With the support of the Erasmus+ Programme of the European Union

Capacity Building in the field of higher education

Erasmus+ - Key Action 2

Capacity Building within the Field of Higher Education

eACCESS Project

Project number: 610041-EPP-1-2019-1-PL-EPPKA2-CBHE-JP

EU-Asia Collaboration for aCcessible Education in Smart Power Systems

WP 1	PREPARATION
TASK 1.1	Review of compatibility and update of existing relevant course units and teaching modules available at the partner universities.
LEAD PARTNER	AUTH
PARTICIPATING PARTNERS	TUL, KEC, PU, RUB, ATM, SCU

Project: eACCESS	**Authors:** Georgios Andreou, Anastasia Stefanidi, Ioanna-Myrto Chatzigeorgiou		
DOCUMENT CODE:	**VERSION:** 3	**SUBMISSION DATE:** 07.09.2020	**PAGE:** 1

Document Status		
Date of Issue		
Contributors	Georgios Andreou, Anastasia Stefanidi, Ioanna-Myrto Chatzigeorgiou	
Contact person	Georgios Andreou	
E-mail address	gandreou@auth.gr	
Organization	AUTH	
Approval Status	Draft ☒	Final ☐
Number of pages		
Keyword list		
Recipients	Only Partners ☒	Public ☐
Method of Distribution	Email ☒	Internet ☐
Confidentiality Status	Confidential ☐	Public ☐
Copyrights		

Disclaimer

This project has been funded with support from the European Commission. This publication [communication] reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

"Funded by the Erasmus+ Programme of the European Union"

DOCUMENT HISTORY

VERSION NO	DATE	Approved By	Revised By
1	22.04.2020	Dimitrios Lampridis	
2	25.05.2020	Dimitrios Lampridis	
3	07.09.2020	Dimitrios Lampridis	

TABLE OF CONTENTS

EXECUTIVE SUMMARY

This document describes the status of the partner universities in the beginning of the eACCESS project, with respect to their already available teaching modules. More specifically, an analysis is performed for each partner university regarding its existing electrical engineering courses and the respective facilities and teaching methodologies. Moreover, the current course accreditation system is also examined where applicable, along with the administrative procedures required in order to perform changes in the respective curricula.

This document will serve as a basis for the final selection of the new and/or upgraded courses and laboratories that will be implemented in the partner universities within the scope of the eACCESS project, as well as for the administrative procedures that will have to be followed towards this purpose.

1 Introduction

1.1 Targeted audience

This document is prepared for all eACCESS partners that will have a role in the selection and design of new and/or updated courses and laboratories for the program partner universities.

1.2 Document structure

In the next part of this document, the current situation is analyzed for each partner university. More specifically, a general introduction is offered for each university, followed by an analysis regarding the respective electrical engineering related academic programs. This analysis includes the program aims and learning outcomes, as well as information regarding the program structure and resources, such as the course accreditation system, the relevant course description, the teaching and laboratory facilities, the learning/administration management system, as well as the required approval procedure for new courses/programs. Moreover, the student entry requirements are presented for each university along with information regarding the existing academic staff, and a SWOT analysis is offered for each presented program.

The last part of this document comprises the conclusions, which pinpoint the aspects of each program that can be improved through changes within the context of the eACCESS project.

◇◆◇

2 Kantipur Engineering College

Kantipur Engineering College, abbreviated as KEC was established in 1998 with BE program in Civil Engineering in a rented building at Sitapaila Chowk, Kathmandu. Besides, the college in 1999 in collaboration with the University of Belarus, started a BE program in Civil and Industrial Engineering under Extra-Mural faculty of the Polotsk State University, Belarus. With a specific objective of imparting quality education, in 1999 the college shifted to its own complex at Dhapakhel, Lalitpur, a location best suited for engineering education inside Kathmandu Valley with peaceful and pollution free environment. The college started BE in Computer Engineering and BE in Electronics and Communication Engineering from 2000 and 2002, respectively. KEC endeavors to fabricate accomplished and capable engineers proficient enough to face the dynamic changes of the present century at a relatively tenable cost. BE in Electrical Engineering and Bachelor in Architecture are in pipeline.

KEC is a second oldest private engineering college of Nepal and is affiliated to Tribhuvan University. Today Kantipur Engineering College is one of the best engineering colleges of Nepal in terms of quality engineering education, peaceful and pollution free environment, own physical infrastructure, and international linkage.

The Department of Computer and Electronics Engineering runs two programs: B.E. in Computer Engineering and B.E. in Electronics and Communications Engineering of Institute of Engineering, Tribhuvan University. Program of B.E. in Computer Engineering was started in 2000. Likewise, program of B.E. in Electronics and Communications Engineering was started in 2002. Both Computer Engineering and Electronics and Communications Engineering are relatively newer branches of engineering disciplines and the department is committed to offer the best of academics and industrial legacy to our aspiring students and faculties.

2.1 Program aims and learning outcomes

Electrical engineering in Nepal is concerned with efficient and reliable generation, transmission and distribution of electrical power regarding their control and protection system. This program also focuses on the utilization of electrical power in various areas such as industrial application, communication systems, information technology systems, building electrification and renewable energy. It is also concerned with study, design and application of electrical equipment, device and other end use system. In spite of huge potential of hydroelectricity in Nepal, it still deficits power. The unreliable power transmission and distribution network are to be upgraded. Thus, **Bachelor in Electrical Engineering** aims to produce engineering manpower needed for meeting the national goals and aspirations. It will assist in performing various researches and development works so as to strengthen the national engineering capabilities and solve engineering problems. The program aims to

offer training, various courses, internship and conduct problem-oriented research.

Electrical engineering graduates will be able to plan, design, research and develop manufacturing and management strategy of electrical systems and devices which are required to facilitate the needs of modern and developing societies. Graduates can aid for efficient and reliable planning, operation and maintenance of generation, transmission and distribution of electrical power and power system network. Bachelor of Electrical Engineering program will be able to produce engineers with dynamic, well-rounded personalities, adaptable to ever-increasing demands of emerging technologies involving analytical and practical skills.

◆

Master in High Voltage Engineering aims to:

- provide a practical based graduate course on high voltage engineering.
- assist students from different institutes by providing the opportunity to use the high voltage laboratory at KEC.
- prepare technically skilled manpower on high voltage engineering so as to assist in the plans and policies of the Government of Nepal to extend the transmission of electrical energy.
- develop the online learning platform to assist the students at KEC as well as from some other countries.

After the completion of this program:

- the students are expected to have learned the practical based courses on high voltage engineering.
- the students are expected to have learned the required skill and knowledge that can prepare them to work in industries and manufacturing plants.
- the students will be able to research different topics related to high voltage and power systems.
- technically skilled manpower will be prepared to work in high voltage generation and transmission which could assist the Nepal government to formulate its plan and policies.

2.2 Program structure and resources

2.2.1 Credit system

Kantipur Engineering College is currently running its **Bachelor's degree** in engineering in Civil, Computer and Electronics engineering in affiliation with Institute of Engineering, Tribhuvan University (TU). The syllabus and whole teaching learning methodology is developed by Tribhuvan University. None of the bachelor's degree in engineering from TU do have credit system.

TU have assigned different per week teaching hours for different subject considering the importance, practical, tutorials and the length of subject. As per their detail syllabus for all Bachelor's degree, KEC follows per week teaching hour for whole semester. Every semester lasts for generally around 15 teaching weeks and 4 exam weeks. The weightage of all subjects is in marks system. The weightage of the subject is irrespective from per week teaching hours. Generally, most of these subjects have 100 full marks along with practical marks (25 or 50 marks). Each semester generally consist 6 or 7 subjects and their full marks varies from 700-800.

To simplify these points, we use a very simple and easily understandable idea so that it could be comparable to credit system. In the following table, some random subjects from Bachelor of Electrical Engineering are selected as example to illustrate equivalent credit system.

Subject	**Teaching Hours per Week**	**Written Exam Weightage**	**Practical Exam Weightage**	**Equivalent Credits**
Electrical Engineering material	Lecture: 3 Tutorial: 1 Practical: 0	100	0*	4
Electric Machine I	Lecture: 4 Tutorial: 1 Practical: 1.5	100	25	5
Transmission and Distribution design	Lecture: 3 Tutorial: 0 Practical: 3	100	50	6
Engineering Professional Practice	Lecture: 2 Tutorial: 0 Practical: 0	50	0*	2

Note 0*: Practical exam weightage = 0 means there is no practical for that subject. Hence, the total

weightage of subject (written exam + practical exam) / 25 gives the equivalent credit of that subject.

Thus, for all together 8 semesters, we have 245 equivalent credits which can be illustrated as follows:

Semester	Equivalent Credits
1st	29
2nd	26
3rd	35
4th	30
5th	32
6th	29
7th	32
8th	32
Total Credits	245

2.2.2 Courses

At present the program curriculum is still under development. Thus, the description of the respective courses will not be part of this deliverable, whose scope is to deliver information regarding existing curricula. This description will be part of D1.2 “Selection and the set-up of pilot sites and course units/modules for the project implementation and validation” along with the new/updated courses envisioned within the context of the eACCESS project.

2.2.3 Teaching facilities

Number of rooms:

- For Classes: 3
- For Department of Electrical Engineering: 1

Number of projectors: 12

2.2.4 Laboratory facilities

KEC already have the following **common laboratories** for the Computer and Electronics and Civil Engineering undergraduate students:

Laboratory	Available Numbers
Chemistry Laboratory	1
Physics Laboratory	1
Mechanical Workshop Laboratory	1
Thermodynamics Laboratory	1
Computer Laboratory	7

Beside these common laboratories KEC have two laboratories: **Electric Circuit and Machine laboratory** and **Instrumentation and Control laboratory** regarding Electrical Engineering. These laboratories can support the bachelor's degree of Electrical engineering up to 4th semester. Electric Circuit and Machine laboratory can support practical and experiments for three subjects: Basic Electrical Engineering, Electric Circuit Theory and Electric Machine. Similarly, Instrumentation and Control laboratory supports two subjects: Instrumentation I and Control system. For the better utilization of space and faculties, these different subject laboratories are allocated in same room of laboratory block.

Brief details of these laboratories are discussed below.

LABORATORY: *Electric Circuit and Machine*	
Objective	To familiarize students about basic of circuit behavior and circuit theory. To provide the opportunity to practice the setup and control of transformer, DC motor and AC induction motors.

The laboratory hosts practical activities of the following courses:

BASIC ELECTRICAL ENGINEERING LABORATORY

Description:

In this laboratory, students are given the opportunity to investigate the fundamental rules of DC and AC basic circuit operation including single and three phase systems.

Figure 2.1: Electrical Lab-1 room for Basic Electrical Engineering, Electrical Machines and Electric Circuits Theory

Experiment	Objectives	Outcome
Verification of Ohm's Law and observe temperature effects in resistance	• To verify ohms law • To observe temperature effect in resistance	Student will be able to measure voltage, current & power in DC circuit. Student will understand the ohms law and temperature coefficient.
Verification of Kirchhoff's law and familiarization with series and parallel connections	• To verify Kirchhoff's law in series and parallel circuit	Student will be able to understand and implement KCL and KVL in series as well as parallel circuit.
Measurement amplitude, frequency and time with oscilloscope by examining phase relation in RL & RC circuits	• To be familiar with Dual channel Oscilloscope • To understand phase angle in capacitive and inductive circuit	Handling dual channel oscilloscope to measure various parameters of electrical signals along with the concept of phase lead and lag.
Measurement of AC power, three phase star/delta connections	• To measure three phase AC power in balanced and unbalanced star and delta connection	Practical skills in active and reactive power measurement in the balanced and unbalanced systems

Two-wattmeter method of 3 phases power measurement and Watts's ratio curve	• To measure three phase AC power using two wattmeters	Practical skills in active and reactive power measurement in the balanced and unbalanced systems using two wattmeter in order to calculate power factor.

Equipment:

- Variable DC sources
- 1-phase and 3 phase variable AC sources
- 3 phase loads
- Connecting leads and probes
- Oscilloscopes
- Decade box (R, L and C)
- Ammeter, voltmeter and wattmeter.

Responsible Person: Er. Avishek Sapkota, Assistant Lecturer

Capacity: 24 students

ELECTRIC CIRCUITS THEORY LABORATORY

Description:

The objective of this laboratory is to further develop practical skills and help students to study frequency phenomena, work in basic electrical circuits and use in practice appropriate analytical tools like Laplace transformation, to determine the time and frequency domain responses of electric circuits. Students can understand transient behavior of first order and second order system.

Experiment	Objectives	Outcome
Resonance in RLC circuits	• To observe resonance phenomenon and hence draw resonance curve in series RLC circuit	Understanding and control of resonance phenomena in electrical circuits.
Transient Response in first Order System passive circuits	• To observe transient behavior of first order passive circuit • To determine time	Students can understand transient behavior of first order electrical system.

	constants	
Transient Response in second order system passive circuits	• To observe transient behavior of second order passive circuit. • To find out damped natural frequency and critical resistance for given RLC network.	Students can understand transient behavior of second order system their oscillation and damping.
Frequency response of first order passive circuits.	• To observe frequency response of first order passive filter circuit	Students can understand frequency domain characteristic of first order filter circuits. Students can determination crossover frequency using bode plot.
Frequency response of second order passive circuits	• To observe frequency response of second order passive filter circuit	Students can understand frequency domain characteristic of second order filter circuits. Students can determine crossover frequency using bode plot.

Equipment:

- Signal Generators
- Decade boxes (Resistances, Inductance, Capacitance)
- Oscilloscopes
- Connecting leads and probes

Responsible Person: Dr. Bishal Rimal, Lecturer

Capacity: 24 students

ELECTRICAL MACHINES LABORATORY

Description:

The objective of this laboratory is to impart knowledge on constructional details, operating principle and performance of transformers, DC machines, 3-phase induction machines.

Figure 2.2: Electrical Lab-1 room Specifications-DC Shunt Machines Set and Three phase loads

Figure 2.3: Electrical Lab-1 room Specifications-Sources, Indicating Instruments and Small Transformer sets and Function Generator

Figure 2.4: Electrical Lab-1 room Specifications-Sources, Indicating Instruments and Small Transformer sets and Function Generator

Experiment	Objectives	Outcome
Study of magnetic circuits	• To draw B-H curve for a sample of iron core and to compare its relative permeability with normal iron core	Student will be able to understand the magnetic circuit, B-H curve and relative permeability.
Study of two winding transformers	• To analyze the construction and operation of two winding transformers • To perform turn ratio test • To perform open circuit (OC) and short circuit (SC) test to determine equivalent circuit parameter of a transformer	Student will be able to understand all the components of two winding transformer and their equivalent circuit.
Study of DC shunt motor and its speed control	• To exercise speed control of DC shunt motor by armature control method and field control method	Student will be able to understand the speed control phenomenon of DC shunt motor using Armature and field control method.
Study of three	• To draw/understand torque versus	Student will be able to understand

phase induction motor	speed characteristics of induction motor.	the variation of torque along with slip.

Equipment:

- Single phase Transformer core
- Variable AC sources
- Autotransformer
- DC shunt motor experiment kit and three phase Induction Motor experiment kit
- Ammeter, Voltmeter and Wattmeter

Responsible Person: Dr. Sushil Paudel, Lecturer

Capacity: 24 students

LABORATORY: ***Instrumentation and Control***	
Objective	To familiarize students with amplifiers, different types of sensors and their operation. To provide students with the opportunity to use simulation software. To analyze the performance of open loop and closed loop control systems.

The laboratory hosts practical activities of the following courses:

INSTRUMENTATION LABORATORY

Description:

This course deals with methods and measurement device for a wide range of measurement problems.

Figure 2.5: Electrical Lab-2 Specifications-Signal Sources and Op-Amp sets

Experiment	Objectives	Outcome
Study of Operational Amplifier	• To study operation of amplifiers in electrical circuits in various mode	Student will be able to understand characteristics, working modes and application of operational amplifiers.
Study of Resistive transducer	• To familiarize performance, characteristics and application of Thermocouple and Thermistors	Student will be able to understand construction, working and application of thermistor and thermocouple.
Study of Inductive transducer	• To familiarize performance, characteristics and application of LVDT(Linear Variable Differential Transformer)	Student will be able to understand construction, working and application of LVDT.
Study of DAC	• To be Familiarize with 4 bit and 8 bit D/A Converter	Student will be able to understand the DAC and its bit weightage.
Study of Different Sensors	• To be familiar with various sensor using Sensor Lab kit	Student will be able to get fundamental knowledge on sensing light, pressure, temperature, IR and other non-electrical entities along with their scope of application.

Equipment:

- Op-Amp training kit
- LVDT training kit
- D/A converter training kit
- Sensor-training kit Scientech2311

Responsible Person: Dr. Bishal Rimal, Lecturer

Capacity: 24 students

CONTROL SYSTEMS LABORATORY

Description:

The objective of this laboratory is to demonstrate basic concepts of control systems and to apply these solutions to typical physical processes.

Figure 2.6: Electrical Lab-2 Specifications-Kits for Control System Experiments

Figure 2.7: Electrical Lab-2 Specifications-Kits for Control System and Instrumentation Experiments

Experiment	Objectives	Outcome
Introduction to MATLAB and Simulink	To introduce and use MATLAB and Simulink: • To simulate open loop and closed loop control system • To analyse frequency response and predict stability of given transfer function • To model armature and field controlled DC motor	Students get knowledge about open loop and closed loop control system modelling and simulation for their responses to various input, as well as control system stability. In Simulink student analyze the influence of model armature and field-controlled DC motor
PID controller	• To use and analyze the effect of P-Control, I-control and D-Control along with PI, PD and PID modes • To observe effect of these modes on first order and second order closed loop control system	Students study and understand the effect and working of analogue control modes, P, I, D, PI, PD and PID mode and tuning of PID controller.

Simulation of PID controller	• To simulate and observe the effect of PID controller in P, I, D, PI, PD and PID mode for closed loop control system so as to compare with previous practical	Students understand and simulate the response of P, I, D, PI, PD and PID controller with first order and the second order systems and compare the hardware output with the simulation output.
PID controller with motor interface	• To gain practical experience on the principles and applications of continuous closed loop PID controller, its feedback systems • To observe and understand DC motor control using PID controller	Students will be able to gain invaluable practical experience on the principles and applications of continuous closed loop PID controller, its feedback systems, DC motor position control with the help of a reference signal as input and PID Controller and their response with the help of square wave
DC motor speed control	• To control speed of permanent magnet DC motor using PWM technique at various loading	Student will be able to understand speed control of permanent magnet DC motor using PWM technique. They will be capable to understand variable loading of motor which can be achieved by a built-in eddy current brake.

Equipment:

- PID controller kit (Scientech 2451)
- Motor Interface kit (Scientech 2453)
- DC motor and Assembly Set (Scientech 2457)
- MATLAB software

Responsible Person: Dr. Sushil Paudel, Lecturer

Capacity: 24 students

2.2.5 Learning/administration management system

Moodle Learning Management System shall be used for creation of new course and administration, documentation, tracking, reporting, and delivery of courses.

User Creation:

Admin can create user accounts manually. This process is called Manual authentication and is enabled

by default on a site. As an administrator, someone can add users one at a time from *Site administration > Users > Accounts > Add a new user*. Also it is possible to upload users in batches with a CSV file from Site *Administration > Users > Accounts > Upload users*.

In addition certain fields can be locked, set password expiry dates and other configure other settings from Site administration > Plugins > Authentication > Manual accounts.

It is possible for users to connect to Moodle via single sign on from other systems.

Assigning Role:

A role is a collection of permissions defined for the whole system that you can assign to specific users in specific contexts. The combination of roles and context define a specific user's ability to do something on any page. The most common examples are the roles of student and professor in the context of a course. Admin than can assign and manage various roles to these users as per requirement via *Administration > Site Administration > Users > Permissions > Define roles.*

Assignment Activity:

The assignment activity provides a space into which students can submit work for professors to grade and give feedback on. It is possible to have them submit work as a group and you can also choose as a professor to grade their work 'blind' in other words not to see the identities of those who have submitted assignments. Assignments can have deadlines and cut off dates - which can also be extended if necessary.

Assignment (Submission) types:

Students can type directly into Moodle, upload files or add media. The options are in the Submission types section and if you don't see a particular option, get the admin to check the Site administration settings in Assignment settings documentation.

Online text: Text typed into the Atto editor is automatically saved and the professor can set a Word limit which will display a warning if students exceed it.

File submissions: Students can upload files of any type the professor specifies. The professor can specify the maximum number of files which may be uploaded and a maximum size for each file.

Students may be able to add a note (comment) to their professor when they submit their work.

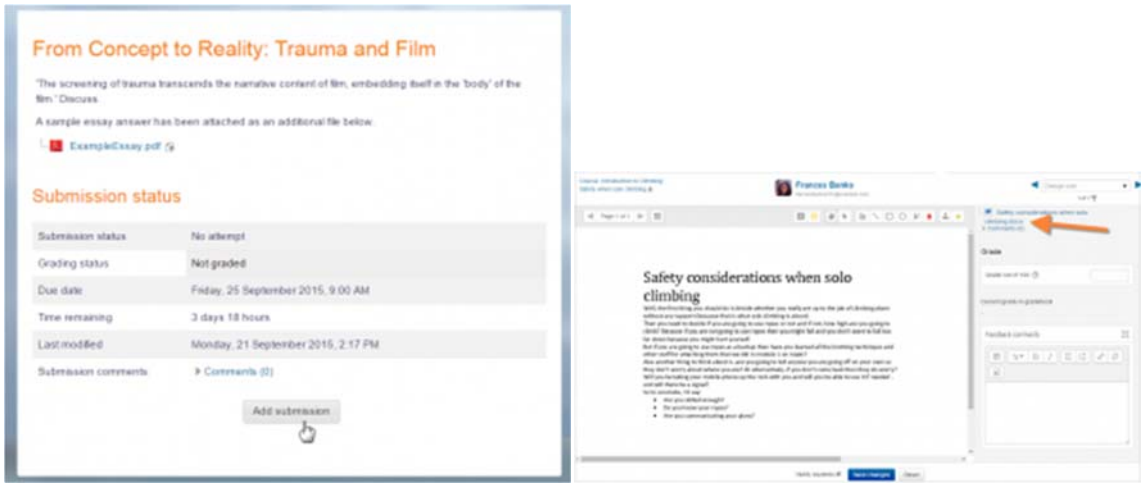

Figure 2.8: Assignment - Student View vs Professor View

Feedback types:

Professors may give feedback in various ways.

Students may upload documents such as .docx, .odt and PDF and the professor can annotate directly on the student's submission (requires Ghostscript and unoconv or Google Drive converter to be installed by an admin).

With online text submissions, if the professor sets "Comment inline" to 'yes' they will be able to give feedback on the student's submission directly in one of two ways:

The student's submission will appear in the feedback comments box (if enabled) so professors can annotate on it and add their feedback comments in the same area.

If the admin settings allow it, the student's submission will appear in a large box to the left, allowing the professor to annotate using comments, highlighting, stamps and other features.

Feedback comments:

allows graders to leave comments about the students' submissions as well as grades.

Annotate PDF appears if this setting is enabled by the Site administrator in the Manage assignment feedback plugins section of Site admin and will allow the professor to annotate using comments, stamps and other features.

Offline grading worksheet gives the professor a link to download the grading list as a spreadsheet. They will then be able to enter grades and feedback comments offline and then re-upload the sheet.

Feedback files allow graders to upload files with feedback when marking. These files may be the

marked-up student assignments, documents with comments, a completed marking guide, or spoken audio feedback.

Grading assignments:

Assignments may be graded with simple Grade points or customizable Scales. If you change the Grading method to Advanced grading, you can then use a Marking guide or Rubric.

Tracking progress

There are several ways to track student progress in Moodle.

Grades:

Every course has its own Gradebook which is accessible from *Course administration > Gradebook setup*. Some activities such as Assignment and Quiz send grades back to this gradebook. It is also possible for professors to enter grades directly into the gradebook.

Course completion:

As an extension of activity completion, enabling Course completion allows for a course to be officially marked as finished, either manually or automatically according to specified criteria. If the Course completion status block is added, students can see their progress during the course. Professors can view the overall progress of students towards course completion from *Course administration > Reports > Course completion*.

