knowledge (CO 3), and special skills (CO 4).

1. Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude compared to the attitude of students in general. Attitude assessment also considers the activeness of students following lectures.
2. Final grades include the results of the attitude, knowledge and skills assessment obtained from individual assignments, group assignments, presentations, quizzes, Midterm Examinations, and Final Semester Exams with the following guidelines.
</td></tr>
</table>

No	CO	Assessment Object	Assessment Technique	Weight
1	CO1	Assessment of attitude, presence, discipline, activeness	Observation	10%
2	CO2	Presentation and practice results	Observation	10%
3	CO3, CO4, and CO5	a. Individual assignments	Individual Practice Test (adapts to the technique used)	10%
		b. Group assignments and Group practice		10%
		c. Midterm exam		20%
		d. Final exams		40%
			Total	100%

Forms of media:	Board, LCD Projector, Laptop/Computer
Literature:	1. Sukisno, Toto. (2012). Handout Operasi Sistem Tenaga Listrik 2. Stevenson, William D. (1984). *Analisis Sistem Tenaga Listrik*. Jakarta. Penerbit Erlangga 3. Marsudi, Djiteng. (2006). *Operasi Sistem Tenaga Listrik*. Yogyakarta: Penerbit Graha Ilmu 4. J.Wood (1984). *Power Generation, Operation,and Control*. John Wiley and Sons. 5. Sadat, Hadi. (1999). *Power System Analysis*. Singapore: McGraw-Hill.
Date of revision	10 August 2018

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP) **MODULE HANDBOOK**

Module name:	Industrial Automation System Design Lab Work
Module level,if applicable:	Undergraduate
Code:	EKO6252
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	6th
Module coordinator:	Sunomo, M. T.
Lecturer(s):	1. Ariadie Chandra Nugraha, M.T. 2. Dr. Haryanto, M.Pd.,M.T.
Language:	Bahasa Indonesia
Classification within the curriculum:	~~Compulsory~~/Elective Course
Teaching format / class hours per week during the semester:	200 minutes lectures, 240 minutes structured activities, and 240 minutes self-study per week.
Teaching and Learning Method	Tutoial, Task, Demonstration.
Workload:	Total workload is 181 hours per semester which consists of 200 minutes lectures, 240 minutes structured activities, and 240 minutes self-study per week for 16 weeks.
Credit points:	2
Prerequisites course(s):	-
Expected Learning Outcomes:	After taking this course the students have ability to: ELO1 Demonstrate piousness to God, high loyalty to academic values, norms, and ethics ELO3 Capable to perform professional works in his/her field of expertise both individual and team works

	ELO4 Master in basic sciences and principles of electric ELO7 Capable to manage vocational education and training of electrical engineering expertise by utilizing information and communications technology
Course Outcomes:	CO1 Devoted to God Almighty and able to show a regius attitude and character, CO2 Students actively participate, take responsibility, and have the motivation to develop themselves, CO3 Students are able to plan a system based electronic hardware, CO4 Students are able to build a system based electronic hardware, CO5 Students are able to present a system based electronic hardware,
ELO and CO mapping:	(see table below)
Courses Description:	The material in this course is a combination of applications from various basic sciences, such as electricity, analog and digital electronics, power electronics, control systems, mechanical technology, programming, information technology, microcontrollers and robotics. In this course, students are required to make hardware technology work. In the early weeks, students are assigned by the instructor to search for works that have been made by students in the same field of study, and analyzed to find out whether the work can be developed, modified, or improved so that the performance can be used as the title of the device hard to be made as an assignment in this course. By making hardware that is demanded, it is expected that students will truly have competence in soldering techniques, techniques of assembling electronic devices, techniques of making printed strand boards (circuits), and repair techniques (trouble shooting) if the equipment fails to work.
Assessments:	The assessment was conducted to measure all learning outcomes, namely attainment learning achievements (CO 1 and CO 2), knowledge (CO 3), and special skills (CO 4). 1. Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using the assumption that basically every student has a good

	ELO1	ELO3	ELO4	ELO7
CO1	✓			
CO2	✓			
CO3		✓		
CO4		✓	✓	
CO5		✓	✓	✓

attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude compared to the attitude of students in general. Attitude assessment also considers the activeness of students following lectures.

2. Final grades include the results of the attitude, knowledge and skills assessment obtained from individual assignments, group assignments, presentations, quizzes, Midterm Examinations, and Final Semester Exams with the following guidelines.

No	CO	Assessment Object	Assessment Technique	Weight
1	CO1-CO5	Individual Assignment	Practicum report	10%
		Group Assignment	Practicum	20%
		Mid	Written test	25%
		Final Exam	competence test	40%
		Attendance	Documentation	5%
			Total	100%

Forms of media:	Board, LCD Projector, Laptop/Computer
Literature:	1. Ogata, Katsuhiko, 1995, Teknik Kontrol Automatik, Erlangga. 2. Andrianto, Heri. (2008). Pemrograman Mikrokontroler AVR ATMEGA 16 menggunakan Bahasa C (CodeVision AVR). Bandung: Informatika. 3. Lingga Wardana, 2006, Belajar Sendiri Mikrokontroler AVR Seri ATMega 8535. Yogyakarta: Andi. 4. Rachmad Setiawan, 2006, *Mikrokontroler MCS51*, Graha Ilmu. 5. Houpis, C.H., & Lamont, G.B. (1992). Digital control systems theory, hardware, software. (2nd Ed.). New York: McGraw Hill, Inc.
Date of revision	17 August 2018

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Bachelor of Education in Electrical Engineering Study Program (B.Ed.Electrical SP)