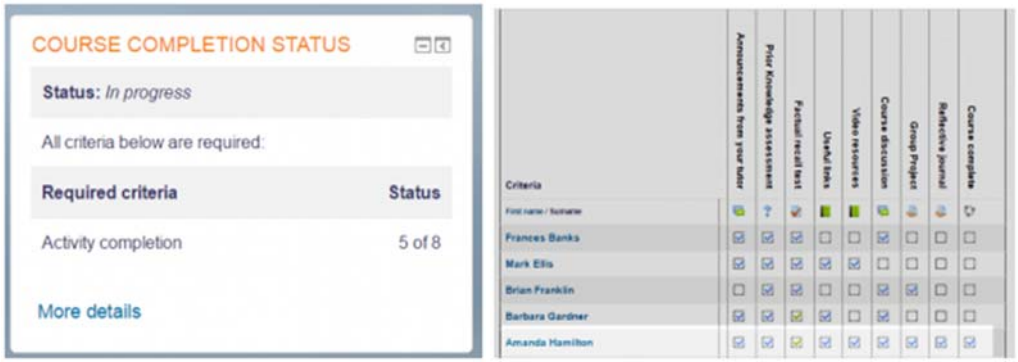

Figure 2.9: Course Completion - Student View vs Professor View

Activity completion:

If Activity completion is enabled by the administrator and in the course settings, professors can indicate for each course item how they wish it to be registered as complete. A tick/checkmark will then appear against the activity. Students may either mark it complete manually or the item will automatically be registered as complete once a student has met the specified criteria. These may be

viewing a resource, submitting an assignment, posting in a forum or other conditions. The professor can see an overview of who has completed what in the activity completion report *in Course administration > Reports > Activity completion*.

Badges:

Badges can be awarded either manually or using activity completion settings in a course and are a popular way to motivate students. Students may be awarded badges at different stages of the course for different levels of progress.

Course reports:

A number of Course reports are available to the professors in their course to help them track the progress of their students. In addition to the activity and course completion reports mentioned above (which are only available if these settings are enabled) there are also activity reports, participation reports and general course logs.

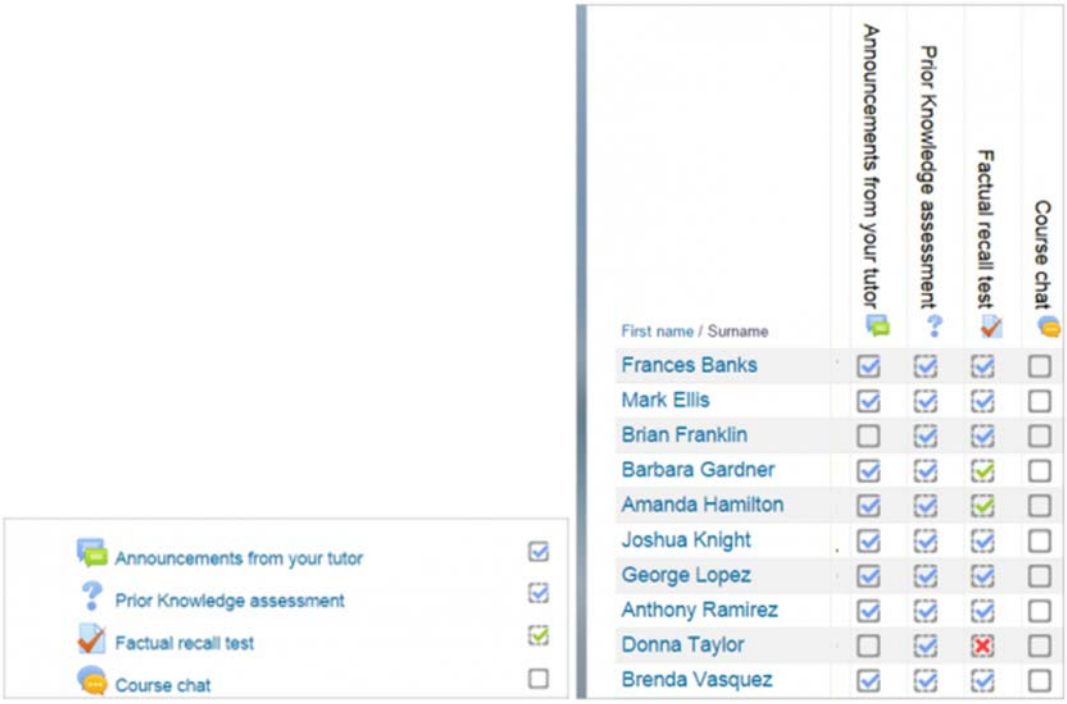

Figure 2.15: Student View vs Professor View

2.2.6 Approval procedures for new course/program

Kantipur Engineering College (KEC) has already applied to run bachelor's degree in Electrical

Engineering under the affiliation of Tribhuvan University (TU). The approval process has been passed through Planning Division, Feasibility Study Committee, Faculty board and now is waiting for the final approval from the Executive Council of TU. Once approved, the college also needs approval from Nepal Engineering Council, a professional council body in engineering.

Nepal Engineering Council easily provides approval if it finds that the college fulfills all the requirement to launch a new program.

Note: The college fulfills all the requirement for running bachelor's degree in Electrical Engineering set by Nepal Engineering Council and Tribhuvan University.

2.3 Entry requirements

Student selection criteria

For **Bachelor's degree** in Electrical Engineering:

KEC is an affiliated college of Tribhuvan University (TU) and admits students according to the guidelines set by Institute of Engineering (IOE), TU. IOE calls applications for admission in bachelor's degree programs offered by TU during June and takes computer-based entrance exams during July. The students successfully passing the entrance examination are then admitted to the constituent and affiliated colleges of TU on the Merit Basis from August. The academic session starts from October.

Students willing to pursue bachelor's degree in engineering under TU must pass +2 level (Grade 12) in Science offered by the National Examination Board of Nepal (Need to take two papers of Mathematics; 200 marks) or equivalent degree like A Level.

For **Master's degree** in High Voltage Engineering:

To enroll in the master's degree in High Voltage Engineering at KEC, the application will be called in January. Entrance examination will be conducted by the college during the month of February. The students passing the entrance examination will be admitted on the Merit Basis by the college. To apply for the master's degree, the students must have completed the bachelor's degree in a relevant subject with minimum 50% or second division.

Planned Students Number

Students' enrollment each year:

- **Bachelor's** Level = 48
- **Master's** Level = 30

2.4 Academic staff

For academic staff recruitment, the college does it in accordance with the staff fulfillment policy approved by the College Management Committee. The college invites candidates to apply for the required position through the advertisement in a National Daily and college website. To reach more prospective staff, the college also posts the vacancy on Facebook. After shortlisting, a committee including Principal, Vice Principal, Head of the Department, Experts from outside the college takes an interview of the candidates. Successful candidates are then asked for class observation to evaluate their teaching performance. The best candidate(s) is/are then selected for the faculty position. As the language for teaching and examination is English, the candidate proficiency in English should be good. The proficiency in English is evaluated during the interview.

The qualification and experience criteria for faculty position is as follows:

Position	Minimum Qualification and Experience
Associate Professor	PhD with 4 years teaching experience
Junior Associate Professor	Master's degree with 5 years teaching experience
Senior Lecturer	Master's degree with 3 years teaching experience
Lecturer	Bachelor's degree with 1 year teaching experience

2.5 SWOT analysis

BACHELOR PROGRAM: *Electrical Engineering*

Internal factors

STRENGTHS:

1. Reputation: Oldest and highly reputed among the affiliated engineering college of Tribhuvan University, the oldest and the largest university of Nepal.
2. Infrastructure: Own physical infrastructure in safe and friendly environment.
3. Environment best suited for academic activities.
4. More than 50 international partner universities in Asia and Europe.

5. Located in Kathmandu Valley, education hub of Nepal.
6. Highly motivated and dedicated management, faculty and staff.
7. Strong support of staff and faculty to achieve the college mission.

WEAKNESSES:

1. Faculty strength: No electrical engineering program till date, so there is a need to hire more faculty in electrical engineering.
2. Retention of faculty is challenging. Faculty apply for higher education and respective positions in institutions abroad.
3. Inadequate lab infrastructure.
4. Inadequate research facilities.
5. No online teaching-learning platform.
6. No financial support from the Government and other national agencies.
7. Limited resources for college development.
8. Limited resources for faculty and staff development.

External factors

OPPORTUNITIES:

1. Involved in several EU funded programs for technological and knowledge transfer from European and Asian universities.
2. Potential for college growth and faculty and staff development.
3. Engineering program with advanced and Laboratory infrastructure.
4. Online platform implementation.
5. Huge potential of jobs in both government and private sectors power companies and Nepal Electrical Authority.
6. Increase interest in students for quality education in Nepal.
7. Increase in research activities.

THREATS:

1. Education Policy of the government in transient state and hindering the affiliation process.

2. No systematic and timely process for course and program accreditation.
3. Poor retention of students in Nepal for bachelor's programs. Students generally go to India and abroad for higher education.
4. Fee collected from the students is not sufficient to sustain the program.
5. Financial crisis caused by the corona pandemic might hinder the paying capacity of the students to continue their higher studies. It also might hinder in achieving the objective and goals mentioned in our timeline.
6. Approval process from the university and the government authority is lengthy and tedious.

◆

MASTER PROGRAM: *High Voltage Engineering*

Internal factors

STRENGTHS:

1. Reputation: Oldest and highly reputed among the affiliated engineering college of Tribhuvan University, the oldest and the largest university of Nepal.
2. Infrastructure: Own physical infrastructure in safe and friendly environment.
3. Environment best suited for academic activities.
4. More than 50 international partner universities in Asia and Europe.
5. Located in Kathmandu Valley, education hub of Nepal.
6. Highly motivated and dedicated management, faculty and staff.
7. Strong support of staff and faculty to achieve the college mission.

WEAKNESSES:

1. Faculty strength: No electrical engineering program till date, so need to hire more faculty in electrical engineering.
2. Retention of faculty is challenging. Faculty apply for higher education and job in abroad.
3. Inadequate lab infrastructure.
4. Inadequate research facilities.

5. No online teaching-learning platform.
6. No financial support from the Government and other national agencies.
7. Limited resources for college development.
8. Limited resources for faculty and staff development.

External factors

OPPORTUNITIES:

1. First type of graduate program with laboratory facility in Nepal.
2. Involved in several EU funded programs for technological and knowledge transfer from European and Asian universities.
3. Low intake capacity in Master's program in electrical engineering in comparison to the number of students completing bachelor's degree in Nepal. Introduction of the master's program will help to minimize the gap.
4. Potential for college growth and faculty and staff development.
5. Lab infrastructure modernization.
6. Online platform implementation.
7. Huge potential of jobs in both government and private sectors power companies and Nepal Electrical Authority.
8. Increase interest in students for quality education in Nepal.
9. Increase in research activities.

THREATS:

1. Education Policy of the government in transient state and hindering the affiliation process.
2. No systematic and timely process for course and program accreditation.
3. Poor retention of students in Nepal for master's program. Students generally migrate abroad for higher education.
4. Fee collected from the students is not sufficient to sustain the program.
5. Financial crisis caused by the corona pandemic might hinder the paying capacity of the students to continue their higher studies. It also might hinder in achieving the objective and goals mentioned in our timeline.

6. Approval process from the university and the government authority is lengthy.

◇◆◇

3 Pokhara University

Nepal adopted the multi-university concept in 1983. The idea of Pokhara University (PU) was conceived in 1986; however, it was established only in 1997 under the Pokhara University Act, 1997. The Incumbent Honorable Prime Minister and the Honorable Minister for Education of the Federal Democratic Republic Nepal are the Chancellor and the Pro-Chancellor, respectively. The Chancellor appoints the Vice Chancellor, the principal executive officer of the university. The Registrar is designated to assist him/her in financial management and general administration. A non-profit autonomous institution, PU is partly funded by the Government of Nepal and partly by revenues from its students and affiliated colleges.

Pokhara University has four faculties. They are Faculty of Science and Technology, Faculty of Health Sciences, Faculty of Management Studies and Faculty of Humanities and Social Sciences. The Faculty of Science and Technology and Faculty of Management Studies were established in 1997 under the Pokhara University Act. Likewise, Faculty of Humanities and Social Sciences was established in 2004 and Faculty of Health Sciences was established in 2016.

The Faculty of Science and Technology was established in 1997 under the Pokhara University Act. In 1997. PU has adopted four years Bachelor Programs based on credit-semester system. An academic year of the University consists of two semesters of 16 weeks each.

3.1 Program aims and learning outcomes

The **Bachelor of Electrical and Electronics Engineering** program under the Faculty of Science and Technology of the Pokhara University is designed to produce high quality Electrical and Electronics engineers equipped with sound theoretical knowledge and practical skills.

◆

The university introduced new program **M.Sc. Electrical Power System Engineering** from 2019 March intake which will be new program in our contest. The Master's program in Electric Power Engineering covers courses in Electric Power Engineering including systems and components where electricity is principally used to transfer energy. The program is concerned with understanding, modeling and analyzing a wide range of topics related to design, operation, and control of individual power system components as well as power system in its entirety.

Program objectives:

- To disseminate knowledge of the principles and practices of the electrical power industry regarding generation, transmission, distribution and electrical machines and their controls.
- To prepare the students to have career in the electrical power industry / research organization / teaching.
- To provide good foundation in mathematics and computational technology to analyze and solve problems encountered in electrical power industry.
- To equip the students in the state of art in the technologies in power generation, control and management as well as with alternate and new energy resources.

Program outcomes:

The learners shall be able to

- pursue a professional career in industry as well as an academic research career.
- identify problems in electrical power systems, analyze the problems, and solve them using all the required and available resources.
- apply their knowledge of electrical power principles, as well as mathematics and scientific principles, to new applications in electrical power.
- perform, analyze, and apply the results of experiments to electrical power application improvements.

3.2 Program structure and resources

3.2.1 Credit system

The **Bachelor of Electrical and Electronics Engineering** program is a four-year program structured in eight semesters. A student needs to complete 137 credit hours of course work and project work for graduation.

Each subject (course) is assigned a certain number of credits depending generally upon the input parameters like the lecture, tutorial and practical work hours in a week. In theory subjects which do not involve practical sessions, one lecture per week is assigned one credit as a general rule.

Each course is identified by three letters followed by a three-digit number. The three letters indicate the subject area (e.g., MTH for mathematics, PHY for physics, etc.). In the course description, the figures in parenthesis following the course number, for example, (3-1-2), indicate the hours per week devoted to lecture, tutorial, and practical, respectively. A 3-credit hour subject will normally be covered in 45 lecture hours.

BACHELOR PROGRAM: *Electrical and Electronics Engineering*		
Code	**Course Name**	**Credits**
MTH 112	Engineering Mathematics I	3
PHY 111	Physics	4
MEC 111	Thermal Science	2
MEC 120	Engineering Drawing	2
CMP 113	Programming in C	3
ELE 110	Basic Electrical Engineering	3
MTH 114	Engineering Mathematics II	3
CHM 111	Chemistry	4
CMP 115	Object Oriented Programming in C++	3
ENG 111	Communication Techniques	2
MEC 110	Mechanical Workshop	1
MEC 130	Applied Mechanics I	3
MTH 212	Engineering Mathematics III	3
ELE 210	Electrical Engineering Materials	2
ELE 211	Network Theory	3
ELX 212	Logic Circuits	3
ELX 210	Electronic Devices	3
ELX 220	Electromagnetic Field and Waves	3
MTH 214	Engineering Mathematics IV	3
MTH 230	Numerical Methods	3
ELX 231	Instrumentation	3
ELX 214	Electronic Circuits	3
ELX 230	Microprocessors	3

ELE 220	Electrical Machines	3
MGT 321	Organization and Management	2
ELE 320	Advanced Electrical Machines	3
CMM 310	Signals and Systems	3
ELE 330	Transmission and Distribution	3
ELE 322	Control Systems	3
MTH 220	Probability and Statistics	3
ELX 310	Power Electronics	3
ELE 333	Power System Analysis	3
CMM 312	Communication System Engineering	3
ELE 331	Power Plant Equipment	3
ELE 332	Switch Gear and Protection	3
ELE 360	Research Methodology	2
ECO 411	Engineering Economics	3
ELE 430	Transmission Line Design	3
ELE 420	Machine Design	3
ELX 430	Advanced Instrumentation	3
	Elective I	3
ELE 390	Project I	2
ELE 431	Utilization of Electrical Power	3
ELX 460	Professional Ethics in Engineering	2
ELE 433	Power Plant Design	3
ELE 432	High Voltage Engineering	3
	Elective II	3
ELE 490	Project II	4

TOTAL:	137

◆

The **Master of Electrical Power System Engineering** program consists of 60 credits, corresponding to two years of full-time studies. The year is divided into two semesters; each of the semesters has fifteen-week study periods.

MASTER PROGRAM: *Electrical Power System Engineering*		
Code	**Course Name**	**Credits**
EPS 501	Computer Aided Power System	4
EPS 502	Distribution System Planning and Design	3
EPS 503	Advanced Power Electronics	3
EPS 504	Optimization Technique	3
EPS 505	Power Market and Deregulation	3
EPS 551	Power System Dynamics and Stability	4
EPS 552	Advanced High Voltage Engineering	3
EPS 553	Power System Operation and Control	3
EPS 591	Seminar	2
	Elective I	3
EPS 601	Power System Reliability	3
EPS 602	Engineering Project Management	3
EPS 603	Project	2
	Elective II	3
	Elective III	3
EPS 691	Dissertation	15

TOTAL:	60

3.2.2 Courses

BACHELOR PROGRAM: *Electrical and Electronics Engineering*

The curriculum is designed to equip students with the competencies, theoretical knowledge, and practical skills. The curriculum comprises the following four distinct components:

- **Foundation Courses:** These courses develop students' background for better understanding of core and elective courses.
- **Core Courses:** These courses will help students to understand principles and practices in the basic and functional areas of electrical and electronics engineering.
- **Elective Courses:** The curriculum is oriented to have intensive study in the field of interest. A student may select any three of the listed elective courses. These courses take place as other regular courses and are graded in the same way.
- **Project Work:** The objective of the project work is to develop practical skills of the students. This is a group work and each group will consist of at most 4 students. Students must follow the prescribed format to prepare project report.

[MTH 112] **ENGINEERING MATHEMATICS I**

Objectives:

To acquaint the students with the knowledge of differential calculus, Integral calculus, analytic geometric and vector algebra.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 2
- Practical: 0

[PHY 111] **PHYSICS**

Objectives:

To impart knowledge of basic concepts in applied physics and make the students familiar with topics like interference, diffraction, polarization, fiber optics, lasers, wave mechanics, material properties, electromagnetic phenomena etc.

Methodology [hours/week]:

- Lecture: 4
- Tutorial: 2
- Practical: 2

[MEC 111] **THERMAL SCIENCE**

Objectives:

To comprehend the application of the laws of thermodynamics in various systems. To make able to distinguish the cycles in various engines, and pumps. To make able to calculate energy/ quantity of heat transfer by conduction and radiation.

Methodology [hours/week]:

- Lecture: 2
- Tutorial: 1
- Practical: 2

[MEC 120] **ENGINEERING DRAWING**

Objectives:

To familiarize the students with drafting and engineering drawing practices.

Methodology [hours/week]:

- Lecture: 0
- Tutorial: 0
- Practical: 6

[CMP 113] **PROGRAMMING IN C**

Objectives:

To acquaint the students with the basic principles of programming and development of software systems. To introduce fundamentals of Programming using C.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 0
- Practical: 3

[ELE 110] **BASIC ELECTRICAL ENGINEERING**

Objectives:

To familiarize the students with the concepts of electrical circuits, magnetic circuits, transformer and rotating Machine.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 1
- Practical: 2

[MTH 114] **ENGINEERING MATHEMATICS II**

Objectives:

The main objective of this course is to provide the basic knowledge of solid geometry, calculus of several variables, differential equations, Laplace transform so that prospective engineers can use this knowledge in their professional courses.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 2
- Practical: 0

[ELE 210] **ELECTRICAL ENGINEERING MATERIALS**

Objectives:

To provide the knowledge of quantum mechanics, wave equation and its application in semiconductor devices. To impart the knowledge of magnetic and di-electrical properties of material. To familiarize the conduction mechanism in solid conductor and semiconductors.

Methodology [hours/week]:

- Lecture: 2
- Tutorial: 2
- Practical: 0

[ELE 211] **NETWORK THEORY**

Objectives:

To impart the knowledge of transient behavior of Single- and Double-time constant circuit. To familiarize the knowledge of transfer function, frequency responses, filters.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 1
- Practical: 2

[ELX 210] **ELECTRONICS DEVICES**

Objectives:

To introduce the fundamentals of electronic devices and circuits.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 1
- Practical: 2

[ELX 220] **ELECTROMAGNETIC FIELDS AND WAVES**

Objectives:

To deepen the understanding of Electromagnetic Theory by building on the concepts learnt in Engineering Physics and Basic Electrical Engineering and application of vector integral and differential calculus for solving abstract electromagnetic problems.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 1
- Practical: 0

[ELX 219.3] **LOGIC CIRCUITS**

Objectives:

To familiarize the students with the fundamentals of logic gates, Boolean algebra and designing of combinational and sequential logic circuits.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 1
- Practical: 3

[MTH 214] **ENGINEERING MATHEMATICS IV**

Objectives:

To impart the knowledge of complex variable and Fourier and Z-transform with application. To familiarize with wave and diffusion equations in cartesian, cylindrical, and polar coordinates. To provide basic knowledge of Linear Programming.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 2
- Practical: 0

[ELX 231] **INSTRUMENTATION**

Objectives:

To Impart the basic principle of instruments and operation of analogue instruments. To familiarize with A/D, D/A converters and signal conditioning circuits. To impart the knowledge of basic digital instruments.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 1
- Practical: 2

[ELX 214] **ELECTRONIC CIRCUITS**

Objectives:

To provide knowledge in designing amplifiers. To provide knowledge feedback in amplifiers. To develop design skill of electronic circuits.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 1
- Practical: 2

[ELX 230] **MICROPROCESSORS**

Objectives:

To familiarize the students with the basics of microprocessors, their architectures, memory organization, operation through timing diagrams, assembly language programming, interfacing with peripherals and applications to Electrical Engineering.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 1
- Practical: 2

[ELE 220] **ELECTRICAL MACHINES**

Objectives:

To familiarize the students with the construction and operation of dc machines single-phase and three-phase transformers and Asynchronous machine.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 1
- Practical: 2

[MTH 230] **NUMERICAL METHODS**

Objectives:

To be familiar with the theory of numerical analysis for solving algebraic and transcendental equations, solution of ordinary and partial differential equations related to engineering problems, numerical differentiation and integration.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 1
- Practical: 3

[MGT 321] **ORGANIZATION AND MANAGEMENT**

Objectives:

To impart the knowledge of the organization behavior and management.

Methodology [hours/week]:

- Lecture: 2
- Tutorial: 0
- Practical: 0

[ELE 320] **ADVANCED ELECTRICAL MACHINES**

Objectives:

To familiarize the students with the construction and operation of asynchronous and synchronous machines in motoring and generating modes. To impart the knowledge of electromechanical energy conversion and construction and operation of special machine.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 1
- Practical: 2

[ELE 331] **POWER PLANT EQUIPMENT**

Objectives:

To Introduce the knowledge of electro-mechanical equipment used in different types of conventional power stations.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 1
- Practical: 0

[ELE 330] **TRANSMISSION AND DISTRIBUTION**

Objectives:

To Impart the knowledge of power transmission line modeling, per-unit modeling, Power Flow, VAR requirement and VAR compensation. To familiarize with electrical and mechanical aspects of power transmission line.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 2
- Practical: 0

[ELE 322] **CONTROL SYSTEMS**

Objectives:

To introduce the fundamentals of modeling, analysis, response of control systems and design of the P, PI and PID controller in continuous data systems.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 1
- Practical: 2

[CMM 310] **SIGNAL AND SYSTEMS**

Objectives:

To introduce signal characteristics and analysis, theory related to systems and its analysis.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 1
- Practical: 2

[CMM 312] **COMMUNICATION SYSTEM ENGINEERING**

Objectives:

To Impart the knowledge of Analog and Digital Communication. To familiarize different types of Modulation demodulation technique used in communication system.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 1
- Practical: 1

[ELX 310] **POWER ELECTRONICS**

Objectives:

To familiarize the students with the characteristics of semiconductor devices, triggering circuits and their applications for power control.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 1
- Practical: 2

[ELE 333] **POWER SYSTEM ANALYSIS**

Objectives:

To familiarize the students with the methods/ techniques for analyzing a power system during normal operation and under faulted conditions.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 1
- Practical: 2

[ELE 332] **SWITCHGEAR AND PROTECTION**

Objectives:

To introduce the concept and necessity of protection in generation and transmission, and applications of switchgears including internal operation of different types of circuit breakers.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 1
- Practical: 2

[ELE 360] **RESEARCH METHODOLOGY**

Objectives:

To impart the knowledge related to development of proposal and scientific paper.

Methodology [hours/week]:

- Lecture: 2
- Tutorial: 1
- Practical: 0

[MTH 220] **PROBABILITY AND STATISTICS**

Objectives:

The main objectives of this course are to provide basic concepts of probability and statistics to the engineering students. After completing this course, the student would be able to understand variables, probability distribution, point estimation hypothesis testing. simple linear regression and correlation.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 2
- Practical: 0

[ECO 411] **ENGINEERING ECONOMICS**

Objectives:

To impart the basic knowledge related to financial, economic and management aspects of engineering project.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 2
- Practical: 0

[ELE 420] **MACHINE DESIGN**

Objectives:

To familiarize the students with the concepts of electrical design of asynchronous and synchronous machines along with transformers

Methodology [hours/week]:

- Lecture: 2
- Tutorial: 2
- Practical: 0

[ELX 430] **ADVANCED INSTRUMENTATION**

Objectives:

To familiarize the knowledge of the theory related to digital instrumentation. To realize the microprocessor and micro controller-based instrumentation. To impart the information related to Bio-Medical equipment.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 1
- Practical: 2

[ELE 430] **TRANSMISSION LINE DESIGN**

Objectives:

To impart the knowledge about the design aspects of a power transmission systems.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 0
- Practical: 2

[ELE 390] **PROJECT I**

Objectives:

The project work is introduced in 7th semester in Bachelor Program and it is the integral part of 8th Semester project work. This will be the Group work of the students. In this component students should do literature survey and identify the problem/ research gap. As an outcome of this course student shall defend their proposal for 8th Semester project work.

Methodology [hours/week]:

- Lecture: 2
- Tutorial: 0
- Practical: 0

[ELX 460] **PROFESSIONAL ETHICS IN ENGINEERING**

Objectives:

The main objective of this course to introduce the ethical and legal environment in engineering practice.

Methodology [hours/week]:

- Lecture: 2
- Tutorial: 0
- Practical: 0

[ELE 432] **HIGH VOLTAGE ENGINEERING**

Objectives:

To familiarize the students with the phenomenon of breakdown in insulators, generation of high voltage, measurement of high voltage, testing of insulators and over-voltages / transients in power system.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 1
- Practical: 0

[ELE 433] **POWER PLANT DESIGN**

Objectives:

To impart the knowledge of technical requirements and economic principals related to design of switchyards, power plant layout and plant design layout.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 1
- Practical: 0

[ELE 432] **UTILIZATION OF ELECTRICAL POWER**

Objectives:

To familiarize the students with the lighting, heating, welding and electric tractions. To impart the knowledge of dynamics of electro-mechanical system during starting, braking and other disturbance.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 1
- Practical: 0

[ELE 490] **PROJECT II**

Objectives:

In this course student shall implement the proposal defended in project I. Project II will consist of simulation, fabrication of set up required for the project, workstation, experiments and results, analysis, validation of results, conclusions and report writing.

Methodology [hours/week]:

- Lecture: 0
- Tutorial: 0
- Practical: 4

[Elective I] [ELE 451] **MICRO HYDRO POWER**

Objectives:

To Impart the Knowledge of different components of micro hydro and design aspects of different component of micro hydro. To familiarize with grid integration and issues related to power quality and optimum location for the penetration.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 1
- Practical: 1

[Elective I] [ELE 454] **SOLAR PHOTOVOLTAIC TECHNOLOGY**

Objectives:

To impart the knowledge of Photovoltaic system's components and issues related to grid integration.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 1
- Practical: 1

[Elective I] **ARTIFICIAL INTELLIGENCE AND ITS APPLICATION IN POWER SYSTEMS**

Objectives:

To impart the knowledge of understand fundamentals of various AI based techniques. To differentiate between algorithmic based methods and knowledge-based methods. To use appropriate AI framework

for solving power system problems.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 1
- Practical: 0

[Elective I] **PLC AND SCADA**

Objectives:

To Impart the knowledge of the Architecture, components used in SCADA system. To impart the Knowledge Hardware and Software aspects of PLC and its application in automation.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 1
- Practical: 1

[Elective II] [ELE 450] **ELECTRIC ENERGY SYSTEM MANAGEMENT**

Objectives:

To study planning and management aspects of electrical energy supply, and to gain some familiarity with demand characteristics and load forecasting.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 1
- Practical: 0

[Elective II] **POWER SYSTEM RELIABILITY**

Objectives:

To familiarize the students with the concept of reliability in power systems, reliability indices and the assessment of reliability indices in power transmission and distribution systems.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 1
- Practical: 0

[Elective II] [ELE 456] **POWER SYSTEM RELIABILITY**

Objectives:

To study planning and management aspects of electrical energy supply, and to gain some familiarity with demand characteristics and load forecasting.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 1
- Practical: 0

[Elective II] [ELE 455] **ELECTRICAL DRIVES**

Objectives:

To impart the knowledge of Direct current machine control, Dynamic modeling of industrial motor drive and control strategies. To familiarize in depth information about need of vector, DTC and DFLC control.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 1
- Practical: 0

[Elective II] **FACTS**

Objectives:

To familiarize the students with the development of HVDC and FACTS technology, the concept of power quality and its improvement.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 1

- Practical: 1

◆

MASTER PROGRAM: *Electrical Power System Engineering*

The course structure is based on the Semester system. Each Year is divided in first and second semester. In first year, first semester, five core courses are offered and in second semester, three core courses are offered. Three different elective subjects are offered in second semester and students can choose any two of them. The second year, first semester consists of two courses and one individual project work. Four electives from different fields are offered in this semester and students can choose two of them. The second year second semester is entirely allocated for dissertation work.

The dissertation shall be individual's work and be entirely research based. Students shall be encouraged to publish research papers in national and international journals as an outcome of their dissertation work.

Core and Elective Courses

The course consists of two types; core and elective. The Core Courses which deal with the advanced theoretical concept, mathematical modeling and analyzing of the electrical power network under different circumstances and the Elective Courses will be also related to the components of the power system or the application-based courses.

Similarly, conferences and seminars will be organized regularly to provide the information and creative ideas for strengthening the research capabilities of the enrolled students. Also, students will be encouraged to participate in various national and international conferences.

Project Work

The purpose of the project work in second year, first semester is to provide an opportunity for the student to investigate, analyze and to provide possible solution to an existing energy related problem. The project must be completed in the allocated time. During the 2nd Year 1st Sem. Student will perform the literature review to obtain the research gap and he/she will suggest the solution to fill the research gap at the end of semester.

Dissertation / Master's Thesis

The main objective of Master's Degree Dissertation is to carry out original research work concerning Electrical Power related problems and solve those problems. Students need to fulfill following criteria to begin the Master's thesis:

- Students are eligible to defend the proposal of Master's thesis after completing all core courses of the program.
- Students are eligible for final defense of the dissertation only completing all courses of the program.

Students are encouraged to publish articles in national and international journals.

[EPS 501] **COMPUTER AIDED POWER SYSTEM**

Objectives:

To understand the fundamental static modeling of power system components. To impart in-depth knowledge on different methods of power flow solutions. To perform short circuit fault analysis and understand the consequence of different type of faults. To perform power system security analysis and optimal power flow solutions in detail. To perform the computer aided analysis of large-scale power System.

Contents:

- General Introduction
- Power Flow Analysis
- Short Circuit Analysis
- Power System Security
- Optimal Power Flow

Methodology [hours/week]:

- Lecture: 4
- Tutorial: 0
- Practical: 2

[EPS 505] **POWER MARKET AND DEREGULATION**

Objectives:

To provide in-depth understanding of operations of deregulated electricity market systems. To examine typical issues in electricity markets and how these are handled worldwide in various markets. To enable students to analyze various types of electricity market operational and control issues using new mathematical models.

Contents:

- Power Sector
- Power Sector Economics and Regulation
- Deregulation and Reconfiguring Power systems
- Electricity Markets and Pricing
- Transmission Planning and Pricing

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 0
- Practical: 0

[EPS 502] **DISTRIBUTION SYSTEM PLANNING AND DESIGN**

Objectives:

To impart the knowledge of design, analyze and evaluate distribution system and design based on forecasted data. To identify and select appropriate substation location and components sizing. To design and evaluate a distribution system for a given geographical service area from alternate design alternatives.

Contents:

- System Planning
- System Design and Operation
- Voltage Regulation and Automation
- Distribution System Protection
- Grounding
- Case Studies

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 0
- Practical: 0

[EPS 503] **ADVANCED POWER ELECTRONICS**

Objectives:

To impart the knowledge of power semiconductor devices and its switching characteristics for selecting device. To impart the knowledge of converter and inverter analysis, design and its application in renewable energy, motor drives etc.

Contents:

- Power Semiconductor Devices
- AC to DC Converters
- DC to DC Converters
- Inverters
- Multilevel Converters
- Application

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 0
- Practical: 2

[EPS 504] **OPTIMIZATION TECHNIQUE**

Objectives:

To impart the knowledge of Linear Equations in Linear Algebra and approaches in solving linear equations. To impart the knowledge of control and optimization of linear and non-linear system. To impart the knowledge of developing robust controller for power system and power electronics devices.

Contents:

- Review of Linear Algebra and its Application
- State Space Analysis
- Linear Systems
- Linear Control Theory
- Nonlinear Control Theory

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 0
- Practical: 0

[EPS 552] **ADVANCED HIGH VOLTAGE ENGINEERING**

Objectives:

To provide in-depth knowledge of high voltage phenomena and high voltage systems. To enable students to analyze different high voltage systems using various models.

Contents:

- High Voltage Systems
- Line and Ground Parameters
- High Voltage Testing
- Electrical Discharge Mechanisms
- Outdoor Insulators
- Overvoltage and Insulation Coordination
- EHV Cable Transmission

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 0
- Practical: 0

[EPS 551] **POWER SYSTEM DYNAMICS AND STABILITY**

Objectives:

To provide knowledge on dynamic modeling of a synchronous machine. To provide and enhance small signal stability problem in power systems. To perform transient stability analysis using unified algorithms and familiarize the methods of transient stability enhancement. To analyze voltage stability problem in power system.

Contents:

- Dynamic Modeling of Power System Components
- Small-Signal Stability
- Transient Stability
- Voltage Stability

Methodology [hours/week]:

- Lecture: 4
- Tutorial: 0
- Practical: 0

[EPS 553] **POWER SYSTEM OPERATION AND CONTROL**

Objectives:

To provide the knowledge of power system operation and control. To impart knowledge of power system security and ELD applications. To understand economic operation of power system, control and planning.

Contents:

- Introduction
- Power system security and Reactive power generation control
- State Estimation and Economic Load Dispatch Problem with Application
- Real Time Modeling, System Security Monitoring & Control
- Energy/Economy Functions, Control and Planning

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 0
- Practical: 0

[EPS 601] **POWER SYSTEM RELIABILITY**

Objectives:

To impart the reliability concepts and method of estimating the system reliability of simple and complex systems. To use reliability theory as a tool for decision support for design, operation and planning of electric power system.

Contents:

- Review of Probability and Probability Distribution
- Concept of Reliability
- Reliability Evaluation of Simple and Complex System
- Reliability Evaluation using Probability Distribution
- Markov Model
- Generation and Distribution Systems Reliability

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 0
- Practical: 0

[EPS 602] **ENGINEERING PROJECT PLANNING AND MANAGEMENT**

Objectives:

To describe the process involved in each phase of the project management life cycle. To apply project management tools, procedures, techniques, and skills for successful completion of the project. To create a Work Breakdown Structure (WBS) and a Project Management Plan. To apply project monitoring and control tools for cost, time and quality control of project. To apply project appraisal and evaluation techniques to determine the viability of projects.

Contents:

- Project Management Concepts, Body and Organization Structure
- Project Planning and Scheduling
- Budgeting and Cost Estimating
- Project Appraisal and Investment Evaluation Criteria
- Financing of Infrastructure Projects
- Project Risk and Uncertainty
- Project Monitoring and Control
- Project Evaluation and Termination
- Case Studies

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 0
- Practical: 0

[Elective I] [EPS 571] **ADVANCED ELECTRICAL DRIVES**

Objectives:

To Impart the mathematical modeling of three phase asynchronous and synchronous machine. To Provide the knowledge of converter fed drive systems and inverter fed drive systems. To Impart the knowledge of design of power electronics and drives system.

Outcomes:

Describe and analyze the converter fed drives. Design power electronic for converter fed drives. Describe the Mathematical modeling of Electrical machine and Vector control and DTC control.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 0
- Practical: 0

[Elective I] [EPS 572] **DYNAMIC MODELING OF ELECTRICAL MACHINE**

Objectives:

To impart the knowledge of importance of 3-2 phase conversion and two axis modeling of three phase machine with different frames. To provide the knowledge and performance based on dynamic model of three phase induction, synchronous and permanent magnet machine.

Outcomes:

Describe the reference frame theory and dynamic modeling of different electrical machine.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 0
- Practical: 0

[Elective I] [EPS 573] **FLEXIBLE AC TRANSMISSION SYSTEM**

Objectives:

To emphasize the need for FACTS controllers and application. To impart knowledge on operation, modeling and control of HVDC link.

Outcomes:

Describe the basics of power transmission networks and need for FACTS controllers. Explain about static var compensator in detail and Controlled Series Compensation. Understand the significance about different voltage source converter-based facts controllers.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 0
- Practical: 0

[Elective I] [EPS 574] **MICRO CONTROLLER AND DSP BASED SYSTEM DESIGN**

Objectives:

To provide the requisite knowledge for the designing of control/ triggering/ closed loop circuitry employing embedded controller readily available. To provide with the requisite knowledge for the interfacing of the digital controllers with power electronics system for better control. To understand design of microcontrollers / DSP controlled systems especially for the PE interface. To provide knowledge about the digital implementation of conventional controllers.

Outcomes:

Describe the basics of power transmission networks and need for FACTS controllers. Explain about static var compensator in detail and Controlled Series Compensation. Understand the significance about different voltage source converter-based facts controllers.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 0
- Practical: 0

[Elective II] [EPS 633] **RISK ASSESSMENT OF POWER SYSTEMS**

Objectives:

To familiarize with risk evaluation techniques for power systems, different types of risks in power systems. To give broad overview of generating system risk evaluation techniques, transmission system risk evaluation techniques. To give broad overview of risk centered maintenance and its application to transmission system maintenance scheduling, analysis of probabilistic spare equipment analysis.

Outcomes:

Evaluate the risk of generating system, and composite system. Apply the knowledge of reliability to design secure and reliable networks.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 0
- Practical: 0

[Elective II] [EPS 632] **DISTRIBUTED GENERATION AND MICROGRID**

Objectives:

To study the types of distributed generation sources and micro-grid, and their impact on isolated and grid connected power system.

Outcomes:

- Demonstrate detailed knowledge of main concepts and principle relating to distributed generation schemes and application in electrical network.
- Recognize the impact of DG on network performance.
- Explain the main feature of the protection scheme in distribution network with DG.
- Understand technical and economical factor which should be taken in account when designing distribution system reinforcement particularly with DG.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 0
- Practical: 0

[Elective II] [EPS 631] **ADVANCED POWER SYSTEM PROTECTION**

Objectives:

To understand basic philosophy of digital power system protection, PMU, transient response of PMU and application of PMU.

Outcomes:

Understand the solid-state relay and numerical relays.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 0
- Practical: 0

[Elective II] [EPS 634] **NON-LINEAR CONTROL SYSTEM DESIGN**

Objectives:

- To impart knowledge on phase plane analysis of non-linear systems. and describing function-based approach to non-linear systems.
- To educate on stability analysis of systems using Lyapunov's theory.
- To introduce the concept of sliding mode control.

Outcomes:

- Describe the time-invariant systems in state space form as well as analyze, whether the system is stabilizable, controllable, observable and detectable.
- Classify singular points and construct phase trajectory using delta and isocline methods.
- Use the techniques such as describing function, Lyapunov Stability, Popov's Stability.
- Design a sliding mode controller for a MIMO process and to identify the tradeoff.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 0
- Practical: 0

[Elective III] [EPS 642] **ARTIFICIAL INTELLIGENCE APPLICATIONS IN POWER SYSTEMS**

Objectives:

To impart the knowledge of understand fundamentals of various AI based techniques. To differentiate between Algorithmic based methods and knowledge-based methods. To use appropriate AI framework for solving power system problems.

Outcomes:

Describe the basic of AI and its application in the power system.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 0
- Practical: 0

[Elective III] [EPS 643] **SOCIAL AND ENVIRONMENTAL IMPACTS OF TECHNOLOGY**

Objectives:

- Aware students about the social and environmental impact of engineering and technology in the society and need of social and environmental impact assessment for the sustainability of the project.
- Train students to analyze the social and environmental data and to develop Environmental Impact Assessment (EIA) / Social Environmental Impact Assessment (SEIA) report.

Outcomes:

Describe the social and environmental impact the technology. Use knowledge to prepare EA, EIA and SEIA reports.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 0
- Practical: 0

[Elective III] [EPS 644] **RENEWABLE ENERGY SOURCES AND GRID INTEGRATION**

Objectives:

- To study about the integration of various renewable energy sources into the grid.
- To analyze the grid integration issues of renewable generation and dynamic performance of the network.

Outcomes:

This course provides a brief knowledge about integration of various renewable energy sources into the grid and its issues.

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 0
- Practical: 0

[EPS 591] **SEMINAR**

Objectives:

In this course students shall review recent journal / conference papers of electrical power engineering Students should undergo literature survey and identify the topic of seminar and finalize in consultation with Guide/Supervisor. Students should use multiple literatures and understand the topic and compile the report in standard format and present in front of Panel of Examiners.

Seminar assessment should be based on following points:

- Quality of Literature survey and Novelty in the topic.
- Relevance to the specialization
- Understanding of the topic
- Quality of Written and Oral Presentation

[EPS 603] **PROJECT**

Objectives:

The project work is introduced in 3rd semester in M.Sc. Program in electrical power system engineering and it is the integral part of M.Sc. dissertation. This will be the individual work of the students. In this component of the M.Sc. Dissertation students should do literature survey and identify the problem/ research gap for Dissertation and finalize in consultation with Guide/Supervisor. Students should use multiple literatures and understand the problem. As an outcome of this course student shall defend their proposal for the dissertation

Key Notes:

Project work should be assessed based on following points

- Quality of Literature survey and Novelty in the problem
- Clarity of Problem definition and Feasibility of problem solution
- Relevance to the specialization
- Clarity of objective and scope

Project works should be accessed through a presentation/ viva by a panel of Internal and external examiners appointed by the Head of the Department/Institute of respective Program.

[EPS 691] **DISSERTATION**

Objectives:

In Dissertation, the student shall implement the proposal defended in project works. Dissertation will consist of simulation, fabrication of set up required for the project, workstation, experiments and results, analysis, validation of results, conclusions and dissertation writing.

The students are allowed to take part in final defense only after completing core and elective courses.

Keynotes:

Mid Term / Final Defense of the Dissertation should be assessed through a presentation jointly by Internal and External Examiners appointed by the Faculty of the science and Technology. Midterm / Final Defense of the Dissertation should be assessed based on following criteria

- Quality of Literature survey and Novelty in the problem
- Clarity of Problem definition and Feasibility of problem solution
- Relevance to the specialization or current Research / Industrial trends

- Clarity of objective and scope
- Quality of work attempted
- Validation of results
- Quality of Written and Oral Presentation

Students should publish at least one paper based on the work in reputed International / National Conference / Refereed Journal.

3.2.3 Teaching facilities

The class has the capacity of 48 students with 1 individual classroom for lecture hours. During the tutorial classes and for laboratory work students are divided into two groups. Each classroom has one multimedia projector with internet connection. The existing infrastructure is a four-story building and a separate laboratory block. There is the well-furnished ICT laboratory and video conferencing system.

3.2.4 Laboratory facilities

BACHELOR PROGRAM: *Electrical and Electronics Engineering*

Faculty of Science and Technology, School of Engineering started undergraduate program in Electrical and Electronics Engineering in August 2009. During the one-decade duration University is continuously providing tremendous support to the school for the sustainability as well as quality products. The school is successful in establishing following laboratories to support the electrical engineering studies. Beside that the school has collaboration with different utility companies of the country. The power industries of the nation are now providing the opportunity of one-month internship to our undergraduate students.

Existing Laboratory Status

The program has the following laboratories for the undergraduate students. Beside these, the school has some laboratories which are common for all bachelor students of engineering program.

Common Basic Laboratories

Laboratory	Available Numbers
Physics Laboratory	1
Chemistry Laboratory	1

Mechanical Workshop Laboratory	1
Drawing Hall	2
Thermal Science Laboratory	1
Computer Laboratory	2
Distance Learning Laboratory	1

Specific Laboratory

Some of the laboratories are combined and allocated in same space for the better utilization of space and laboratory staffs.

BASIC ELECTRICAL ENGINEERING LABORATORY

Description:

This laboratory facilitates basic circuit theory experiments, both regarding DC circuits and AC single and three phase circuits. Students do experiments related to the verification of circuit theorem, voltage regulation calculation, single phase power measurement, three phase power measurements, power factor improvement and basic operation of electrical machines.

Figure 3.1: Basic Electrical Engineering Laboratory at PU

Experiment	Objectives	Outcome
Verification of KVL and KCL in Laboratory	• To verify KVL and KCL in Laboratory	Students learn to connection procedure of series, parallel circuits and measurement device in laboratory. Student will learn about the calibration of measurement

		device.
Verification of Thevenin's theorem and Maximum power transfer theorem in laboratory	• To verify Thevenin's theorem and Maximum power transfer theorem	Students learn to measure Thevenin's voltage, resistance in laboratory. Student will able to develop the setup to measure the power ver. load resistance in laboratory for the particular internal resistance.
Experiment on the measurement of real power and power factor of the circuit	• To measure real power and power factor of series and parallel AC circuit	Students learn measurement of real power and able to determine power factor of the circuit. Student will able to determine the effect of parallel capacitor on the power factor in laboratory.
Experiment on the measurement of power and power Factor of three phase system	• To measure line, phase parameter and power of three phase system	Students learn to develop the required set up for the measurement of three phase power of Delta and Y load with Y generation. Student will learn to measure three phase power using two wattmeters.
Experiment on single Phase Transformer	• To determine turns ratio of the single-phase transformer and voltage regulation	Students learn relation between terminal voltages and turns ratio. Student will learn effect of load on the secondary of transformer.

Equipment:

- DC fixed and variable power supply
- AC single phase fixed and variable power supply
- AC three phase fixed and variable power supply
- DC shunt motor with provision for load test
- AC three Phase Induction Motor with provision for load test
- Single phase transformer
- Single and three phase auto transformer
- Clamp meter
- Rheostat
- Capacitive load
- Inductive load
- Ammeter, voltmeter, digital multi meter
- LCR meter
- Digital CRO

- Wattmeter, digital wattmeter, three phase watt meter
- Computer, printer and multimedia

Responsible Person: Lalit Bickram Rana M.E., Assoc. Professor
Upendra Prasad Yadav, technical staff
Keshav Basyal, technical staff

Capacity: 24 students

ELECTRICAL MACHINE LABORATORY

Description:

The students validate in practice operational characteristics of various electrical machines including DC separately excited machine, different types of DC generators. Students learn how to determine with practical tests technical parameters of the single-phase transformer and induction motors. They perform the control of three phase AC generator, wound rotor induction motor. They prepare voltage characteristics and perform synchronization of three-phase synchronous generator. They exercise parallel operation of power transformers, as well as parallel operation of AC generators including the analysis of the impact of machine excitation and control of mechanical power.