MODULE HANDBOOK

Module name:	Pneumatics Lab Work
Module level,if applicable:	Undergraduate
Code:	EKO6253
Sub-heading,if applicable:	-
Classes,if applicable:	-
Semester:	6th
Module coordinator:	Totok Heru Trimaryadi, M. Pd.
Lecturer(s):	1. Amelia Fauziah Husna, M.Pd.
Language:	Bahasa Indonesia
Classification within the curriculum:	~~Compulsory~~/Elective Course
Teaching format / class hours per week during the semester:	200 minutes lectures, 240 minutes structured activities, and 240 minutes self-study per week.
Teaching and Learning Method	Demonstration, Lecture, Discussion, Task, Practice.
Workload:	Total workload is 181 hours per semester which consists of 200 minutes lectures, 240 minutes structured activities, and 240 minutes self-study per week for 16 weeks.
Credit points:	2
Prerequisites course(s):	-
Expected Learning Outcomes:	After taking this course the students have ability to: ELO1 Demonstrates devotion to YME God, the practice of values, norms, and academic ethics ELO3 Can carry out work in accordance with the professional field of expertise both individually and in teams

	ELO5 Mastering work standards, work methods, work implementation, and testing in the field of electric power engineering or industrial automation. ELO6 Able to plan, implement, and evaluate learning in the field of electric power or automation ELO9 Able to develop innovations in education, and publish the results of his work
Course Outcomes	CO1 Fear God Almighty and be able to show a religious attitude, honest and patient CO2 Demonstrates responsibility for work in their area of expertise independently. CO3 Knowledge of the preparation of scientific works including work reports in accordance with scientific procedures based on data and information analysis. CO3.1 Understanding pneumatic and electrop pneumatic components CO3.2 Understand pneumatic and electropneatic component symbols according to international standards CO4 Facilitating, evaluating, implementing learning and learning outcomes in a professional manner, as well as community partnerships within the framework of vocational education in carrying out duties as a teaching profession CO4.1 Assembling a basic set of single actuators CO4.2 Arranging a basic series of plural actuators CO4.3 Designing pneumatic based control systems CO4.4 Designing an electrop pneumatic based control system CO5 Apply logical, critical, systematic, and innovative thinking in the context of developing or implementing science and / or technology in accordance with their area of expertise

<table>
<tr>
<td>ELO and CO mapping</td>
<td>
<table>
<tr><th></th><th>ELO1</th><th>ELO3</th><th>ELO5</th><th>ELO6</th><th>ELO9</th></tr>
<tr><td>CO1</td><td>✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td>✓</td><td></td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td>✓</td><td></td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td></td><td>✓</td></tr>
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<tr>
<td>Courses Description:</td>
<td>Pneumatic Practice Course is a course that discusses and applies about: 1) pneumatic and electrop pneumatic components, 2) pneumatic and electrop pneumatic component symbols, 3) how pneumatic and electrop pneumatic components work, 4) calculation of compressive strength on pistons, 5) direct and indirect pneumatic and electropneatic circuits, 6) pneumatic and electropneatic circuits of single and plural actuators, and 7) variations of various pneumatic and electropneatic circuits for 2 actuators.</td>
</tr>
<tr>
<td>Assessments:</td>
<td>

The assessment was conducted to measure all learning achievements, namely attainment learning achievements (CO 1 and CO 2), general skills (CO 4), knowledge (CO 5), and special skills (CO 6).
Attitude assessment is carried out at each meeting using observation techniques and / or self-assessment using the assumption that basically every student has a good attitude. The student is given a value of a very good attitude or not good if it shows significantly better or less good attitude compared to the attitude of students in general. The results of the attitude assessment are not a component of the student's final grade, but rather as one of the graduation requirements. Students will graduate from this course if at least have a good attitude. Attitude assessment also considers the activeness of students following lectures.
Final grades include the results of an assessment of knowledge, general skills, and special skills obtained from individual assignments, group assignments, quizzes, Insertion Exams, and Final Semester Examinations with the following guidelines.

The final mark will be weight as follow:
<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td>1</td><td>CO1 and CO2</td><td>Attitude
Liveliness of the discussion</td><td>Observation</td><td>10%</td></tr>
</table>
</td>
</tr>
</table>

2	K.1.2.1, K.1.2.2, S.1.4.1, S.1.4.2, S.1.4.3, S.1.4.4, G.2.1	a. Individual assignments b. Group assignments c. Quiz d. Midterm exam e. Final exams	a. Accuracy of program results b. Presentation c. Writen	10% 10% 10% 20% 40%
			Total	100%

Forms of media:	Board, LCD Projector, Laptop/Computer
Literature:	1. Croser, P., 1989. Pneumatics : Basic Level TP 101 . Festo Didactic KG, D-7300 Esslingen 1. 2. Croser, P., 1994. Pneumatik. Festo Didactic. Penyunting: Budi Hartanto. 3. Patient, P., Pickup, R., dan Powell, N., 1985, Pengantar Ilmu Teknik Pneumatika., Alih bahasa: Widodo, A.T.K., Jakarta: PT.Gramedia 4. Sugihartono, 1985, Dasar-dasar Kontrol Pnematik, Tarsito, Bandung. 5. Suyanto, 2000, Pengantar Sistem Pneumatik, Jurusan Pendidikan Teknik Mesin dan Teknik Mesin, Universitas Negeri Yogyakarta. 6. Werner, H., 1993. Pneumatics: Book of Exercises with Solutions. Festo Didactic KG, D73734 Esslingen.
Date of revision	30 August 2018

This book, which entitled The Module Handbook, contains the compilation of Course Specifications in Bachelor of Education in Electrical Engineering Study, Faculty of Engineering, Yogyakarta State University.