Experiment	Objectives	Outcome
Performance parameter evaluation of single-phase transformer	• To conduct no load test to evaluate the shunt parameter • To conduct short circuit test to evaluate series parameter	Students can evaluate the voltage regulation and efficiency for the loading condition of the given transformer
Parallel operation of the single-phase transformer	• To conduct suitable test to identify the polarity of the given single-phase transformers • To conduct the suitable test to evaluate circuit parameters of the single-phase transformers • To develop the connection and experiment to find out the load sharing among the parallel connected single-phase transformers	Students learn the need of the parallel operation and load sharing among them.
Experiment to determine turns ratio	• To connect the three single-phase transformers in possible three-phase	Students will learn need of three phase transformer and

and phase group of three phase transformer	connection • To determine the line to line voltage ratio of possible connection • To measure the phase difference in laboratory	its possible connection
Study of the separately excited and self-excited DC shunt generator	• To develop the connection required to run MG set available in laboratory • To study the effect of the excitation • To identify the critical field resistance of self-excited dc generator and effect of residual magnetism	Students will learn the importance of the vector group
Study of three phase cage induction machine	• To develop the setup and experiment to determine the equivalent circuit parameters of SCIM • To develop the required setup and conduct experiments for the load test	Student will learn about the starting of DC Motor and terminal characteristics of DC generator
Study of the self-excited induction generator	• To develop the set up for the induction generator in the laboratory and study the effects of varying capacitance upon the generated voltage • To study the voltage and speed regulation with load.	Student will learn development of the circle diagram of the induction machine and predict its performance from it
Experiment on the synchronous generator	• To determine the equivalent circuit parameter of the three-phase alternator from synchronous impedance method and prediction of the machine performance for different load	Student will learn about the effect of load power factor on its performance
Study of the slip ring induction machine and V curves	• To study the characteristics of a slip ring induction motor with varying external rotor resistance and stator voltage • To run slip ring induction motor as a synchronous motor and study the characteristics of synchronous motor with varying degree of excitation	Student will be able to convert the available induction SCIM into generator and explain its behavior

Equipment:

- DC generator
- AC generator
- Three phase induction motor: SCIM, slip ring
- Single phase induction motor
- Single phase transformer
- Three phase transformer
- Tachometer
- Three phase power supply
- DC power supply
- Clamp meter
- Electro dynameters
- Phase meters
- Synchronous machine
- DC compound motor
- Resistors
- Rheostat
- Capacitive load
- Inductive load
- Single and three phase voltage regulators
- Ammeter, voltmeter
- Digital CRO
- Torque meter
- Three phase power meter
- Synchronizing panel
- MATLAB software

Responsible Person: Dr. Bishal Silwal, Academic Staff
Lalit Bickram Rana, Academic Staff
Upendra Prasad Yadav, Technical Staff
Keshav Basyal, Technical Staff

Capacity: 24 students

ANALOG ELECTRONICS LABORATORY

Description:

In this laboratory students conduct physical experiments involving basic electronic components,

analyze characteristics of the typical devices, study various application based on operational amplifiers.

Figure 3.2: Analog Electronics Laboratory at PU

Experiment	Objectives	Outcome
Experiment with diode and diode circuits	• To obtain diode characteristics, to develop, test and measure the diode application circuits, half wave rectifier, full wave rectifier, clipper and clamper	Students are able to identify diode polarity. They will understand significance of cut-in and breakdown voltage of diode. Student will able to develop diode circuits rectifier in breadboard and able to measure waveforms with digital oscilloscope.
Experiment with BJT	• To find out input and output characteristics of BJT in laboratory using training kit as well as IC with measuring equipment	Students learn the BJT (Common Base Configuration) characteristics. Student will develop circuits in Bread Board to identify input and output characteristics of BJT.
Experiment with FET and MOSFET	• To find out input and output characteristics of FET/MOSFET in laboratory using training kit, as well as IC with measuring equipment	Students learn the FET/MOSFET (Common Base Configuration) characteristics. Student will develop circuits in Bread Board to identify input and output characteristics of FET/MOSFET.
Experiment with Common Emitter Amplifier	• To obtain gain and frequency response of the CE amplifier	Students learn about the need of coupling and bypass capacitor and about effect of emitter resistance on the gain and bandwidth.

Experiment with op-amplifier (u 741)	• To familiarize students with operational amplifier	Students learn about op-amp IC and realize simple inverting, non-inverting and summing amplifier circuits.
Experiment with timer 555 and voltage controller IC 556	• To familiarize students with IC 555 and 556	Students will able to understand astable and monostable operation 555 time. Students will learn the working principle of VCO and implement this device in laboratory conditions.
Experiment with voltage regulator	• To study Zener diode-based voltage regulator	Students will be able to design and simple Zener diode-based voltage regulator. They will be able to work with commercially available voltage regulator (IC 78xx and 79xx).
Experiment with power amplifier	• To realize Class A, Class B and Class C amplifier using demonstration kit	Students learn about operation of power amplifiers, their efficiency, cross distortion, etc.
Experiment with oscillator	• To design phase shift and Wein Bridge oscillator in laboratory	Students learn how to design oscillator and they will be able to implement it in the laboratory conditions.
Experiment with signal generator	• To develop the signal wave form generator (square wave, quadrature, sawtooth, triangular)	Student learn design of signal generator and able to implement in laboratory.
Experiment with multivibrator	• To design and implement astable and monostable multivibrators using operational amplifier	Student learn the circuit operation and time calculation of mutivibrator and its application.
Experiment with negative feedback amplifier	• To implement negative feedback amplifier	Students learn about negative feedback amplifier and its bandwidth. They are able to perform frequency response analysis.

Equipment:

- Digital storage oscilloscope
- Function generator
- Dual power supply unit
- Small center tap transformers IC testers

- Printed circuit boards
- Digital multi meter
- Spectrum analyser
- Analogue multimeter
- CRT
- Milliampere meter, Microampere meter
- Breadboards
- Students project boards
- Characteristics trainer kit for BJT, MOSFET and FET
- Amplifier trainer kits
- Feedback amplifier trainer kits
- Oscillator trainer kits

Responsible Person: Dr. Madhusudhan Kayastha, Assoc. Professor
Sanjeev Thapa, Asst. Professor
Rammani Adhikari, Asst. Professor
Ramu Poudel, Technical Staff

Capacity: 24 students

DIGITAL ELECTRONICS LABORATORY

Description:

This laboratory is used to conduct experiments dealing with logic boards and microprocessor devices.

Figure 3.3: Digital Electronics Laboratory at PU

Experiment	Objectives	Outcome

Experiment with verification of K-map	• To verify 4 variables K-map in laboratory	Students learn basic gates truth table, pin diagram. They are able to realize given 4 variable K-map in project board
Experiment with JK, T and D flipflop devices	• To verify truth table of JK, T, D flipflop devices and to implement and test T and D flipflop circuits from JK flipflop components	Student learn about the pin configuration and data sheet of JK flipflop devices. Students are able to make required connection to convert the flipflop.
Experiment with adder and subtractor devices	• To realize the 4-bit binary full and half adder	Students learn more about the Ics connections, pin diagram, datasheet. They are able to realize the task using project boards.
Experiment with counter and seven segment display	• To implement a digital circuit a counter which counts 0-99 and display the result	Students learn operation of counters and simple display circuit.
Addition of number	• To developed basic software to add two hexadecimal and decimal numbers	Students can program microprocessor kit to add two 8-bit numbers.
Subtraction of number	• To developed basic software to subtract two hexadecimal and decimal numbers	Students can program microprocessor kit to subtract two 8-bit numbers.
Multiplication of number	• To developed basic software to perform multiplication of two 8-bit numbers	Students can program microprocessor kit to multiplicate two 8-bit numbers.
Division of Number	• To developed basic software to divide two 8-bit numbers	Students can program microprocessor kit to divide two 8-bit numbers.
Finding largest number from an array	• To developed basic software to find the largest number in an array	Students can program microprocessor kit to find the largest number in an array.
Finding smallest number in an array	• To developed basic software to find the smallest number in an array	Students can program microprocessor kit to find the smallest number in an array.

Equipment:

- Digital storage oscilloscope
- Function generator
- Dual power supply unit
- Small center tap transformers IC testers
- Printed circuit boards
- Digital multimeter
- Spectrum analyzer
- Analogue multimeter
- CRT
- Milliamper meter, Microampere meter
- Breadboard
- Computer, printer and multimedia

Responsible Person: Er Manoj Kumar Singh, Academic Staff
Er. Sanjeev Thapa, Academic Staff
Mr. Ramu Poudel, Technical Staff

Capacity: 24 students

CONTROL AND INSTRUMENTATION LABORATORY

Description:

In the laboratory students conduct practical exercises concerning network theory, instrumentation and control theory.

Figure 3.4: Control and Instrumentation Laboratory at PU

Experiment	Objectives	Outcome
Experiment on conversion of physical variables into electrical signal	• To calibrate different sensor	Students learn about temperature, light and pressure sensors and their calibration.
Signal conditioning using active devices or op-amp	• To realize signal conditioning circuit in laboratory	Students learn about operational amplifier and signal conditioning circuits like integrator, differentiator, summer and wave form generators.
Measurement of physical variables using various bridges.	• To measure the value of inductor, capacitor and resistor using bridge circuits	Students are able to implement bridge circuits and to measure electrical parameters.
Error measurements in instrumentation system.	• To determine the error in instrumentation	Students are able to calculate an error and correction factor of the typical instrumentation circuit.
Transmission of signal in different mediums.	• To transmit signal in different medium	Students learn the signal propagation characteristics and parameters, like reflection and transmission and they are able to assess transmission and reflection coefficients.
Conversion of analog signal into digital and digital into analog signal.	• To realize A- D converter and D-A converter	Student will understand basic principle of A/D and D/A converters.
Experiment on transient and steady state responses of 1st order passive networks	• To observe transient responses of 1st order systems	Students learn DC transient response of R-L and R-C circuits.
Experiment on transient and steady state responses of 2nd order passive network;	• To observe the transient and steady state behavior of 2nd order system	Students learn about the DC transient of RLC circuit and AC transient of RLC circuit.
Experiment on measurement of frequency responses of 1st order and	• To observe and measure frequency response	Students learn about the frequency response of 1st and 2nd order system.

2nd order circuits.		
Experiment on the measurement of harmonic content of a waveform	• To analyze signals using spectrum analyzer	Student are able to measure and analyze the harmonic content of non-sinusoidal wave forms.
Experiment on conversion of a T network into a Pi network and measurement of network response.	• To convert T into Pi network and vice versa	Student learn about conversion of network and measurement of parameters of networks.
Identification of control system components	• To identify the basic control system component	Student are able to develop transfer function and block diagram of servo systems for position and velocity control.
Open and closed loop performance of servo position control system	• To verify open and closed loop performance of servo position control system	Student can verify effects of loop gain on response, as well as compare results with theory.
Open and closed loop performance of servo velocity control system.	• To observe open and closed loop performance of servo velocity control systems	Students are able to verify effects of loop gain on response as well as compare results with the theoretical background.
Simulation study of feedback system using TUTSIM	• To make students familiar with TUTSM and design of feedback system	Students learn about TUTSM and they can design system with TUTSM.
Design a PID controller	• To design PID controller for position control servo and verify design with TUTSM	Student are able to design a PID controller for position control servo as well as to verify design with TUTSM.
Non-electrical control system	• To observe the performance of non-electrical control systems	Students understand non-electrical control systems (hydraulic or pneumatic servo systems).

Equipment:

- Digital storage oscilloscope
- Function generator
- Dual power supply unit

- Digital multimeter
- Spectrum analyser
- Analogue multimeter
- CRT
- Milliampere meter
- Microampere meter
- Breadboards
- Trainer kit for A/D and D/A conversion
- Servo motor system
- Transducers
- Bridge circuits
- Different sensors
- Decade inductors
- Capacitors
- Resistors
- PLC
- Software: TUTSM, MATLAB
- Printer, computer and multimedia

Responsible Person: Raju Wagle
Keshav Basyal

Capacity: 24 students

POWER SYSTEM AND SWITCHGEAR PROTECTION LABORATORY

Description:

This is the combination of hardware and software exercises. In this laboratory students conduct practical exercises dealing with power system design, planning and operation, switchgear and protection design, settings and maintenance. Students also run computer simulation of power system operation, faults calculation, etc.

Figure 3.5: Power System and Switchgear Protection Laboratory at PU

Experiment	Objectives	Outcome
Parallel operation of synchronous machines	• To synchronize alternator to infinite bus • To study the effect of variation of field excitation and prime mover input	Students know how to synchronize synchronous generator. They understand effects of excitation and prime mover control on real and reactive power output.
Experiment to determine ABCD parameter of the given transmission line model	• To conduct suitable test to compute the A,B,C,D parameter of nominal Pi and T model	Students know methods to calculate ABCD parameter. They can determine the regulation and efficiency of given line for different loading condition .
Experiment to determine sequence impedance of unloaded generator	• To determine the sequence impedance of three phase Y grounded alternator	Students learn methods to evaluate sequence impedance of the grounded alternator.
Experiment with relays and protection devices	• To study the characteristic of IDMT overcurrent relays and overvoltage relays	Students learn basics of protection devices operation.
Power flow analysis using MATLAB	• To run power flow studies in three bus test system from Newton Raphson and Gauss Seidel method	Students learn how to use the MATLAB software to solve the power flow problem.
Transient Stability	• To simulate transient	Students know how to run simulation

using MATLAB	stability in a three-bus power system	for three different conditions: prefault, during fault and post fault. They know effects of fault clearing time on rotor angle stability.
Experiment on fault analysis	• To simulate SLG , DLG and LL faults in the given power network	Students know how to calculate the different type of short circuit currents using MATLAB/ETAP software. They understand the relationship between the type of fault and the effects.

Equipment:

- Dedicated computer simulation laboratory
- Synchronous motor and generators
- Synchronizing panel
- Three phase power meter
- Clamp meter
- Digital oscilloscope
- Relays
- System for overcurrent protection
- Transmission line model
- Three phase power analysers

Responsible Person: Er. Annanta Adhikari, Academic Staff
Upendra Yadav, Technical Staff

Capacity: 24 students

POWER ELECTRONICS AND DRIVES LABORATORY

Description:

In this laboratory students conduct regular laboratories exercises dealing with power electronics and electrical drives. The laboratory space is also used for the research and final year project implementation in the case of undergraduate students.

Figure 3.6: Power Electronics and Drives Laboratory at PU

Experiment	Objectives	Outcome
Experiment on SCR device	• To fire the SCR and control the voltage across the ac bulb	Student will learn turn on and turn off Mechanism of SCR Firing circuit and ground isolation between power circuit and signal circuits. Student will get hands on skill on power electronics circuit.
Speed control of DC shunt Motor using power Electronics	• To control the speed of DC motor by controlling duty cycle of Class A chopper in laboratory	Student will learn turn on and turn off behavior of Power MOSFET and realization of gate driver circuit. Also, student will learn ground isolation.
DC machine Simulation	• To develop the mathematical model of DC Seperately excited machine in matlab and analysis the dynamic of the Machine ie the speed and current response for both voltage and load torque disturbance • Simulation of the dc machine during Braking	Student will learn mathematical model of DC machine and its realization in MATLAB. Student will also learn braking of Machine and effect of parameters like braking resistance and inertia on braking time.
Simulation of power	• To simulate the power electronics converters (Semi and Full) with R, L	Student will learn converter operation, effect of source

electronics converters	and RLE Load for both continuous and discontinuous mode	inductance and harmonics generated from the converters.
Simulation of Power Electronics Inverter	• To simulate single Phase half, full and three phase SPWM based inverters	Students will learn more about PWM base inverters: Unipolar and Bipolar pwm techniques, harmonic spectrum and need of PWM inverters.
Experiment on buck converter	• To design the mathematical model of buck converter in matlab environment using basic math operator and Simulate both closed loop and open loop condition	Student will learn more about buck converter its modeling and operation in closed and open-loop condition.

Equipment:

- Dedicated computer simulation laboratory
- Thyristor trainer kits
- Various measurement devices
- Electrical drives
- Digital oscilloscope
- MATLAB software

Responsible Person: Er. Lalit Bickram Rana

Capacity: 24 students

COMMUNICATION LABORATORY

Description:

In this laboratory student conduct exercises dealing with electromagnetic fields and waves, electromagnetic signals and telecommunication systems.

Experiment	Objectives	Outcome
Experiment on mapping electrostatic field on electro-conducting paper	• To prepare electrostatic field model	Students know how to map electrostatic field.

Determination of dielectric constant of an insulator	• To determine dielectric constant of the insulating material	Students learn how to assess the dielectric constant and how collect necessary measurements.
Study of magnetic hysteresis	• To obtain B-H curve	Students learn how to produce B-H curve and collect necessary data.
Measurement of standing waves on transmission lines, reflections, power measurements	• To observe the transmission signals	Students learn about propagation delay and attenuation by measuring losses and phase shift between original and reflected waves of open circuited coaxial cable.
Study of AM/FM modulation and demodulation circuits and systems	• To make student familiar with AM and FM signal modulation	Students learn about principles of AM modulation and demodulation, as well as about FM modulator and demodulator.
FFT analysis of signals	• To do fast Fourier transformation using spectrum analyzer	Students learn about the harmonics contents in non-sinusoidal signals. They can determine harmonic spectrum.

Equipment:

- Digital oscilloscope
- Measuring devices
- Function generator
- Dual power supply unit
- Spectrum analyser
- Communication AM and FM trainer kit
- Modulator and demodulator trainer kit
- Set up for electrostatic field mapping
- Dielectric measurement devices

Responsible Person: Er. Sanjeev Thapa, Academic Staff
Ramu Poudel, Technical Staff

Capacity: 24 students

◆

MASTER PROGRAM: *Electrical Power System Engineering*

Another achievement of the Faculty of Science and Technology is the establishment of Master's degree in Electrical Engineering in Power System since 2019. However, the laboratories are designed to conduct experiments and fulfill objectives of the undergraduate students.

3.2.5 Learning/administration management system

There is no provision of software system developed yet which is applicable for administration, documentation, tracking, reporting, and delivery of courses but we are developing it for master level program. The software for administration and accounting has already been installed for pure administration system only.

3.2.6 Approval procedures for new course/program

For New Curriculum development or Modernization of existing curriculum the respective Dean office and Curriculum Development Center are responsible. Dean office formed the committee for the need assessment and on the basis of the recommendation of this committee dean office and CDC will follow following steps:

1. Organize meeting / workshop between academia / experts of industry / Utility company people to finalize the structure of curriculum.
2. Hire experts to develop the draft copy of detail curriculum.
3. Organize meeting / workshop between academia/ experts of industry / Utility company people to get the feedback from stake holders finalize detail curriculum.
4. Subject committee will approve the curriculum and forwarded to dean office for the necessary action.
5. Dean office recommended to the academic council for the approval.

3.3 Entry requirements

BACHELOR PROGRAM: *Electrical and Electronics Engineering*

Student selection criteria

The entry requirement for the applicants in **BE Electrical and Electronics program** is higher secondary level (10+2) in Science or Diploma in Engineering, or equivalent, from a recognized institution with at

least second division marks at higher secondary level. Besides the basic academic requirements, an entrance examination will be conducted for all the applicants by the concerned school/college. To enroll in BE Electrical and Electronics program, an applicant needs to demonstrate his/her proficiency by passing the entrance examination.

The entrance examination application form and the information brochure of BE Electrical and Electronics program will be provided on request at the concerned school/college, upon payment of prescribed fee. The concerned school/college scrutinizes the applications, the eligible candidates are informed to appear in the entrance examination and the exact date(s) of the entrance examination is communicated to the applicants. The candidates shall be admitted on merit basis according to their performance in the entrance examination. The subjects and weight for each subject of the entrance examination will be Physics: 20%; Chemistry: 20%, Mathematics: 40% and English: 20%.

Entrance Conduction: Conduction of Central Entrance Examination (objective types) based on +2 Level Curriculum of Science stream or Diploma in Engineering, or equivalent. The students who appeared in the examination and secure 45% (45 out of 100) marks in will be listed in the merit list of the university. Based on merit list the following category of the student will be eligible for admission.

The concerned school/college may also conduct interviews for the candidates before their final selection for admission. Eligible foreign students may be admitted against limited seats on the basis of an interview to be conducted by the concerned school/college. The candidates, who are given provisional admission, pending submission of the qualifying certificates, are required to submit all necessary documents within a week of the beginning of regular classes. Otherwise, the admission will be automatically annulled.

Planned Students Number

The intake capacity of Pokhara University is 48 number of students in each section.

Activities	Percentage (%)	Number
Paying Stream	80	38
Scholarship Stream	20	10
Total Quota		**48**

◆

MASTER PROGRAM: *Electrical Power System Engineering*

Student selection criteria

Students with Bachelor degree in Electrical Engineering or Electrical and Electronics Engineering or its equivalent are eligible to join the program. Also, the applicant must have along with the above criteria a minimum of 16 years formal education (12 years of schooling plus four years of graduation). Furthermore, the applicant must have secured a minimum of second division or CGPA of 2.00 (out of 4.00) or equivalent at the bachelor's degree level. The final decision on admission is taken on the basis of merit scores on the admission entrance test, however the criteria for scholarship should fulfil all these requirements and the criteria for scholarship as mentioned by the act of Pokhara University.

The applicant is required to submit the following documents with the application form made available by the concerned college by paying a predetermined application fee:4

- Completed and signed application form
- Official transcripts from all the academic institutions attended.
- Certificate of experience

Certificates of all degrees and experience should be photocopied and submitted with proper attestation. Enrolment is conditional upon completion of all admission formalities including payment of all fees as determined by the college. Incomplete applications shall not be processed.

A notice inviting applications for admission is publicly announced. Application forms and information brochures are provided, on request, after the payment of the prescribed fee. The concerned college considers the application. The eligible candidates are informed to take the entrance test. The date and time for the entrance test are informed to the applicants by the concerned colleges. Final selection of students will be made on the basis of their aggregate scores in the entrance test. The subjects and weightage for each subject areas of the entrance test will be as mentioned below.

- Engineering Mathematics: 20%
- Electrical Engineering subjects: 70%
- Computer and Programming skill: 10%

The college may also hold interviews for the candidates before their final selection for admission. Eligible foreign national students may be admitted against limited seats on the basis of an interview to be conducted by the college. The candidates, who are given provisional admission pending submission of the qualifying certificates, are required to submit all necessary documents within a week of the beginning of regular classes.

Planned Students Number

The intake capacity of Pokhara University in Master's level is 15 students, starting in 2019.

3.4 Academic staff

Pokhara University started the services since 1997 and established as one of the leading technical University of Nepal. There are four faculties of Pokhara University and altogether 66 colleges are running the programs under the faculties. At present, there are more than thirty thousand students are studying in 61 different programs. Pokhara University has its own service commission to recruit the faculty and staffs required for teaching learning and administrative work. The following is the criteria set by the Pokhara University service commission for the permanent/contract professor selection.

#	Position	Minimum Qualification
1	Assistant Instructor	Diploma Level of Academic Qualification, Open Competition
2	Deputy Instructor	Diploma Level of Academic Qualification with 4 years of relevant experience, Open Competition
3	Instructor	Bachelor's degree in engineering or Diploma Level of Academic Qualification with 8 years of relevant experience, Open Competition
4	Lecturer	Master of Engineering, Open Competition
5	Reader	Minimum Master of Engineering with 11 years of teaching/research experience or PhD in engineering with 8 years of teaching/research experience and must secure 60 % marks (Publication, Academic Qualification, Experience and Interview), Open Competition
6	Professor	Minimum Master of Engineering with 13 years of teaching/research experience or PhD in engineering with 10 years of teaching/research experience and must secure 70 % marks (Publication, Academic Qualification, Experience and Interview), Open Competition

There are three different mode of faculty recruitment at Pokhara University based on the above criterion which is listed below.

#	Position	Minimum Qualification
1	Permanent Position	Pokhara University Service Commission

2	Full Time Contract	School can appoint the faculty upon the recommendation from Dean and approval from Registrar-Maximum for 1 year period
3	Course Contract	School can appoint the faculty upon the approval from Dean--Maximum for 1 year period

3.5 SWOT analysis

BACHELOR PROGRAM: *Electrical and Electronics Engineering*

Internal factors

STRENGTHS:

1. Quality technical education in Nepal
2. Affordable fee structure compared to other universities in Nepal
3. Good reputation within society
4. Flexible job market in Nepal
5. Experienced and reputed faculty members
6. Beautiful place of Nepal
7. Active student clubs and research centers
8. Updated course module including field-based exposure provision
9. 20% fee waiver scholarship to deserving candidates
10. Laboratory facility as per the course module
11. Central Library system with more books and resources
12. Credit transfer system
13. GPA/CGPA based evaluation system
14. Internationally recognized program

WEAKNESSES:

1. No centralized evaluation during entrance exam
2. Poor infrastructure facility

3. Academic and administrative blocks are in same place
4. No provision of Educational Management System
5. One-on-one student counselling
6. 15 km far from city
7. No student bus facility system
8. No strong student alumni
9. Active student clubs and research centers
10. Less parking facility within University premises
11. Weak security services
12. Less e-resources available
13. Less hand on skill as per the market demand
14. Poor regular evaluation

External factors

OPPORTUNITIES:

1. Enhance the fame of university through marketing and communication
2. Provide carrier fair for job placement opportunity to potential students
3. Collaboration with industry and Government of Nepal on research and business development for income generation
4. Organizing workshop, seminars, conferences, training programs for the students and young faculties
5. Built healthy relationship with national universities
6. Collaboration with national and international universities to enhance HEI.
7. Provide consultancy services to the community, industry, and the government

THREATS:

1. Competitive market for quality education
2. Modernization of existing curriculum

3. Mis perception on slow service delivery
4. Competitive to job market
5. Less attraction towards University teaching
6. High Faculty and staff turnover
7. Slow schedule on recruitment of human resources
8. Position of University in the international market
9. Changing rules and regulations of the Government of Nepal
10. Less investment from Government of Nepal
11. More challenges for student fee increment
12. Less number of student graduation

◆

MASTER PROGRAM: *Electrical Power System Engineering*

Internal factors

STRENGTHS:

1. Quality technical education in Nepal
2. Affordable fee structure compared to other universities in Nepal
3. Good reputation within society
4. Flexible job market in Nepal
5. Experienced and reputed faculty members
6. Beautiful place of Nepal
7. Active student clubs and research centers
8. Updated course module including field based exposure provision
9. 20% fee waiver scholarship to deserving candidates
10. Laboratory facility as per the course module

11. Central Library system with more books and resources
12. Credit transfer system
13. GPA/CGPA based evaluation system
14. Internationally recognized program
15. High power development potential of the country

WEAKNESSES:

1. No centralized evaluation during entrance exam
2. Poor infrastructure facility
3. Academic and administrative blocks are in same place
4. No provision of Educational Management System
5. One-on-one student counselling
6. 15 km far from city
7. Poor transportation facility
8. No strong student alumni
9. No active student clubs and research centers
10. Insufficient parking space within the university
11. Weak Security services
12. Less e-resources available
13. Less hand on skill as per the market demand
14. Poor regular evaluation

External factors

OPPORTUNITIES:

1. Enhance the fame of University through marketing and communication
2. Provide carrier fair for job placement opportunity to potential students
3. Collaboration with industry and Government of Nepal on research and business development for income generation

4. Organizing more workshop, seminars, conferences, training programs for the students and young faculties
5. Built healthy relationship with national universities
6. Collaboration with national and international universities to enhance HEI.
7. High demand of power specialist for different hydropower projects
8. Provide consultancy services to the community, industry, and the government

THREATS:

1. competitive market for quality education
2. Modernization of existing curriculum
3. Mis perception on slow service delivery
4. Competitive to job market
5. Less attraction towards University teaching
6. High Faculty and staff turnover
7. Slow schedule on recruitment of human resources
8. Position of University in the international market
9. Changing rules and regulations of the Government of Nepal
10. Less investment from Government of Nepal
11. More challenges for student fee increment
12. Less number of student graduation

◇◆◇

4 Royal University of Bhutan

The College of Science and Technology (CST) is the first institute in Bhutan to offer undergraduate degree programs in engineering under the Royal University of Bhutan. The college aspires to be a center of excellence in the field of science and technology, enriched with GNH values by offering quality programs that are relevant to the need of the job market both within and outside the country.

College of Science and Technology (CST), is responsible to oversee the tertiary education system in the Kingdom of Bhutan in the field of science and technology. The College presently offers Bachelor degree programs in Civil Engineering, Electrical Engineering, Electronics and Communications Engineering, Information Technology, Architecture, Engineering Geology and Instrumentation and Control Engineering and Master of Engineering in Renewable Energy. The curriculum got evolved to address the quality, internationalization and with the urgent need felt by the country. Besides the regular programs, the College, having been duly identified and recognized by the Royal Civil Service Commission, conducts short-term training, workshops and courses for in-service civil servants, particularly for technical professionals. Our campus offers high-quality learning, teaching and research spaces to better meet the needs of students, academics and researchers.

The College has a team of well qualified and committed faculty and relatively good laboratory resources. The Library is being stocked with more books, journals and other learning materials. Internet connectivity is through a leased line of connectivity available to all the staffs and student 24/7.

4.1 Program aims and learning outcomes

The **Bachelor of Engineering in Electrical Engineering** takes a minimum of four years full time.

The program provides access to larger numbers of suitably qualified nationals to be trained as engineers to meet the needs of Bhutan. The increased supply of engineers would also support private sector growth thereby creating additional jobs and strengthening the economy. The courses have been designed to meet the requirements of Bhutan's unique engineering demand. The graduates will find employment in Civil Service, Corporations and Private sector.

The Institute aims to be innovative in the course and curriculum development in order to

- attract and recruit students of good academic ability and potential from all social groups
- develop the potential of each student to meet new challenges and to lay the foundation of the versatility of thinking they will need in careers as professional engineers
- provide students with an engineering education with breadth across the engineering disciplines, combined with some specialized learning, delivered with design and problem

solving as an integral feature

- understand the importance of professionalism, management, and problem-solving techniques for works
- allow career progression and educational development to study for a Master's degree.

Electrical engineering is a challenging but exciting and rewarding area of study. It is a rapidly advancing field that is having a significant impact on shaping modern society. By studying electrical engineering students will be able to understand the significant developments in modern technology and be prepared to play a role in shaping its future.

Students also have a unique opportunity to experience aspects of the Electrical engineering profession by making short visits to sites.

The Undergraduate Degree program in Electrical Engineering centers about analysis, design of components and system and transform the designs into reality.

The aim of the program is to provide the graduates to build successful careers in electrical engineering equipped with basic knowledge of electrical machines, power system, power control drives and the management of electrical networks and design, with professional ethics and leadership quality.

Upon successful completion of the Bachelor of Engineering in Electrical Engineering, the graduates are expected to have ability to:

- apply scientific and technical knowledge in the field electrical engineering
- use relevant software for electrical engineering works
- design electrical networks for power system and industrial applications
- mitigate the electrical engineering problems
- formulate/prepare proposals and project plans
- execute/supervise the implementation of electrical works with quality control measures
- evaluate the professional, ethical and social issues related to electricity
- demonstrate interpersonal skills such as cooperation, negotiation, teamwork and leadership
- build educational foundation to pursue career / higher studies in engineering and entrepreneurs.

4.2 Program structure and resources

4.2.1 Credit

A unit of academic credit or a credit is a measure of "how much": how much material has been covered, how much effort the student has expended in covering the material, and how much content has been covered. It is a measure of academic volume. Credits are the value allocated to modules to describe the student workload required to complete them.

A unit of academic credit consists of 10 hours of notional student effort. Notional student effort is the amount of time spent by students on study. This includes both scheduled contact time (such as for lectures, tutorials, laboratory work, seminars and workshops) and time spent on independent study (such as for assignments and projects) and any other additional time and effort that is expected of students enrolled on a module.

At the undergraduate level it is expected that the average, competent, well-prepared, and diligent student will spend on average 1200 hours per academic year in study. This corresponds to the equivalent of 120 academic credits a year.

In summary:

- A unit of academic credit = 10 hours of notional student effort
- A full-time undergraduate year = 120 academic credits
- A full-time postgraduate year = 150 academic credits

Award	Credits	Year of Study [full-time]
Master's degree	180	Postgrad Year 2
Postgraduate Diploma	120	Postgrad Year 1
Postgraduate Certificate	60	Postgrad year 1
Honours degree	480	Year 4
Degree	360	Year 3
Diploma	240	Year 2
	120	Year 1

4.2.2 Courses

BACHELOR PROGRAM: *Electrical Engineering*

[CTS401] **CONTROL SYSTEMS**

Objectives:

The objective of this module is to introduce the fundamental principles of analysis and design of control systems using linear methods, time and frequency responses. The experiments will familiarize actual control techniques with hardware systems.

Contents:

- Introduction
- Transfer Function
- System Analysis
- Error Analysis
- Stability of Systems
- Frequency of Systems
- PID controls
- State Models
- Digital Control System

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 2
- Practical: 3
- Independent: 4

[EMC201] **ELECTRICAL MACHINE I**

Objectives:

The objective of the module is to introduce the physical construction, working principles and practical concepts of D.C. machines, transformers and their applications.

Contents:

- Principles of Electro-Mechanical Energy Conversions
- D.C. Machines
- Transformers

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 1
- Practical: 2
- Independent: 6

[EMC302] **ELECTRICAL MACHINES II**

Objectives:

To develop the basic concepts on the constructional details, working principle, testing procedure, controls, conceptual analysis, the applications of the Poly-phase, single-phase induction machines, Synchronous machines and special machines.

Contents:

- Induction Machines
- Synchronous Machines
- Special Machines

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 1
- Practical: 2
- Independent: 6

[PSS301] **POWER GENERATION**

Objectives:

The module is to provide students to identify and understand the different sources of energy used for electric power generation, principles and major components/equipment of power generation, renewable energy resources, generation planning, tariffs, power plant economics, power factor improvement.

Contents:

- Introduction of Energy
- Non-Renewable sources
- Renewable Sources
- Generation Planning
- Power Plant Economics

Methodology [hours/week]:

- Lecture: 4
- Tutorial: 1
- Practical: 0
- Independent: 7

[PSS302] **POWER TRANSMISSION AND DISTRIBUTION**

Objectives:

The module is to make students understand, analyze and design electrical power transmission and distribution systems including power system planning and voltage control. The module also introduces advanced power systems.

Contents:

- Introduction
- Mechanical Design of Overhead Lines
- Transmission Line
- Underground Cables
- AC Distribution System
- Voltage Control
- Grounding System
- Transmission System and Distribution System Planning
- Travelling Waves
- Substation Equipment

Methodology [hours/week]:

- Lecture: 4
- Tutorial: 1
- Practical: 0
- Independent: 7

[PSS402] **SWITCHGEAR AND PROTECTION**

Objectives:

The module is to make students understand the concept of switchgears and their use for protection in power systems. It also covers the protection of feeders, transmission lines and generators. The

module deals with the principles of circuit breaking and circuit breaker fundamentals. It also covers the working principle of protective switch gears like CT and PT. This module will also develop the students' abilities to solve numerical regarding the system safety.

Contents:

- Fault calculation and analysis
- Instrument transformers (CT/PT/CVT)
- Protective Relays
- Protection Schemes
- Overview of Protection in Generators
- Overview of Protection Transmission and Distribution systems
- Circuit Breakers

Methodology [hours/week]:

- Lecture: 4
- Tutorial: 1
- Practical: 0
- Independent: 7

[PSS404] **POWER SYSTEM ANALYSIS**

Objectives:

The module is to make students understand, familiarize with different spectrum of power system analysis carried out in a conventional power system. The module will make the students understand the terminal conditions and nature of power system planning that makes each of the analysis procedures significant.

Contents:

- System Representation
- Formation of Network Matrices
- Load Flow Studies
- Short Circuit Studies
- Stability Studies
- Introduction to Power System Control

Methodology [hours/week]:

- Lecture: 2
- Tutorial: 1

- Practical: 2
- Independent: 7

[PSS405] **HIGH VOLTAGE ENGINEERING**

Objectives:

This module will enable students to learn on high-voltage technology and electrical insulating materials. It covers the basic theories and the most important methods of high voltage engineering such as: Generation of high voltages and currents; Non-destructive testing of materials; High voltage test and measurement techniques; Electrical breakdown strength of gaseous, liquid and solid insulators; Dielectric properties of electrical insulation.

Contents:

- Ionisation and decay process
- Electric breakdown in solids, liquids and gases
- Generation of high voltage and high currents
- Measurements of high voltage and high currents
- Non-destructive testing of materials
- High voltage testing

Methodology [hours/week]:

- Lecture: 2
- Tutorial: 0
- Practical: 2
- Independent: 8

[PSS406] **FACTS CONTROLLERS**

Objectives:

The module enables students to understand on how to enhance the transmission capability of transmission system by shunt and series compensation using static controllers by applying the knowledge of power electronics in the efficient design and operation of power systems. And the roles of FACTS devices in power system operation, planning, control and protection.

Contents:

- Introduction
- Static VAR Compensator (SVC) and Applications

- Series Compensation Schemes
- FACTS Controllers
- Coordination of FACTS Controllers

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 1
- Practical: 0
- Independent: 8

[PSS407] **ADVANCED POWER SYSTEM PROTECTION**

Objectives:

This module will introduce the in-depth knowledge on the protective schemes and relaying for the power system protection. The students will be also introduced to analyze and design of overcurrent, differential and distance relaying schemes and the coordination among the circuits.

Contents:

- Over Current Protection
- Apparatus Protection
- Distance and Carrier Protection of Transmission Lines
- Busbar Protection
- Numerical Protection

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 1
- Practical: 0
- Independent: 8

[PSS408] **POWER MARKET AND TRADING**

Objectives:

The module is to familiarize students to understand power sectors, pricing methods, tariffs, impacts, risk, hazards and remedial measures.

Contents:

- Introduction
- Introduction to Power Sector Structure in Bhutan
- Power Sector Economics and Regulation
- Price Formation
- Power Sector Restructuring and Market Reform
- Electricity Markets Pricing and Non-Price Issues
- Impact of Energy Systems on Environment
- Risk and Hazard Management in Energy Sector

Methodology [hours/week]:

- Lecture: 3
- Tutorial: 1
- Practical: 0
- Independent: 8

4.2.3 Teaching facilities

Electrical Engineering Department at College of Science and Technology has adequate number of classrooms for teaching. In general, 4 years course has 4 classrooms. During tutorial, students are split into small groups. One group goes to laboratory practical and other goes for tutorial in classroom. Classroom is equipped with LCD projector and white board.

4.2.4 Laboratory facilities

The Faculty of Electrical Engineering at the College of Science and Technology, Royal University of Bhutan is currently operating the following physical laboratory facilities included in the Undergraduate study programs in Electrical and Electronic Engineering:

ELECTRONICS LABORATORY

Description:

This physical laboratory space hosts practical activities for two subjects: Electronics and Circuit Theory and is divided into three parts Electronics I, Electronics II and Circuit Theory I. The objective of the Electronics laboratory is to give students the opportunity to conduct practical experiments with basic electronic components, learn operational characteristics of basic electronic circuits, as well as acquire skills in the design, assembly and testing of electronic devices. The objective of the Circuit Theory

Laboratory is to convert the theory into hands-on experience with simple electrical circuits (DC and AC) and experimental verification of the fundamentals of Ohm's, Kirchhoff current and voltage laws.

Experiment	Objectives	Outcome
	Part I	
Experiment 1	• To plot characteristics of p-n junction diode	Students understand operational characteristics of p-n diode.
Experiment 2	• To study of half-wave rectifier circuit using p-n junction diodes	Student can build the half wave rectifiers using p-n junction diode.
Experiment 3	• To study of full-wave rectifiers without and with filters	Students can build the full wave rectifiers.
Experiment 4	• To study of basic clipper circuits	Students can build clipper circuit .
Experiment 5	• To study of basic clamper circuits	Students can build clamper circuit .
Experiment 6	• To study characteristics of Zener's diode and its application as voltage regulator	Students canuse of Zener diode.
Experiment 7	• To analyse characteristics of bipolar junction transistor	Students know different applications of bipolar junction transistor.
Experiment 8	• To build of single stage amplifier and its analysis	Students know the basic concepts behind the design of electronic circuits.
Experiment 9	• To analysis of cross over distortion in power amplifiers	Students know the basic concepts behind the design of electronic circuits.
Experiment 10	• To study the efficiency of power amplifiers – Class A or Class B	Students can use different power amplifiers in typical electronic devices and systems.
	Part II	
Experiment 1	• To design and analysis of two stage RC coupled amplifiers	Students can define operating parameters of RC coupled amplifiers.
Experiment 2	• To study series current feedback and	Students understand the effects

	to measure the voltage gains with and without bypass capacitor.	related to different designs of the close-loop amplifiers.
Experiment 3	• To construct an inverting and non-inverting amplifier using an OPAMP and perform the frequency analysis.	Students understand and use in practice various systems and its application in digital devices.
Experiment 4	• To study the application of Op Amp as Adder and Subtractor circuit.	Students acuire ability to understand, analyze and design various combinational and sequential circuits.
Experiment 5	• To design and analyze a RC Phase shift oscillator with OPamp and determine the oscillating frequency	Students can identify basic requirements for a design application and propose a cost-effective solution.
Experiment 6	• To design and analyze the operation of a 555 timer circuit in monostable and astable mode of operation and determine the rise time, fall time and frequency	Students have the knowledge skills to identify basic requirements for a design application and propose a cost effective solution.
Experiment 7	• To design and test a series voltage regulator using a transistor and Zener diode and determine the regulated voltage.	Students can identify basic requirements for a design application and propose a cost-effective solution.
Experiment 8	• To design and test a shunt voltage regulator using an OPamp and Zenerdiode and determine the regulated voltage.	Students acquire design, implementation and testing skills regarding digital circuits.
Experiment 9	• To construct a simple current mirror using BJT and measure the currents flowing in the circuit.	Students gain skill to build, and troubleshoot digital circuits.
	Part III	
Experiment 1	• To verify KCL and KVL	Students can identify the circuit components. They are able to verify practically the principles of of Kirchhoff laws.
Experiment 2	• To verify Superposition Theorem	Students can confirm in practice the superposition theorem.

Experiment 3	• To verify Thevenin	Students can verify and explain Thevenin's theorem.
Experiment 4	• To verify Norton's Theorem.	Students can explain Norton's theorem and the can verify the theory with practical electrical circuit implementation.
Experiment 5	• To verify maximum power transfer theorem	Students can proof in practice the maximum power transfer limit in electrical circuits.
Experiment 6	• To measure AC waveforms	Student can distinguish the DC and AC waveform and analyse and explain the components of AC waveforms.
Experiment 7	• To plot phasor diagram of RL and RC circuits	Student can verify the phasor diagram drawn using collected data samples.
Experiment 8	• To demonstrate resonance curves of series RLC circuits	Student can identify the resonant frequency and explain the relationship of Q-factor and resonant frequency for series RLC circuit.
Experiment 9	• To demonstrate resonance curves of parallel RLC circuits	Student can identify the resonant frequency and explain the relationship of Q-factor and resonant frequency for parallel RLC circuit.

Equipment:

- CRO, 35MHz
- Function Generator ST-4061
- Signal Generator 1 MHz
- Multi-meter DM 97, Scientech
- Bread Board with power supply
- Auto compute LCR-Q-meter
- Verro board/Project Board

Responsible Person: Pema Lhamo, Lecturer

Cheku Dorji, Lecturer

Capacity: 20 students

ELECTRICAL MACHINE LABORATORY

Description:

This laboratory is divided into two parts. The objective of this laboratory is to familiarize students with designs and operational characteristics of the basic electrical machines, which are key components of the transmission and the distribution network.

Experiment	Objectives	Outcome
	Part I	
Experiment 1	• To study of basic constructional features of and principles of rotating machines	Students know the working principles and construction of DC rotating machines.
Experiment 2	• To determine open circuit and external characteristics of DC machine	Students can analyse the power stages, various losses and efficiency of DC machines.
Experiment 3	• To perform speed control of DC motor	Students understand different methods of speed control of DC motors.
Experiment 4	• To perform OC & SC test on single-phase transformer	Students can perform basic transformer tests (polarity test, voltage ratio test, open and short circuit tests).
Experiment 5	• To perform load test on single-phase transformer and compute voltage regulation and efficiency.	Students can perform transformer load test.
Experiment 6	• To determine (Separation) the various losses of a single-phase transformer	Students can design and perform tests to understand and assess various losses in power transformers.
Experiment 7	• To study of basic constructional features and principles of rotating machines	Students are capable of describing the working principles and construction of AC rotating

		machines.
Experiment 8	• To determine open circuit and external characteristics of DC machine	Students can analyse the power stages, different losses and efficiency.
	Part II	
Experiment 1	• To determine equivalent circuit of three phase induction motor	Students identify the components in the single-phase equivalent circuit of a three-phase induction motor.
Experiment 2	• To perform brake test on three phase induction motor	Students analyse three-phase induction motor braking methods.
Experiment 3	• To plot circle diagram of three phase induction motor	Students preform various tests to identify different losses and power.
Experiment 4	• To perform speed control of three phase Induction motor	Students identify best methods of speed control for a particular use.
Experiment 5	• To determine regulation of three phase alternator by synchronous impedance method and AT method	Students understand regulation of alternators.
Experiment 6	• To determine regulation of alternator by ZPF method	Students understand regulation of alternators.
Experiment 7	• To perform parallel operation of alternators	Students meet the growing demand of energy.
Experiment 8	• To determine V and inverted V curves of three phase synchronous machines	Students understand the relation of excitation and current.
Experiment 9	• To analyse operational characteristic and control methods for single phase and 3-phase induction motors (Demonstration only)	Students understand operation of single phase and three phase induction motors. Students learn how to implement brake test on single phase induction motors. They can estimate from measurements losses of three phase induction motor and to adjust operational parameters of three phase alternator using two reaction theoretical model of the synchronous machine.

Equipment:

- High Voltage Insulation Tester
- Leakage Current Tester
- DC Compound Set fitted with DC Shunt Motor Set
- Alternator Set with Synchronising Unit (DL2109T13)
- 3-Phase Line Model (DL7901)
- Electrical Trainer (Model No. XPO-ET)
- 3-phase slip ring induction motor (micromot, model no. 1008)
- 3-phase synchronous motor (model 1009)
- DC motor generator set (model 1028)
- 3-phase Dahlander/pole changing Induction motor
- DC motor with generator set (6.3A, 3000rpm)
- DC compound motor
- 3-phasesquiral cage induction motor
- Synchronous Generator (380V, 1.37A, 0.6kW)
- DC Shunt Motor (220V, 6.3A, 1.1kW, 1500rpm)
- 3-phase power supply (0-380V, 8A, DL 1013T1, AC/DC power supply (DL 30016)

Responsible Person: DorjiWangdi, Nidup
Roshan Chhetri, Asst. Professor

Capacity: 20 students

POWER SYSTEM HIGH VOLTAGE LABORATORY

Description:

The objective of this laboratory is to give students the opportunity to conduct electrical tests on materials and power system apparatus.

Figure 4.1: Power System High Voltage Laboratory at RUB

Experiment	Objectives	Outcome
Experiment 1	• To teach student show to measure and verify dielectric strength of different insulation material	Students can identify and analyze basic problems dealing with high voltage and high currents. They can explain theories of breakdown in gaseous, liquid, and solid materials.
Experiment 2	• To perform dielectric test for oil transformers	Students can analyse the insulation design of different types of machines.
Experiment 3	• To perform lightning impulse test	Students can recognize the different types of lightning tests and conduct high voltage tests on equipment.
Experiment 4	• To perform test on circuit breakers	Students can identify different types of non-destructive testing of materials and interpret results.
Experiment 5	• To perform test on MCCB, RCCB (mini circuit breakers)	Students can identify different types of non-destructive testing of materials and interpret results.
Experiment 6	• To perform test on cables	Students can identify different types of non-destructive testing of materials and interpret results.

Experiment 7	• To perform test on insulators	Students can identify different types of non-destructive testing of materials and interpret results.
Experiment 8	• To perform breakdown test on insulating materials	Students can explain theories of breakdown in gaseous, liquid, and solid. They can distinguish and characterize different types of insulation and insulation materials.

Equipment:

- 0-75 KV/10mA Motorized Oil Insulation test set
- MCCB/MCB/Bi-Metal Over current Trip test set
- Relay testing set
- RCCB (Earth leakage) test set
- Overcurrent Relay test set
- Primary Injection Test Kit
- 60KV/300mA AC High Voltage test set
- 100KV HIGH VOLTAGE TEST (AC) system

Responsible Person: Cheku Dorji, Lecturer

Capacity: 20 students

POWER SYSTEM SIMULATION LABORATORY

Description:

This is a computer laboratory and the objective of this laboratory is to familiarize students with professional software package for key power system and grid calculations, to give students the opportunity to prepare and run simulation experiments and analyse the results and influence of the selection of models and simulation parameters.

Figure 4.2: Power System Simulation Laboratory at RUB

Experiment	Objectives	Outcome
Experiment 1	• To create power system model and the single-line diagram of a power system	Students can prepare the basic power flow diagram and set up network configuration and parameters.
Experiment 2	• To perform load flow studies	Students can use software tools to set up and launch load flow studies and analyse results.
Experiment 3	• To perform various short circuit (L-G, L-L-G, L-L, L-L-L) calculations	Students can use software tools to compute short circuit currents and determine the current ratings of power system equipment.
Experiment 4	• To perform the transient circuit analysis	Students are capable of preparing and running simulations of transients to determine the ratings and settings of protection devices circuits (CB, fuse, relay etc.).
Experiment 5	• To perform shunt and series compensation of transmission lines.	Students knows how to assessparameters of transmission lines.
Experiment 6	• To perform reactive power control by a tap changing transformer	Students understand the importance of reactive power control and can explain the

		obtained simulation results.
Experiment 7	• To determine the economics of going in for 220 kV single circuit and double circuit	Students can do economic assessment of different technical solutions for transmission lines.

Equipment:

- Desktop computers with MiPower and DigSILENT software (20 computing stations)
- DC Compound Set fitted with DC Shunt Motor Set

Responsible Person: Karma Wangzom, Lecturer
Cheku Dorji, Lecturer

Capacity: 20 students

INSTRUMENTATION LABORATORY

Description:

The objective of this laboratory is to familiarize students with instrumentation, measurement techniques and data analysis and allow them to perform laboratorial work in the other electrical laboratories and workshops.

Experiment	Objectives	Outcome
Experiment 1	• To construct Owen's Bridge and measure the unknown value of inductance	Students can use bridges for measuring unknown inductance, capacitance, resistance, mutual inductance and frequency.
Experiment 2	• To measurement of strain, pressure and speed	Students can identify different type of transducers and apply them for measuring a particular physical parameter.
Experiment 3	• To study characteristics of thermocouples	Students can identify different type of thermocouples and apply them for measuring a particular physical parameter.
Experiment 4	• To measure active power, reactive power, apparent power using	Students can analyse the construction and working principle

	electronic power meter of different load	of different types of ammeters, watt meters, energy meters, maximum demand indicator and power factor meter.
Experiment 5	• To study the effect of introducing a measuring device into a circuit, and how the instrument affects the measurement	Students can analyse uncertainties of the measuring instruments and measurement system.
Experiment 6	• To learn how to calibration of energy meters	Students can recognize the designand working principle of different types of ammeters, watt meters, energy meters, maximum demand indicator and power factor meter.
Experiment 7	• To learn how to use in practical measurements harmonic distortion analyzer	Students can interpret the measured electrical parameters.
Experiment 8	• To design instrumentation system	Students can identify and choose appropriate transducers and apply them for measuring a particular physical parameter. They are capable of using data loggers for recording time series data.

Equipment:

- Current leakage tester
- Wheatstone Bridge
- Shearing Bridge
- Wein Bridge with oscillator with earphone
- Anderson's Bridge with earphone
- Kelvin's Bridge
- Dual Trace CRO
- Maxwell's Bridge
- DC power supply
- Digital earth tester
- Hay's Bridge
- Owen's Bridge
- De Sauty's Bridge

- Torrioddal CT for AC ammeter
- CRO
- Single phase wattmeter (0-1kW, 2.5/10A, 75/150/300V)
- Sensor Trainner Kit (XPO-MIT)
- Energy meter calibration board
- Instrumentation & Trainner (DYNALOG 1750)
- Data acquisation set (DYNA 1760)
- Instrument TransformerKit (CT& PT)
- Calibration of Wattmeter (DC Potentiometer Kit)
- Displacement Sensing Transducers
- Sensor Trainer Master Unit (XPO-MIT)
- Function Generator

Responsible Person: Dorji Wangdi, Associate Lecturer
Namgay Tenzin, Associate Lecturer

Capacity: 20 students

POWER ELECTRONICS AND CONTROL SYSTEMS LABORATORY

Description:

This physical space hosts two laboratory units, Power Electronic Laboratory and Control Laboratory.

Figure 4.3: Power Electronics and Control Systems Laboratory at RUB

Figure 4.4: Power Electronics and Control Systems Laboratory at RUB

The objective of the Power Electronic Laboratory is to expose students to operation and characteristics of power semiconductor devices and passive components, their practical application in power electronics, to provide a practical exposure to operating principles, design and synthesis of different power electronic converters, to introduce students to industrial control of power electronic circuits as well as safe electrical connection and measurement practices.

Experiment	Objectives	Outcome
Experiment 1	• To study the characteristics of SCR, TRIAC and UJT including UJT Pulse Generator/Trigger source	Students can design selected types semiconductor devices for switching applications and power conversion applications.
Experiment 2	• To design and assemble SCR triggering circuit and obtain AC phase control using resistance triggering.To study and setup SCR triggering circuit and implement AC phase control using UJT triggering circuit	Students can design the semiconductor devices for switching applications and power conversion applications.
Experiment 3	• To study the operation of a single phase fully controlled converter with R, R-L and RLC load	Students can identify different types of power converters and they can analyse the operation of power converters.

Experiment 4	• To design and analyse the operation of single-phase AC voltage controller. To design and analyse the operation of Three phase fully controlled converter	Students can identify different types of power converters and they can design and analyse the operation of power converters
Experiment 5	• To study the operation of operation of single phase, two stage sequence controllers. To study the operation of DC to DC converter	Students can identify different types of power converters and analyse the operation of power converters.
Experiment 6	• To study the operation of single phase PWM inverters and converters	Students can identify different types of power converters and analyse the operation of power converters.
Experiment 7	• To model and simulate of single-phase half-controlled bridge rectifier with R, RL and RLE loads. To modelling and simulation of single-phase full bridge voltage source inverter	Students can identify different types of power converters and analyse the operation of power converters.
Experiment 8	• To model and simulate of single-phase AC voltage controller with R and RL load	Students can identify different types of power converters and analyse the operation of power converters.

The objective of the Control Laboratory is to give the students opportunity to investigate in practical implementation various controller design principles, to develop controllers for a set of hardware and software applications.

Experiment	**Objectives**	**Outcome**
Experiment 1	• To study dynamic response of 1st and 2nd order systems	Students can compare performance of first and second order systemsan they can explain the characteristics of 1st& 2nd order. Students can calculate the time domain specifications.
Experiment 2	• To analyse operation of P Controller for 1st order system	Students can explain the function of controllers in control systems and evaluate the performance of P type controller.
Experiment 3	• To study PI, PD, and PID Control for	Students can properly select P, PI,

	1st order system	PD and PID controllers for various applications. They understand and apply combined functions of the controllers. Students can compare the control functions for 1st order systems.
Experiment 4	• To study PID Controller for 2ndorder system	Students can select a suitable second order systems and can distinguish between2nd order system and 1st order systems.
Experiment 5	• To practice PID parameter tuning with Zieglar Nichols 1st method	Students can draw the characteristics of the 2nd order system. They can analyze the time domain characteristics.
Experiment 6	• To practice PID parameter tuning with Zieglar Nichols 2nd method	Students can explain the Zieglar Nichols method for PID parameter tuning for 1st order system. They can evaluate the transient and steady state parameters of the control process.
Experiment 7	• To designlinear systems and P-Controller with OP-Amps	Students can explain the Zieglar Nichols method for PID parameter tuning for 2nd order system. They can evaluate the transient and steady state parameters of the control process.
Experiment 8	• To design interlocks or sequential control with digital ICs	Students can define the transfer function of the system . They can analyze the effects of the gain parameter on the performance.
Experiment 9	• To analyse the state space representation in different canonical forms for a given system	Students can identify the required states of process condition. They can choose proper digital ICs and optimize the process operation.
Experiment 10	• To check whether the system is observable or controllable using Kalman's method	Students can identify the different canonical forms and differentiate transfer function models and a state space models. They can perform suitable analysis using MATLAB software.

Equipment:

- Oscillator kit
- Digital Oscilloscope
- DC Servo Motor
- Digital DC Servo Motor
- Power Electronic Workstation
- Electronic Workstation
- PID Control Trainer master unit

Responsible Person: YoezerDema, Lecturer
Manoj Sharma, Lecturer

Capacity: 20 students

ELECTRICAL WORKSHOP

Description:

The objective of this laboratory is to give students the opportunity to develop practical skills necessary for the implementation and maintenance of basic electrical circuits, devices and system.

Experiment	Objectives	Outcome
Experiment 1	• To identify and write down the specification of commonly used electrician's tools, equipment and fittings	Familiarization with electrical tools used in daily work of electrician. Students can select appropriate tools for practical electrical manual tasks.
Experiment 2	• To making different types of electrical joints and connections	Students are capable of preparing different types of joints and connections used in electrical wiring.
Experiment 3	• To perform soldering on joints and printed circuit boards	Students acquire soldering skills on joints and PCBs.
Experiment 4	• To carry out, test and prepare BOQ for PVC Wiring and testing of electrical installation (from Main DB, MCB-DB, energy meter to Bus Bar	Students can compute estimated cost of simple electrical wiring, and handle electrical tools for circuit and

	chamber)	device wiring.
Experiment 5	• To carry out, test and prepare BOQ for two-way switch wiring	Student can handle electrical tools for wiring and verify theoretically circuit diagram for two-way switch and implement it practically.
Experiment 6	• To carry out, test and prepare BOQ for power circuit wiring	Students know how to assess work cost and they can select appropriate wiring components.
Experiment 7	• To perform testing of fluorescent lamp, frame connection system, choke and starter	Students can assess working conditions of electrical appliance. They can verify operation of fluorescent lighting components.
Experiment 8	• To demonstrate the assembly of ceiling fan and circuit connections	Students know how to check out technical conditions of ceiling fans, identify failures in the electrical parts and repair or replace the defective components.
Experiment 9	• To carry out the earthing test for existing earthing points as per standard code of practice and perform earth resistance test	Students can identify various earthing solutions and they can measure the earth resistance in earthing systems.

Equipment:

- Portable hand drill with minimum power of 550W, Drilling diameter in wood 32/20mm in steel13/8mm, NLS 1000/1900RPM (black & decker)
- Portable rotary hammer drill 16mm, min power of 650W, Drilling diameter in concrete 16mm, in steel13, in masonry 18mm, NLS 2600RPM
- Bench grinder 550W, NLS 2850RPM,WD 205x19mm
- P/F pillar drill 25mm capacity, 8 speed, 1HP, 1440RPM,3ϕ PF switch, U belt + fittings, 1/2 drill chuck arbour, sleeves fine feed, air cooled, mini welding M/C, 150A, 1/2 phase with accessories complete
- Tools kit set(Electrician) 28pcs/set
- Jigsaw Handle top 7 Amp Bosch make #JS470E equivalent make, rod cutting machine cutter disc 355mm Brand Bosch, weight 18, input power 2000W dimension(L*W*H): 53x30.5x39.5 CM
- Angle grinding machine (portable): rated input power 2400W, No-load speed 6500RPM Grinding spindle thread M14, Main handle straight disc diameter 200-2300MM weight 2.3kg

- Switch Tri-control surface grinding (roughing), Vibration emission value ah 8.5M/S2 uncertainty K 1.5M/s2 sanding with sanding sheet

Responsible Person: Gom Dorji, Associate Lecturer

Capacity: 20 students

4.2.5 Learning/administration management system

CST/RUB use institute management system for (http://ims.rub.edu.bt/public/auth/view-login) for all activities. The college is slowly moving towards online management from 2020. Presently Human resource and research management are fully functional out of many activities. VLE is used for online teaching.

◆

The Head of Department (HoD)/Program Leader is responsible for the overall health and the day to day functioning of the program. All academic and administrative activities are planned at the beginning of every semester in consultation with the Department staff and the Management. The HoD makes a semester block plan based on the annual academic calendar circulated by the Dean of Academic Affairs and finalizes the subject allocation based on the interests of the staff with approval from the DAA.

Every tutor's performance is assessed in the form of feedback collected from students through an on-line feedback system (VLE). Starting from summer semester, 2016, two feedbacks are being collected, one in the middle and other at the end of the semester. The feedbacks are assessed by the respective HoDs as one of major indicators of tutors' performance output.

To ensure the quality and standards of the program, two external examiners visit the college annually at different times to inspect the health of the program namely academic standards, objectives and the staff's behavior on a range of matters. Accordingly, external examiner provides professional advice and expertise in the form of findings and reports. Internally, the Department monitors program through a series of follow up meetings as per the semester block plan. The Program committee meeting is convened at least twice in a semester, following the term tests. All tutors teaching modules in the program report the status of their module coverage, student's progress and class attendance. To enhance the effectiveness of Program management the following forums are in placed:

1. **Program Committee (PC)**
2. **Student-Staff Consultative Committee (SSCC)**
3. **Program Board of Examiners (PBE)**

4. College Academic Committee (CAC)

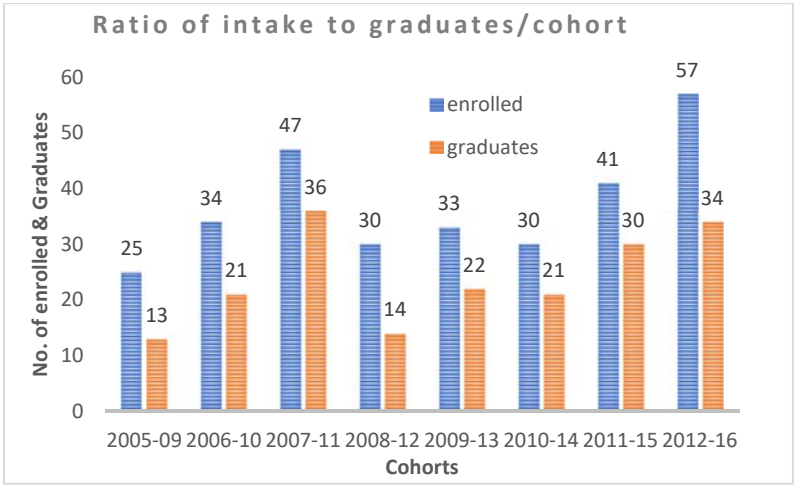

Figure 4.5: Trends in Enrollments & Graduates/Year

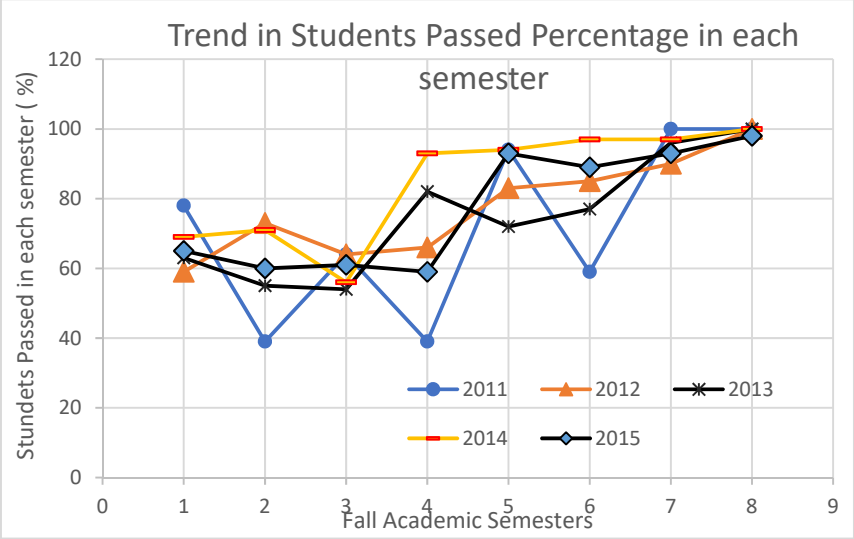

Figure 4.6: Trends in Students Passed Percentage/ semester

Figure 3 shows the trends of academic performances for the last few cohorts (2010-2012). The College and the program have been appreciated for its credibility and standard.

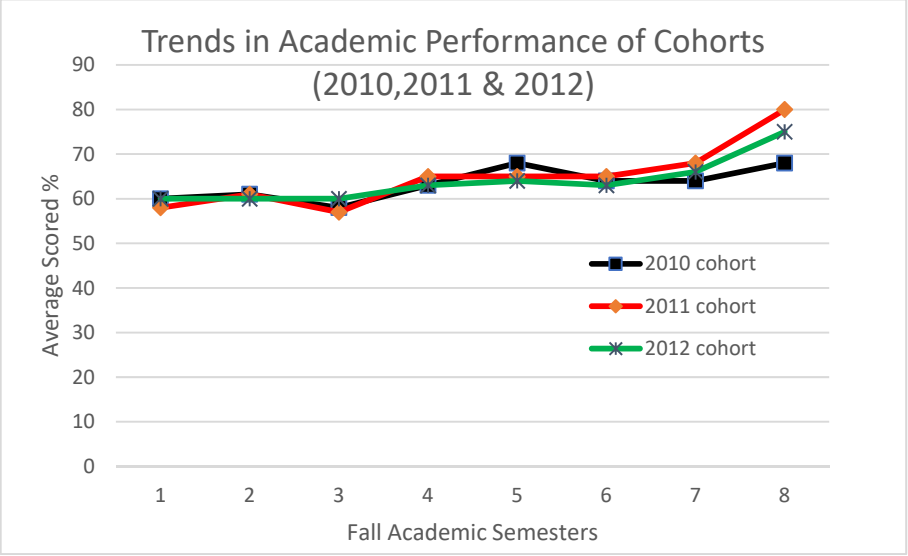

Figure 4.7: Trends in Academic performance of cohort

4.2.6 Approval procedures for new course/program

At RUB, the changes program is of two categories:

1. **MINOR CHANGES**

The following changes under each category may be considered as minor revision:

Category	Change
Changes to a program	Restructuring the program without changes in total credit or adding/deleting any modules (change of module sequence).
Changes to mode of teaching, learning and assessment	Changing mode of assessment without affecting contact hours.
Changes to the structure	Adding new electives or discontinuing current electives, changing pre-requisites or co-requisites.
Changes to entry requirements and procedures	Changing overall aggregate marks and ability rating of subjects.

Changes to subject matter	Changing title of the module without affecting subject matter, mode of assessment, mode of delivery, contact hours, and resource requirements. Adding, deleting or modifying subject matter to an extent which does not change the nature of the program. Increasing or decreasing subject matter by less than 25%.

The changes are proposed by the program committee and approved by the College Academic Committee. It doesn't take more than a week.

2. MAJOR CHANGES

The following changes under each category may be considered as major revision:

Category	Change
Changes to a program	Changing program duration, title of award, level of award, mode of delivery (regular/part-time), total credits, internship or research experience requirement.
Changes to mode of teaching, learning and assessment	Changing approaches to teaching learning from regular over 15 weeks to one week intensive or vice-versa and associated assessment approaches.
Changes to the structure	Increasing or decreasing total credits, adding or deleting core module/s, adding or removing specialization/s, and adding non-credited components.
Changes to entry requirements and procedures	Changing entry requirements such as including/removing language competency, prior experiences, and pre-university education.
Changes to subject matter	Merger of one or two modules or division of a module into two modules and increasing or decreasing subject matter by more than 25%.

The program committee proposes to College Academic Committee which in turn submits to the Academic Board of the Royal University of Bhutan who either approves or sends back to the college for further consultation. Normally this takes about 6 months.

4.3 Entry requirements

Student selection criteria

The entrance requirement for the Electrical Engineering program shall be based on the RUB regulations. The main selection criteria for the program are:

Regular

- Class XII pass students with minimum 50% mark each in Physics, Chemistry, Mathematics and English.
- Based on merit ranking of computed value by a Subject Ability Rating given below:

Subject	Rating
Physics	5
Mathematics	5
Chemistry	4
English	3
Any other subject	1

In-Service

For in-service students, an entrance test will be conducted by the College and candidates should fulfill the following criteria:

- Should obtain at least 40% in entrance test.
- Should have minimum of two years' work experience.

Planned Students Number

The students' intake projection including self-financed students for the next five years for the program will be as shown in Table below:

Intake to Program	2017-18	2018-19	2019-20	2020-21	2021-22
Government Scholarship & Self-financed	50	50	50	50	50
In-service	20	20	20	20	20

4.4 Academic staff

Until such time the University has adequate number of applicants with Masters/PhD Qualifications, the University shall continue to recruit persons after their first degree as Assistant Lecturers. Academics with honors/Bachelor's level will be appointed as assistant lecturers. Persons who already have a Master's Degree shall be recruited as Associate Lecturer. They shall work under the supervision of senior academics for a minimum of two years after which they shall assume full responsibility as an academic.

All the staffs are well-informed on the aims and objectives of the program. Currently the department has a team of experienced and competent teaching staff. There are six faculties with masters, one with PhD in Building Efficiency and Renewable Energy, two with Bachelor in Electrical Engineering and the five technicians assisting the teaching faculty in seven laboratories as shown in the following Table.

#	Designation	Qualification	Remarks
1	Assistant Professor	MScE in Electrical Engineering	
2	Assistant Professor	PhD in Renewable Energy	DAA
3	Associate Lecturer	M.Tech in Control and Automations	HoD
4	Associate Lecturer	M.Tech in Power and Energy Systems	
5	Associate Lecturer	ME in Power Electronic and Drives	Pursuing PhD
6	Assistant Lecturer	ME in Electrical Engineering	
7	Assistant Lecturer	ME in Electrical Engineering	
8	Sr. Technician	Certificate in Electrical Engineering	
9	Sr. Technician	Diploma in Electrical Engineering	
10	Sr. Technician	Diploma in Electrical Engineering	
11	Lab Technician	Certificate in Electrical Engineering	
12	Lab Technician	Diploma in Electrical Engineering	

4.5 SWOT analysis

Internal factors

STRENGTHS:

1. First college to provide UG program in Electrical Engineering
2. College in close proximity to main industry
3. First priority for class 12 students
4. Graduates are well employed as there is ample of scope for employment with Accelerating growth of construction industry, hydroelectric projects
5. Conceptual and analytical skills of the graduates are commendable
6. EE program at CST has greatly enhanced their capability to plan better and work independently

WEAKNESSES:

1. Many young faculties
2. Less exposure to practical research works
3. Many faculties only attended few international conference
4. Lack of sufficient funding

External factors

OPPORTUNITIES:

1. Continuous capacity building of the faculty and expending commensurate compensation
2. Growth of construction industry, hydroelectric projects
3. More such EU project chance
4. Only one competitor
5. Emerging need of our graduates

THREATS:

1. Taking ownership of laboratory by faculties is still a new concept
2. Shortage of self-finance candidate admission
3. Evolving technology
4. Changing regulator

◇◆◇

5 *Atma Jaya Catholic University of Indonesia*

Unika Atma Jaya has eight faculties with twenty one Sarjana (Bachelor's Degree) program founded in different years: The Faculty of Economic and Business Administration and Communication were founded in 1960; the Faculty of Education and language and the Faculty of Engineering were in 1961; the Faculty of law was in 1965; the Faculty of Medicine was in 1967; the Faculty of Psychology was in 1992; and the latest one was the Faculty of Biotechnology in 2002. Atma Jaya also has seven Magister (Master's Degree) programs: Magister Management (MM) and Magister in Applied English Linguistics (LTBI) in 1992; Magister in Professional Psychology in 2005; Magister in Biotechnology in 2011; Magister in Psychology; Magister in Law in 2012; and Magister in Mechanical Science in 2013, as well as one Doctoral program in Applied English Linguistics in 2002.

Electrical Engineering Bachelor Program at AJCUI was established in 1979, with a spirit to prepare skilled manpower for the field of power engineering and electronics which developed massively in the 70s. As many modern technologies has been introduced in recent decades, this program aims to prepare young generations to have strong electrical engineering knowledge and skills, and able to implement an excellent analytical thinking, innovative solution for the needs of society and industry.

Currently, this program has more than 2600 graduates who work in several fields and Industries: Industry automation and control, oil and gas, telecommunication, information technology, start-up companies, and many others.

5.1 Program aims and learning outcomes

Electrical Engineering Bachelor Program in Atma Jaya Catholic University of Indonesia (AJCUI) aims at achieving academic excellence in the field of analysis, design and innovation in shaping future technology. The combination of Christian faith values with science and technology, which is to dedicate expertise and science in Electrical Engineering mastered for the benefit of the community in the form of community service activities that can directly solve the problems that exist in the community with the application and the development of appropriate technology.

The main goal of our program is to produces graduates who:

- master the basic knowledge of electrical engineering supported by mathematics, computer science and programming,
- are able to adapt themselves against technological advancements in electrical engineering problems through hardware and software utilization,
- are able to produce scientific works in the field of electrical engineering that has international standard and is able to encourage the development of relevant technology for the community

through community service activities,

- are able to produce innovative work that has advantages in the field of intelligent, information-based intelligent reliable.

The graduates of Electrical Engineering Bachelor Program at AJCUI are expected to:

- understand fundamental concept of electrical engineering, which supported by mathematics, science, and computer / programming skills
- be able to analyze electrical engineering problems by developing advance solutions through hardware and software utilization
- produce scientific and innovative works in electrical engineering field that has international standard, who relies on the social interests of the community.

Considering the graduates profile, the learning outcomes of this program is to produce graduates who have the ability to:

- apply mathematical knowledge, natural science knowledge, information technology and engineering skills to gain a thorough understanding of the principles of engineering.
- design components, systems and / or processes to meet the expected needs within realistic constraints, for example legal, economic, environmental, social, political, health and safety, sustainability and to recognize and / or utilize the potential of local and national resources with global insight.
- design and carry out laboratory and / or field experiments, interpret and analyze data to strengthen technical judgment.
- identify, formulate, analyze and solve technical problems.
- apply modern methods, skills and technical tools needed to practice engineering.
- communicate effectively both verbally and in writing
- plan, complete and evaluate tasks within existing boundaries.
- work in cross-disciplinary and cross-cultural teams.
- be responsible to the community and to adhere to professional ethics in solving technical problems.
- understand the need for lifelong learning, including access to knowledge related to relevant contemporary issues.

5.2 Program structure and resources

5.2.1 Credit system

The undergraduate program is expected to be complete in 4 years, with a minimum of 144 credits (SKS). One credit is equal to 50 minutes of in-class lecture, 60 minutes of academically structured assignment, and 60 minutes of independent study for per week. One semester consists of approximately 14 weeks aside from exam period. We have two exams per semester, which be held in mid-semester and end- semester.

144 Credits are distributed as following:

BACHELOR PROGRAM: *Electrical Engineering*		
Code	**Course Name**	**Credits**
TKE 131	Calculus I	3
TKE 133	Calculus II	3
TKE 134	Physics Laboratory	1
TKE 135	Physics I Electricity & Waves	3
TKE 137	Programming Concept	2
TKE 139	Intro to Science & Tech Philosophy	2
PAN 100	National Ideology Education	2
AGA 110 UAJ 150	Religion: Catholic Educational of Religion	2
UAJ 160	Logics	3
TKE 132	Physics II Mechanics & Heat	3
TKE 136	Engineering Mathematics I	3
TKE 142	Electric Circuits I	3
TKE 144	Computer Programming	3
TKE 233	Logic Circuits	3
TKE 237	Basic Telecommunication	3
UAJ 180	Multiculturalism	2

TKE 231	Basic Electronics	3
TKE 234	Digital Signal Processing	3
TKE 235	Electrical Measurement	2
TKE 239	Electromagnetic Fields	2
TKE 241	Electric Circuits II	3
TKE 243	Data Base system	2
TKE 245	Data Base Laboratory	1
TKE 246	Basic Telecommunication Laboratory	1
TKE 252	Logic Circuits Laboratory	1
WAR 130	Civic Education	2
TKE 148	Ethics in Engineering	2
TKE 232	Basic Electric Power Engineering	2
TKE 236	Analog Electronics	3
TKE 238	Data Communication & Computer Network	2
TKE 242	Microprocessor System	3
TKE 244	Linear System	3
TKE 248	Electric Circuit & Measurement Laboratory	1
TKE 333	Microprocessor System Laboratory	1
TEB 337	Telecommunication Network	3
TKE 331	Basic Control System	3
TKE 335	Electronics Laboratory	1
TKE 337	Basic Electric Power Engineering Laboratory	1
TKE 435	Project Design	3
TEA 331	Microcontroller	3
TEA 333	Programmable Logic Controller (PLC)	3
TED 339	Web Programming	3

TEB 338	Antennas Propagation	3
TKE 332	Project Management	3
TKE 334	Basic Control System Laboratory	1
TKE 440	Smart Monitoring System	3
TEA 338	Electronic Instrumentation System	3
TEA 342	Electronic Instrumentation Laboratory	1
TPE 455	SCADA	3
TEB 334	Mobile Communication System	3
	Elective 1	3
TKE 433	Entrepreneurship	2
TKE 437	Seminar	2
TKE 439	Internship Program	2
TKE 441	Indonesian	2
	Elective 2	3
	Elective 3	3
	Elective 4	3
	Elective 5	3
TKE 500	Final Project	4
	TOTAL:	144

Electives

TPE 411	Optical Communication System	3
TPE 412	Advanced Data Comm and Computer Network	3
TPE 413	Telecommunication System Modelling and Simulation	3
TPE 420	Satellite Communication System	3
TPE 431	Image Processing	3
TPE 432	Computer Security System	3

TPE 435	Multimedia System	3
TPE 436	Expert System	3
TPE 441	Management Information System	3
TPE 451	Mechatronics	3
TPE 452	Fuzzy System	3
TPE 453	Robotics	3
TPE 454	Medical Electronics	3
TPE 457	Electric machinery Usage and Control	3
TPE 460	Renewable Energy System	3
TPE 461	Hydraulic and Pneumatic	3
TPE 462	Power Electronics	3
TPE 472	Capita Selecta 1	3
TPE 473	Capita Selecta 2	3
TPE 474	Capita Selecta 3	3
TPE 475	Capita Selecta 4	3
TPE 476	Business Communications	3
TPE 477	Enterprise Resource Planning	3
TPE 478	Business and Marketing	3
TPE 479	Logistics Management	3
TPE 480	Probability and Statistics	3
TEA 335	Industrial Electronics	3
TEA 337	Sensor	3
TEB 331	Telecommunication System I	3
TEB 333	Telecommunication System II	3
TEB 335	Engineering Electromagnetic	3
TEB 339	Traffic Engineering	3

TED 331	Java Programming	3
TED 333	Algorithm and Data Structures	3
TED 335	Computer Architecture	3
TEA 332	Electric Machinery	3
TEA 334	Intelligent System	3
TEA 336	Digital System Design	3
TEB 332	Radio & Satellite Communication System	3
TED 332	Operating System	3
TED 334	Modelling and Simulation	3
TED 336	Software Engineering	3
TED 338	.Net Programming	3

5.2.2 Courses

BACHELOR PROGRAM: *Electrical Engineering*

[TKE 131] **CALCULUS I**

Contents:

Definition of limit, continuity and limit calculation techniques, definition of differential as change rate, differential from elementary functions, differential of parameter function and differential of implicit function, differential application to find extreme price and extreme type. Integral as limit from rectangles total area which is called Riemann sum. Integral technique, either integral from elementary functions as well as trigonometric function and application to calculate rotary objects volume, rotary objects area, Cylinder coordinate and Ball coordinate used to calculate flat drawing area, spatial volume, solid objects mass, center of mass.

[TKE 133] **CALCULUS II**

Contents:

Matrix concept, elementary concept on matrix, matrix ranks, determinant, inverse, matrix application to solve Linear Equation System. Vector as well as vector space and its application for line and area equation. Linear transformation, basis change, and its application to find root characteristic and vector characteristic. Vector Differential, nabla operator, gradient, divergence and curl within cartesian coordinate system. Integral vector, Surface integral and Volume integral, and related theorems.

[TKE 135] **PHYSICS I ELECTRICITY & WAVE**

Contents:

Electric field discussing Coulomb's law, electric potential, capacitance, calculating direct current circuit and simple electric power. Magnetic field discussing magnetic force, magnetic induction, Faraday and Lenz law, inductance concept, understanding and solving simple alternate current circuit.

[TKE 137] **PROGRAMMING CONCEPT**

Contents:

Introduction to information technology, flowchart, and basic programming using Borland C. Basic programming in this course would discuss input/output statement, selection statement, looping statement, and function.

[TKE 139] **INTRODUCTION TO SCIENCE AND TECHNOLOGY PHILOSOPHY**

Contents:

Basic concept/philosophy introduction of science and technology and its mutual relationship. Basic sciences role in electrical engineering development particularly on electronic system and ethics in electronic science development.

[PAN 100] **PANCASILA (NATIONAL IDEOLOGY)**

Contents:

Pancasila historical fundamentals, nation values listed in Pancasila, and such values implementation in nation and state life.

[UAJ 150] **EDUCATIONAL OF RELIGION**

Contents:

Discussing a series of learning processes to understand philosophically and ethically related phenomena of religious education that are contained in the views of Humans, Religion, the Environment, Profession and Science and Technology and to design field observations and evaluations of the application of values relevant to the topic learning topic.

[UAJ 160] **LOGICS**

Contents:

Discussion of the ability to think critically through orally as well as written argumentation. Straight, valid and logic thinking principles that subsequently used to test either direct and indirect, deductive and inductive argumentation (reasoning).

[TKE 132] **PHYSICS II HEAT MECHANICS**

Contents:

Kinematics in one and two dimension, dynamic, and Newton law concerning motion, uniform rectilinear motion, accelerated uniform motion, Free fall motion, Circular motion, gravitation, work and energy. Temperature, heat, and thermodynamics law.

[TKE 134] **PHYSICS PRACTICE**

Contents:

Sufficient physics basic concept understanding and definition presentation through demonstration in order to deeply understand issues related to natural law. Subject: capacitance concept, inductance concept, magnetic force, magnetic induction, Faraday's law and Lenz's law.

[TKE 136] **ENGINEERING MATHEMATICS I**

Contents:

First Order Differential Equation, Differential Equation Application of Orthogonal Trajectory, finding Homogenous Linear Differential Equation and non-Homogenous Linear Differential Equation Answer, Cauchy Linear Differential Equation and Legendre Differential Equation. Complex Number System Basics, de Moivre theorem, Complex function, Complex function differential, analytical function, Cauchy Rieman equation, harmonic function, differential rules. Complex integral, complex line integral,

real line integral. Green's theorem on area, Cauchy's Theorem, Cauchy's Integral and Residue theorem.

[TKE 142] **ELECTRIC CIRCUITS I**

Contents:

Unit system of charge, current, voltage, power, energy, resistor, resistor in series/parallel size or Δ-Y relations, voltage divider and current divider, capacitor, and inductor. Ohm's Law and Kirchoff's Law, KCL and KVL, resistive circuits, transient order-1 circuits (RC and RL), transient order-2 circuits (series/parallel RLC), and circuit analysis using node method, mesh method and various technique that can be used in performing circuit analysis, such as superposition theorem, source transformation, Thevenin's and Norton's equivalent circuits.

[TKE 144] **COMPUTER PROGRAMMING**

Contents:

Borland C ++ programming with array, string, structure, and Object-Oriented Programming (OOP). Visual programming using Visual Studio software, with C# programming language. Material on C# include amongst them Console Application and Windows Application.

[TKE 148 **ETHICS IN ENGINEERING**

Contents:

Ethic issues behind engineering development and finding theoretical and practical models of engineering ethic issues solving such as professional integrity, public safety, "enframing", freedom, and living environment.

[TKE 231] **FUNDAMENTAL OF ELECTRONICS**

Contents:

Semiconductor material, diode characteristic and diode circuits application, introduction to transistor and FET characteristic, transistor and FET biasing method, logic gate circuits and amplifier operational circuits.

[TKE 233] **LOGIC CIRCUITS**

Contents:

Number system, Boole algebra, truth table, logic gates of AND, OR, NOT, NAND, NOR, XOR and XNOR. Boole function canonical form, Boole function simplification algebraically, Karnaugh map, tabulation. Combinational logic circuit design. Circuits of adder, subtractor, comparator, code changer, odd/even parity, decoder, encoder, multiplexer and de-multiplexer. Analysis and synthesis of sequential, register, counter circuits.

[TKE 235] **ELECTRICAL MEASUREMENT**

Contents:

Electric measurement tools usage and its application mastering within circuits. Fundamental of measurement technique, electric measurement tool active working principle, Construction and electric measurement tools working requirement, Galvanometer, electrical indicator instrument, wattmeter, integrating instrument. Circuits for resistance, voltage, current and power measurement. Alternate current bridge, transformer for measurement, alternate current source for measurement.

[TKE 237] **FUNDAMENTAL OF TELECOMMUNICATION**

Contents:

Fundamental of data communication, computer network and analogue modulation. Material discussed in this subject include layered approach on data communication network, data communication network devices and its configuration method, observation scheme on data communication network, amplitude modulation and angle modulation.

[TKE 239] **ELECTROMAGNETIC FIELDS**

Contents:

Electromagnetic field basic concepts such as electrostatics, magnetostatics and field. Electromagnetic based on Maxwell equation formulation. Time varying fields, Maxwell contribution for displacement current. Electromagnetic application relevant with discussion concepts.

[TKE 241] **ELECTRIC CIRCUITS II**

Contents:

Sinusoidal function, complex and phasor and phasor diagram. Circuit analysis with various method and

power on circuits with sinusoidal source. Frequency response, quality factor. Apparent power, reactive power, real power, power factor, maximum power transfer. Three phases voltage source. Load on 3 phases system, magnetically coupled/transformer circuits.

[TKE 243] **DATABASE SYSTEM**

Contents:

Database introduction, relational model database, Structured Query Language (SQL) language, database design. Database introduction consist of data definition, data hierarchy, and database models. One of the models is relational model which is common to be used recently. Relational model includes database structure (attribute, record, table, database), relational key, integrity rule. SQL language consist of Data Definition Language (DDL), Data Manipulation Language (DML), Query and View, as well as Security Language on database. General design, Entity Integrity (ER Model) model design, mapping, and design with database normalization would be discussed in database design.

[TKE 245] **DATABASE SYSTEM PRACTICE**

Contents:

Database Management System SQL Server, Structured Query Language (SQL). SQL language consist of Data Definition Language (DDL), Data Manipulation Language (DML), Query and View, as well as Security Language on database.

[WAR 130] CIVIL EDUCATION

Contents:

Civil Education discuss citizen and country, relations of both, with its entire right and obligations based on Pancasila and 1945 Constitution and entire legislations of the Unitary State of the Republic of Indonesia. Relations of both emerge on each right and obligation implementation in the framework of state building and nation building.

[TKE 232] **FUNDAMENTAL OF ELECTRIC POWER ENGINEERING**

Contents:

Basic principle of electric power engineering, electral machine, transformer, induction motor, Synchronous motor, synchronous Generator, DC Generator, DC Motor, single phase machine, power

electronic system on electric power system.

[TKE 234] **DIGITAL SIGNAL PROCESSING**

Contents:

Digital signal processing and designing IIR and FIR discrete system. Digital signal processing process that include mathematical model from signal in form of different equation, mathematical tool to support digital signal processing, convolution, Z transformation, and Fourier transformation. Discrete system, discrete system structure. Analogue filter, digital filter, IIR, FIR digital filter and its implementation application.

[TKE 236] **ANALOG ELECTRONICS**

Contents:

Class A, B and AB power amplifier, one level/more amplifier using BJT and FET with various configuration. Low, medium and high frequency response of amplifier circuits followed with amplifier circuit analysis with negative feedback and oscillator circuits.

[TKE 238] **DATA COMMUNICATION AND COMPUTER NETWORK**

Contents:

Basic Data Communications and Computer Networks. The material discussed in this course covers the layered approach to data communication networks, data communication network devices and their configuration and addressing schemes on data.

[TKE 242] **MICRO-PROCESSOR SYSTEMS**

Contents:

Fundamental of digital electronic based computation system (micro-processor), from microprocessor architecture, assembly language program for Intel x86 family, and micro-processor with memory and input and output devices (input/output, I/O).

[TKE 244] **LINEAR SYSTEMS**

Contents:

Concepts of signal, system and analysis methods from linear system to model and solve electric circuit issues, mechanic circuits and DC motor using model in frequency domain (Laplace) and model in time domain (State Space).

[TKE 246] **FUNDAMENTAL OF TELECOMMUNICATION PRACTICE**

Contents:

Cisco router and Microtic router configuration. Materials discussed in this course include interface and PC addressing configuration, Static and dynamic routing protocol, VOIP, data communication network modulation and its configuration method, addressing scheme on data communication network, and amplitude modulation and angle modulation.

[TKE 248] **ELECTRIC CIRCUIT AND MEASUREMENT PRACTICE**

Contents:

Direct meter and alternate meter adjustment, Wheatstone bridge and Kelvin double bridges, finding wire disturbance location due to short circuit with ground, one phase alternate current power measurement, three phases power measurement, one phase Kwh meter adjustment.

[TKE 252] **LOGIC CIRCUITS PRACTICE**

Contents:

Logic circuits understanding through experiments: fundamentals of logic circuits, multiplexer and de-multiplexer, decoder and encoder, arithmetic logic unit, counter, shift register, DAC and ADC, random access memory, and tools task.

[TKE 331] **FUNDAMENTAL OF CONTROL SYSTEMS**

Contents:

Fundamental of control system concept, system modeling, response system, stability principle from system either through root location description method as well as Bode diagram method, PID compensator and control. Performing response system repairment using PID compensator and control.

[TKE 333] **MICRO-PROCESSOR SYSTEMS PRACTICE**

Contents:

Micro-processor working method understanding and its application through experiments. Assembly language concept, logic and control arithmetic instruction, application instructions, I/O port interface application.

[TKE 335] **ELECTRONIC PRACTICE**

Contents:

Fundamentals of electronic understanding through experiments: diode characteristic, diode circuits, special components, bipolar transistor, JFT, voltage regulator, transistor amplifier 1, transistor amplifier 2, feedback amplifier 1, oscillator 1, oscillator 2 and tools task.

[TKE 337] **FUNDAMENTAL OF ELECTRIC POWER PRACTICE**

Contents:

Electric machines working procedure and usage understanding through experiments: direct current motor, synchronous motor and asynchronous motor, synchronous generator.

[TEA 331] **MICRO-CONTROLLER**

Contents:

Micro-controller system architecture, micro-controller programming language, peripheral possessed by micro-controller system including general I/O, external and timer interruption, serial communication and ended by designing and realizing micro-controller-based system.

[TEA 333] **PROGRAMMABLE LOGIC CONTROLLER**

Contents:

Understanding PLC working method and application as industrial control. PLC architecture. Input Unit, Processor Unit, Output Unit, Memory Unit. Internal relay, external relay. PLC instructions: AND, OR NOT, BIT operation. Timer, Counter, arithmetic operation. Ladder diagram programming language. Simple application example.

[TED 337] **WEB PROGRAMMING**

Contents:

Understanding and designing web-based programming languages. Web programming languages can be grouped into 2, which are static and dynamic. Basic web programming languages that are static, including using HTML, CSS, JavaScript, VBScript, DHTML, HTML5. Dynamic programming languages, in this course, use software in static programming coupled with PHP and MySQL DBMS to store data. Data stored in the database, causing data can be changed as needed, so as to produce a dynamic website. All software used is open source.

[TEB 338] **ANTENNA AND PROPAGATION**

Contents:

Understanding basics of radio wave propagation; to understand functions, antenna types and method in communication system design. Electromagnetic basics, polarization. Wave propagation] surface wave, space wave, sky wave, throphoscattering, reflection and diffraction. Antenna parameters] impedance, radiation pattern, gain, directivity, beam width, side lobe, main lobe, antenna types, structure and parameters. Supporting element for antenna system] matching, feeder, polarizer, circulator, radiator antenna.

[TEB 337] **TELECOMMUNICATION NETWORK**

Contents:

The concept of forming a telecommunications network in terms of transmission, the introduction of equipment that supports the establishment. The customer loop network to the public telephone network with copper cable transmission media, which consists of telephone exchanges, the benefits of telephone exchanges, switching, multiplexing, telephone central hierarchy, communication and signaling between telephone exchanges which are backbone networks. Backbone network can be realized using cable media using optical fiber communication networks that have large bandwidths. Discussion on Optical Fiber Networks, including the introduction of optical transmissions, types of optical fibers, forms and network equipment, introduction of telecommunications network performance.

[TKE 332] **PROJECT MANAGEMENT**

Contents:

Management knowledge in managing project, with material that include project management concept, project life cycle, project organization, project management plan, project scheduling, estimation process, budget compiling and project cost control, project implementation. Engineering Procurement and construction, project control, audit evaluation, project reporting and completion.

[TKE 334] **FUNDAMENTAL OF CONTROL SYSTEM PRACTICE**

Contents:

Material deepening of regulation system and its components through experiments: Position setting system experience with DC signal, speed controlling system with DC signal, position controlling system experience with AC signal, controlling system with hybrid system, root position location, automatic control basic principle, and frequency response.

[TEA 338] **ELECTRONIC INSTRUMENTATION SYSTEM**

Contents:

Signal conditioning concept, instrumentation system characteristic, sensor characteristic, electronic signal processing, data acquisition, and output from processed input signal. Sensorbased measuring instrument and implementation of end course project based instrumentation system making.

[TEA 342] **ELECTRONIC INSTRUMENTATION PRACTICE**

Contents:

Various measuring perspective, instrumentation system that include transducer, signal conditioner (converter, filter circuits), generator signal, software-based measuring system (Lab View).

[TPE 455] **SCADA**

Contents:

Supervisory Control and Data Acquisition System (SCADA) in the electrical and industrial energy systems, such as network topology, system security.

[TEB 334] **MOBILE COMMUNICATION SYSTEM**

Contents:

Understanding for fundamental principle and plans on mobile communication system. Mobile communication system, wave propagation and the characteristic upon mobile communication. Modulation, attenuation calculation. Cellular telephony system and frequency reuse, Cell dividing, and switching process.

[TKE 440] **SMART MONITORING SYSTEM**

Contents:

A simple Wireless Sensor Network as part of the Internet of Things uses the Arduino Uno microcontroller, the Xbee wireless device and the ESP 8266 device as a link to the internet.

[TKE 441] **INDONESIAN**

Contents:

Steps in performing research (topic selection, searching for information that background certain research, finding and evaluating relevant sources with research), learning final project proposal writing method, final project paper, and final project using standard Indonesian language structure, and learning rules concerning seminar and final project from faculty/study program. Subsequently, compiling final project proposal guided by final project supervisor candidate to be later put on seminar.

[TKE 433] **ENTREPRENEURSHIP**

Contents:

Organizational general management, Planning network, Mix marketing, Break event point analysis, Investment analysis, Innovation, creative, Franchise type, Profit, loss of franchise, Selecting and purchasing franchise, Global market orientation, Trading barrier, Successful strategy, Business fairness creativity and innovation, Business fairness creativity and innovation content, Presentation

---

[TKE 435] **PROJECT DESIGN**

Contents:

Evaluation method, progress report mechanism, scientific research definition, Literature searching, making literature review, Problems formulation, research urgency and outcome, Purpose formulation, purpose success measurement determination, Problems scope, assumption used, examined parameter, Relevant theoretical background. Report and evaluation making. 5W+1H concept in design

and evaluation process. Critical thinking. Presenting design and making proposal 1 and proposal 2.

[TKE 437] **SEMINAR**

Contents:

Understanding for case study, as initial step to determine final project research topic. Student present paper in form of Proposal tested by lecturer team. Upon research implementation reach final result, student present result that has been implemented before in certain scientific meeting forum.

[TKE 439] **JOB TRAINING/APPRENTICESHIP**

Contents:

Implementing theoretical science/lecturing use with industrial field conditions. Student make internship on suitable company according selected topic. Observing field/industrial condition. Observation result reported in form of report and presentation.

[UAJ 180] **MULTICULTURALISM**

Contents:

Understanding of multiculturalism, concept of behavior and thinking patterns that continue to be developed dealing with the conditions of a plural society. This concept continues to be developed as an ongoing process in order to organize a plural society (to be) into a multiculturalistic society (being). In a multiculturalistic society there is harmony that makes life peaceful, peaceful and stable in harmony and continues to grow and dynamic in diversity. In his freedom, every citizen is free to express and develop himself in all aspects (dynamic). In equality every citizen respects the same freedoms that exist also in other people (stable).

[TKE 500] **FINAL PROJECT**

Contents:

Deep understanding of certain material in electronic sector that could include: System analysis, hardware or software device design. Discussion topic searching, literature study, field study, testing, analysis and report writing.

[Elective] [TPE 441] **MANAGEMENT INFORMATION SYSTEMS**

Contents:

Organization and method understanding manually as well as through computer support; understanding way to make approach in making, developing and implementing management information system to support decision making; understanding computer role in management and designing concept system.

[Elective] [TPE 411] **OPTICAL COMMUNICATION SYSTEM**

Contents:

Understanding of optical fiber communication system, transmission advantages through optical fiber. The basic techniques of generating and receiving light waves, in streaming optical information signals. Aspects of optical wave transmission and optical fiber attenuation related to the type of optical fiber and the wavelength of light used, as well as the distance of communication that must be traveled. Digital transmission system with optical fiber; point to point links especially the discussion on link power budget, rise time budget, transmission distance; optic intensifier system, wavelength division multiplexing (WDM).

[Elective] [TEB 335] **ENGINEERING ELECTROMAGNETIC**

Contents:

Electro Magnetic understanding based on Maxwell equations concept. Operations del, wave equations and phasor shape representations, Maxwell equations change time, wave propagation in free space, wave propagation in dielectric, skin effect, wave propagation in lossy medium, conductor, Skin depth, reflection coefficient, transmission, critical angle, reflection coefficient, transmission, Brewster angle. Polarization, AR, Pointing Vector, Transmission channel conception related to wavelength dimensions, types of sal.t, their use, salt equation, characteristic impedance, Distributed parameters R, LC, G. Reflection coefficient, VSWR and Impedance matching, Smith chart concept, impedance point, circle reflection coefficient, Stub series, parallel stub, double stub, Richard transformation, Kuroda identity, Waveguide TEM, TE, TM operation area, dominant propagation mode, bandwidth, microstrip channel

---

[Elective] [TPE 460] **RENEWABLE ENERGY SYSTEM**

Contents:

Understanding of types of renewable energy developing in the world today, such as wind energy, solar

radiation energy, geothermal energy and bio mass energy.

[Elective] [TPE 413] **TELECOMMUNICATIONS SYSTEM MODELING AND SIMULATION**

Contents:

The design of telecommunications system models, starting from the generation of information signals, signal transmission reliably on channels having various characteristics, to the signal detection process at the receiver side. Simulations are carried out to allow the system model to operate within the specified limits, with the aim that interactions between the components in a system model can be observed and system performance can be analyzed. One of the radio communication system performance that will be analyzed is the potential interference between systems, with the SEAMCAT simulator software.

Discussions about material modeling and simulation of analog and digital modulation and demodulation schemes, performance analysis of analog and digital modulation schemes, forward error correction modeling and performance analysis, use of SEAMCAT for calculation and analysis of interference probability between radio systems, use of TEMS predictive tools, drive tests for 2G and 3G networks, post-processing, reporting and optimization of 2G and 3G networks.

[Elective] [TPE 472-475] **CAPITA SELECTA 1- 4**

Contents:

Understanding relevant information that keeps updating in the short time manner. Topics cover in this course can be changing every year, regarding the highlights of the year. Example of topics are: Internet-of-things, Advanced optics cable, etc.

5.2.3 Teaching facilities

There are 8 classrooms that can be utilized for teaching or tutorial for Electrical Engineering Department. Each room is facilitated by one projector, sound systems, whiteboard, and PC.

More details about the teaching facility can be explained in the following table:

Type of Room	Room Capacity [people]	Area [m^2]
Classroom	20	26.9

Classroom	40	476.8
Classroom	40	476.8
Classroom	50	664.4
Classroom	55	64
Classroom	60	480
Classroom	70	518.4
Classroom	75	273.6

In-class situation example can be described as the following picture:

Figure 5.1: Class situation at Atma Jaya Catholic University of Indonesia

5.2.4 Laboratory facilities

The Faculty of Engineering at the Atma Jaya Catholic University, Jakarta, Indonesia is currently operating the following physical laboratory facilities included in the Undergraduate and Postgraduate study programs in Electrical and Electronic Engineering:

ELECTRICAL ENERGY CONVERSION LABORATORY

Description:

The Electrical Energy Conversion Laboratory supports students to understand electric machines such as DC Motors, Synchronous and Induction Machine (asynchronous), Generators (DC and Synchronous), Transformer and Ward-Leonard system.

Figure 5.2: Electrical Energy Conversion Laboratory at Atma Jaya Catholic University of Indonesia

Experiment	Objectives	Outcome
DC machines	• To learn the principle of DC motors • To study the characteristics of DC motors under zero load and loaded conditions, comparing experimental results with theory	Students will be able to understand the working principles of DC Motors: Shunt, Compound & Series.
Synchronous & Asynchronous Motor	• To study the definition and characteristics of synchronous and Asynchronous machine as motor and generator	Students will be able to understand the working principles of Synchronous machine.
DC Generator	• To study the working principle of various DC Generators	Students will be able to understand the characteristics of various types of DC generators, compare the results of experiments with theoretical results.
Synchronous Generator	• To study the characteristics of synchronous generators	Students will be able to assemble parallel systems between synchronous

		generators and PLN grids and find out their advantages and disadvantages.
Transformer	• To observe the working principle of transformers	Students will be able to arranges the equivalent circuit of a single-phase transformer.
Ward Leonard: Asynchronous Motor Movement	• To study the work characteristics of Ward Leonard with asynchronous motor drive	Students will be able to arrange Ward Leonard with Asynchronous Motor Drive.
Ward Leonard: Induction Motor Speed Settings with DC Shunt Motor	• To learn how Ward Leonard works with a DC Shunt motor drive • To study the relationship between DC Shunt motor amplifier (ifM), synchronous generator amplifier (ifG), Frequency input (f), Induction Motor Voltage (VMI), Induction Motor Speed (NI)	Students will be able to understand the principle of Ward Leonard and its relation to the Induction Motor and DC Shunt Motor.

Equipment:

Four (4) sets of Consulab and one (1) set of Labvolt 175 W machines comprising of:

- DC machines
- Transformers
- Three-phase induction motors (squirrel cage rotor and wound rotor)
- Synchronous machine
- Synchronizing module
- Load modules (resistive, inductive and capacitive loads)
- Pony brake and electro dynamometer
- Single-phase motors (universal motor, capacitor start motor, capacitor run motor)
- Power electronic modules (Leybold)

Measuring equipment:

- Multimeters (mostly Fluke 87V)
- Single phase & Three Phase Wattmeter (Yokogawa and H& B Wattavi)
- Power factor meter (Yokogawa)
- Phase sequence meter (Hioki)
- Clamp amperemeter (Hioki)
- Tachometer (Hioki)

- Power Quality meter (Fluke 435, complete with simulator)
- Thermal InfraRed camera (Fluke)

Responsible Person: Ir. V. Budi Kartadinata, SE, MT

Capacity: 30 students

Area: 155.68 m^2

TELECOMMUNICATIONS LABORATORY

Description:

The goal of Telecommunication laboratory is to provide environment for students to learn about the practical skills in communication systems, wireless network, and data networking through structured laboratory activities, research, and other practical works.

Figure 5.3: Telecommunications Laboratory at Atma Jaya Catholic University of Indonesia

Experiment	Objectives	Outcome
Cisco Router I – III	• To learn Cisco router configuration using Hyper Terminal	Students will be able to do initial config to routers, setting password, check connectivity between devices, configure RIP protocol, identify problem on configuring RIP, and troubleshoot basic router problems.
Mikrotik	• To learn Mikrotik Router configuration	Students will be able to use Winbox to configure Mikrotik Router; understand bandwidth limit management and its usage; understand bandwidth limit management by

		using burst.
VoIP I & II	• To study Wireless ad Hoc Network for VoIP, configure VoIP network	Students will be able to configure Wireless ad Hoc Network for VoIP; Implement and configure Wireless ad hoc network for VoIP; Install Asterisk and OSLR on VoIP network; Install VoIP app on Android Phones.
Amplitude Modulation	• To learn Amplitude Modulation and the impact of changing related parameters. Experiment with AM signals, and measure AM signal's depth of modulation	Students will be able to generate a real AM signal by generating pure sinewave to create a message signal; Identify AM signal using scope and compare it to the original message; generate speech signal as a message signal, and modulate it using AM method.

Equipment:

Hardware:

- Router (Cisco 1800 Series)
- Router (Mikrotik RB-433)
- Router TP-Link MR3020
- Switch (Cisco)
- Switch (Mikrotik)
- National Instrument Elvis II
- Emona Telecommunication Trainer ETT 202
- PC units

Software:

- HyperTerminal
- Mikrotik WinBox
- Putty
- winSCP
- Server apps (wamp, xamp, appserv)
- LabView

Other available equipment for research / student thesis / add on activities in some courses:

1. Rohde & Schwarz ZVL Vector Network Analyzer (1 unit)
2. Mikrotik Routerboard CCR101612S1S (5 units), CCR-1036 (1 unit), CCR-1016 (3 units)
3. LoRa CO and N_2 modules (1 kit)

4. IoT kits (Sensors, Microcontrollers, Microcomputers, etc)
5. CST Studio (Free Student Version Software)

Responsible Person: Annisa Sarah, S.T., M.Sc

Capacity: 25 people

Area: 160 m^2

INSTRUMENTATION LABORATORY

Description:

Instrumentation Laboratory provides measuring instrumentation to understand the basic of measuring current, voltage, power, cos phi, and RLC through the series of structured and independent laboratory activities.

Figure 5.4: Instrumentation Laboratory at Atma Jaya Catholic University of Indonesia

Experiment	Objectives	Outcome
	Basic Physics Practice	
Introduction to Measuring Instruments	• To learn the work principle of: Amperemeter, Voltmeter, Ohmmeter, Oscilloscope, Flux-meter, and LCR-meter	Students will be able to operate the measuring instruments independently.
Introduction to Error	• To study error theory and draw linear and logarithmic graphs	Students will be able to identify error in measurement; capable to

Measurements	based on measurement	draw graphics from measurement.
Resistor Circuits	• To study the relationship of: voltage, current and resistors on serial resistor circuits by observing Ohm's law and Kirchoff's Law	Students will be able to explain Ohm's and Kirchoff's Laws based on realistic circuits.
Introduction to AC	• To study Peak-to-peak Amplitude, and effective current/voltage value of AC	Students will be able to identify peak-to-peak amplitude and identify effective current/voltage of AC.
Faraday's Law	• To study the Faraday's law of induction	Students will be able to explain Faraday's law of induction by designing a realistic circuit.
Introduction to Transformers	• To study the transformers parameters, measure the impact of changing number of coil, examine the effect of secondary loads on primary currents.	Students will be able to identify relation between parameters of Transformers.
DC Power Measurements	• To study the impact of changing loads to DC power, comparing DC measurement with multi-meter and wattmeter	Students will be able to identify relationship between loads and DC power; able to identify differences between multi-meter and wattmeter.
Electrical Measurement Practice		
Basic Instrument Calibration	• To study the calibration of DC voltmeter and amperemeter Calibration, AC voltmeter Calibration	Students will be able to calibrate basic measuring instruments independently.
Y and Δ Transformation	• To study Y - Δ Transformation and Δ - Y Transformation	Students will be able to design Y – Δ circuits.
Wheatstone & Kelvin Bridge Experiments	• To measure unidentified load/resistors by using Wheatstone & Kelvin Bridges circuit.	Students will be able operate Wheatstone & Kelvin Bridges Circuit to identify load on several circuits.
RLC in AC voltage	• To study the impedance and resonant frequency on Serial and Parallel RLC	Students will be able to identify impedance and resonant frequency on RLC

Inductance and Capacitance	• To study the Inductance measurement, Capacitance measurement, and Time constant	Students will be able to measure inductance, capacitance and time constants.
Advance Transformer	• To define the equivalent circuit of a transformer • To define the turn ratio of a transformer • To investigating the effect of secondary load to the primary current	Students will be able to identify equivalent circuit of transformers, effective turn ratio, and effect of secondary.
Power measurement of a 3-phase system	• To measure the power of a 3-phase system for Y and Δ load • To calculate the power consumption of a 3-phase system using analog KWh meter • To compare the power consumption of a 3-pahse system using digital and analog KWh meter	Students will be able to measure 3-phase power systems for Y and Δ circuit; able to use KWh meter (analog and digital) to read 3-phase system power consumption.
Power measurement of a single-phase system	• To measure the power of a single-phase system for various loads • To compare the power consumption of a single-phase system using digital KWh meter, analog KWh meter • To manually use wattmeter and stopwatch	Students will be able to measure single-phase systems for various loads; able to use KWh meter (analog and digital) to read 3-phase system power consumption.

Equipment:

- Wheatstone
- Multimeter
- Wattmeter
- Oscilloscope
- Kelvin Bridge
- Power Supply
- Single-Phase and Three-Phase Slide Regulator

- AF Signal Generator
- Capacitor Box
- Inductors
- Resistor Slide
- TL Lamp
- Cos-Phi meter
- KWh meter

Responsible Person: Ir. Theresia Ghozali, M.T

Capacity: 20 people

Area: 116.76 m^2

AUTOMATION AND CONTROL LABORATORY

Description:

The automation and control lab supports student to understand control systems, Programmable Logic Controller, Pneumatic Systems, and Supervisory Control and Data Acquisition (SCADA) through series of laboratory activities and research.

Figure 5.5: Automation and Control Laboratory at Atma Jaya Catholic University of Indonesia

Experiment	Objectives	Outcome
	Basic Control Systems Practice	
DC Servo Motor	• To study system performance by	Students will be able to explain

Setting	using potentiometer • To observe transient response, dead-time system, parameters, and impact of PID controller	DC Servo Motor basic working principles.
Analog System Simulation	• To analyse control system and its transient response • To observe impact of changing system parameters (ζ, ω_n) to its transient response	Students will be able to explain control system by the time domain parameters.
Hybrid Setting	• To study position control of Synchro Transmitter, Synchro Receiver, Synchro Control Transformer, Hybrid Position Control System	Students will be able to understand the working principle of Synchronous Control system and Hybrid Control System.
DC Servo Motor Characteristics Measurement	• To observe and study the response characteristics of the DC Servo Motor system in a no-load state and loaded • To determine the effect of loading on the DC Servo Motor • To determine the amount of frictional force on loaded circuit	Students will be able to identify DC Servo Motor Characteristics.
Resolver	• To study the controller resolver as: coordinate system conversion, phase position sensor and angular velocity measurement	Students will be able to operate resolver independently.
Liquid level measurement	• To study the impact of varying parameters on no-feedback control system and feedback control system • To measure liquid level on water tank	Students will be able to identify effects of varying control parameters to measure liquid level on water tank.
Control System Simulation with MATLAB	• To study the impact of second order systems to resistance ratio (ζ) and natural frequency (ω_n), by introducing unit step	Students will be able to identify the changing of resistance ratio (ζ) and natural frequency (ω_n), by introducing unit step.
Programmable Logic Controller Practice		

Introduction to PLC	• To study Relay function by programming LED Control system and Water Tank Control System	Students will be able to identify basic of PLC programming.
Counter	• To study Counter function by programming LED Feedback Control System with authentication feature	Students will be able to design feedback control system with authentication feature.
Pneumatic Control System	• To study working principle of Pneumatic System	Students will be able to design basic pneumatic control system.

Equipment:

- Basic analog control Modules: Lucas Nulle
- Basic analog control Modules: Feedback MS 150
- Compact PLC: Omron CPM 1A and CPM 2A
- Modular PLC: Schneider M 340 with 16 Discrete Input, 16 Discrete output, 4 Analog Input, 2 Analog output
- Modular PLC: GE Fanuc
- Modular PLC Siemens S 7-300
- Modular PLC Honeywell integrated in a process control Module
- Mini DCS: ABB
- Module od sensors: Schneider
- 3- D Printer

Responsible Person: Ir. Melisa Mulyadi, MT

Capacity: 20 people

Area: 170 m^2

COMPUTER LABORATORY

Description:

The Computer Laboratory provides facility to improve knowledge in computer systems and user interface through structured lab activities and research.

Figure 5.6: Computer Laboratory at Atma Jaya Catholic University of Indonesia

Experiment	Objectives	Outcome
Introduction to SQL & DDL	• To understand the definition of database, RDBMS	Students will be able to understand DDL Commands on SQL Server 2008.
Data Manipulation Language	• To understand the definition of DML	Students will be able to understand DML commands on SQL Server 2008.
Query	• To study the principle of query, subquery and join	Students will be able to operate DML commands, use query, to build database.
View	• To understand View and configure View	Students will be able to use View to configure a virtual table for database.
Security	• To understand basic security on SQL Server 2008	Students will be able to configure basic security operations on SQL server 2008.
Object Explorer, Stored Procedure, Trigger	• To study the principle of Object Explorer, Stored Procedure, Trigger	Students will be able to use Object Explorer, Stored procedure and Trigger on SQL Server 2008.

Equipment:

42 units prebuild PC from HP:

- 32 units with I7 processor
- 10 units with I5 processor

Each PC has specifications:

- SSD 125 GB
- Hard Disk: 1 TB
- Ram: 10 GB Operating System: Windows 10

Application software installed:

- Borland C++
- Visual Studio
- SQL Server
- Notepad ++
- XAMPP

Responsible Person: Dr. Lukas, ST, MAI, CISA

Capacity: 50 people

Area: 155.68 m^2

ELECTRONICS LABORATORY

Description:

The Electronics Laboratory supports student to learn the fundamental of electronics and electronics instrumentation such as Op Amp, Oscillator, Switching, PN Diode, Transistors, JFET and several type of amplifiers.

Figure 5.7: Electronics Laboratory at Atma Jaya Catholic University of Indonesia

Experiment	Objectives	Outcome

Basic Electronics Practice		
PN and Zener Diode Circuit	• To observe and study characteristics of PN and Zener Diode	Students will be able to identify parameters of PN and Zener Diode.
Transistors	• To study characteristic of transistor on common emitter configuration, measure transistor parameters (VCE SAT, VBE, dan ICBO) and the changing of temperature on transistors	Student will be able to identify relation between transistor parameters to its performance.
JFET and Sensors	• To study characteristics of JFET, use JFET as voltage amplifier, as a source of constant current • To study the working principles of Thermistor and LDR	Students will be able to configure JFET as voltage amplifier and source of constant current; able to explain the concept of Thermistor and LDR.
Op-Amp	• To study and analyse amplifying circuits and signal processing by using Op-Amp	Students will be able to use Op-Amp on circuits.
Switching SCR (Silicon Controlled Rectifier)	• To study the working principle of SCR	Students will be able to identify the characteristics of SCR and the impact of using SCR to circuits.
Transistor Amplifier	• To study the characteristics of RC Coupling and Direct Coupling	Students will be able to measure voltage of RC Coupling and Direct Coupling as amplifier.
Feedback Amplifier	• To study the concept of feedback amplifier shunt-series	Students will be able to measure parameters on feedback amplifier shunt-series.
Electronic Systems Instrumentation Practice		
Signal generator	• To study basic circuit of signal generator with op-amp	Students will be able to design signal generator by using op-amp.
LabView Simulation	• To study temperature conversion circuit with Lab View	Students will be able to design diagram blocks by using LabView.
Converter circuits	• To study and analyse working principle of converter (e.g. I – V converter) and digital measuring instruments	Students will be able to design converter circuit and able to operate digital measuring

		instruments.
Oscillator	• To study the working principle of oscillator circuits (audio inductive-capacitive)	Students will be able to operate audio inductive-capacitive oscillator, and identify its oscillation frequency and tank circuit capacitance.
Active filters	• To study and analyse frequency response of Active Filters and Cascade effect of Active Filters	Student will be able to identify corresponding frequency response and cascade effect of Active Filters.

Equipment:

- A/D Converter (ED)
- AC Level-Meter (ED)
- AD Converter (ED)
- Analog Multimeter (Sanwa YX-360TRF)
- Audio Oscillator Model 8209 (Hung Chang)
- Audio SSVM (Trio VT-106 4x)
- Board Pengukuran (3x)
- Clampmeter (Fluke 30)
- D/A Converter (ED 2x)
- DC-Power Supply (Aditeq PS3030S 2x)
- DC-Power Supply (TA-710)
- DC-Power Supply (Universal 4x)
- Digital Counter (Leader LDC825)
- Distortion Meter (Leader LDM-171)
- Active Filter (4x)
- Frequency Counter (Kenwood)
- Frequency Spectrum Analyzer (Sanwa SS-30ST 2x)
- Function Generator (Kenwood FG-273 2x)
- Handheld Digital Multimeter (Matrix Type: MX-0056C)
- IC Regulated Power Supply
- Logic Analyzer (Philips)
- Main Generator (Matrix Type GX-249)
- Micro-controller (Arduino MEGA Dual Kit 2x)
- Micro-controller (Arduino UNO Dual Kit 2x)
- Multi Function Counter Model 8100A

- Multimeter (Fluke 175)
- Multimeter (Matrix MX-56)
- Oscillator (Kenwood AG-203A 7x)
- Oscilloscope 20 MHZ (GW GOS-622G)
- Oscilloscope 20 Mhz (GW GOS-620)
- Oscilloscope 20 MHZ (Leader LBO-522)
- Oscilloscope 20 MHZ (Hung Chang 5502)
- Oscilloscope 20 MHZ (Kenwood CS-4025 2x)
- Oscilloscope Digital 60 Mhz (Tektronix TDS1002)
- Programing Console (Omron)
- Pulse Generator (Philips)
- RF Signal Generator Model GRG 450 B (GW 2x)
- Signal Generator (ED-SG-1200)
- Slide Regulator 1 KVA (Matsunaga)
- Sweep Function Generator (Hung Chang G305 8x)
- SWR Meter (Lodestar)
- Tablet HP Android (Xiaomi 5 Inch 16 GB)
- UPS (ICA)
- Voltmeter (Kaise Sk-5000G 5x)

Responsible Person: Dr. Catherine Olivia Sereati, ST, MT

Capacity: 20 people

Area: 160 m^2

EMBEDDED SYSTEM LABORATORY

Description:

Embedded System laboratory is the facility for students to experimenting knowledge in logic circuits, digital systems, microcontrollers and microprocessors through series of laboratory activity, research and student projects.

Figure 5.8: Embedded System Laboratory at Atma Jaya Catholic University of Indonesia

Experiment	Objectives	Outcome
	Logic Circuit Practice	
Fundamental of Logic Gate, Sequential circuits (flip-flop)	• To study the basic concept of logic gate	Students will be able to design logic gate.
Multiplexer and Demultiplexer	• To study the working principle of Multiplexer and Demultiplexer	Students will be able to design multiplexer and demultiplexer logic circuit.
Decoder and Encoder	• To study the concept of 3 to 8 decoder, binary to decimal decoder, excess 3 gray to decimal decoder and BCD to 7 segment decoder	Students will be able to configure 3 to 8 decoder, binary to decimal decoder, excess 3 gray to decimal decoder, and BCD to 7 segment decoder of decoder and encoder.
Arithmetic Logic Unit	• To study Half Adder Circuit, Full Adder Circuit, Comparator circuit, 4-bit binary full adder, Comparator 4-bit unit	Students will be able to configure Half Adder Circuit, Full Adder Circuit, Comparator circuit, 4-bit binary full adder, Comparator 4-bit unit.
Counter	• To study the synchronous and asynchronous counter circuit by using flip-flop J-K and logic gate	Students will be able to design synchronous and asynchronous counter.
Shift Register	• To study the working principle	Students will be able to design shift

	of shift register	register circuit.
Project Board	• To study the concept of project board and its characteristics	Students will be able to use project board to design circuit.
Microprocessor Systems Practice		
Introduction to MASM and Assembly Language	• To study the MASM 6.15 nd TextPad program, Assembly Language, and its basic command	Students will be able to understand Assembly programming language by using MASM 6.15.
Arithmetic, Logic and Transfer Control	• To study arithmetic, logic and transfer control instructions on a program	Students will be able to use arithmetic, logic and transfer control in programming a microprocessor.
Numeric & ALU application	• To apply arithmetic, logic, and transfer control instruction for numeric application	Students will be able to use arithmetic, logic and transfer control instruction for numeric application program.
Basic I/O interface with Parallel port	• To study input-output instruction, parallel port interface, and working principle of push button & LED.	Students will be able to configure basic input-output program with parallel port.
7-segment, metrics keypad, ADC	• To study the working principle of 7-segment, metrics keypad and ADC	Students will be able to operate 7-segment, metrics keypad and ADC.
DC motor and Stepper motor	• To study the concept of DC Motor and Stepper Motor	Students will be able to design and control movement of Stepper Motor and DC by using Assembly Language.
Port addition	• To study the port addition circuit and configuring digital clock	Students will be able to add port by using Assembly Language, and designing digital clock by using addition port circuit.

Equipment:

- AC Power Supply
- Digital Storage Oscilloscope (Kenwood CS-8010)
- Digital Storage Osciloscope 100 Mhz (Tektronix/TDS2012)
- Eprom Eraser (EE-128)

- Frequency Counter (Kenwood/FC758 2x)
- IC Regulated DC Power Supply (Universal)
- INTEL COMPUTE STICK MINI PC
- Laboratory DC Power Supply (GW GPS-1850 3x)
- Laboratory DC Power Supply (GW/GPS3030D)
- Logic Analyzer (Philips pm 3580/30)
- Multitech MPF-C188 (Kenwood FC-758)
- Multitester (Sanwa/CX506 16x)
- Oscilloscope 20 MHZ (Kenwood CS-4025)
- Programmer Tester (Universal LEAP-4-1)
- Sanfix SGF-520 DDS Function Generator
- True RMS Multimeter (Fluke 87 5x)
- Universal Programmer Tester (All-07A)
- XMEGA Xprotolab (Gabotronics 2x)
- Xminilab Portable (Gabotronics)
- TP - Link 300 Mbps Wireless N Router Gigabit, 3 Antenna - TL-WR1043ND
- Seagate Backup Plus SLIM Edition 1TB USB 3.0
- Canon MP 278

Responsible Person: Nova Eka Budiyanta S.Pd., M.Pd., M.T.

Capacity: 20 people

Area: 120 m^2

5.2.5 Learning/administration management system

Burau of Information Technology Systems is responsible to manage and develop information systems on the university level. Academic, financial, and personal data management systems are ue Microsoft SQL Server and Oracle E-business Suite technology. These technology enables university to manage good and adequate access for all academic community data

For the network access, AJCUI also provides optical fiber-based data communication network infrastructure as a media liaison between buildings on the Semanggi campus. Data access speeds of 1 Gbps for intranets and 160 Mbps for internet (upstream : downstream = 1 : 1). To connect all AJCUI's campuses, we use VPN with data access speeds of 100 Mbps with internet network backup links of 16Mbps and VPN link backup of 10Mbps links.

The facilities used by AJCUI to support academic and general administration include:

- 1411 computers connected to the wide network / internet (Computers in all campuses are

secured by TrendMicro and Smartdav antivirus software to ensure the data security), which the 67 of them are the All-in-one PCs (Intel Core i7) and available for students to register courses, check their records, fill course feedback, study and access digital AtmaLib (university library).

- 244 laptops used for administrative and teaching matters.
- 57 server units, 5 storage to handle the needs of university systems. In average, 650 online users are supported by this server and storage.

To support the administrative activities, AJCUI has access to academic, financial, personnel (HR), e-learning, digital library, and other support services. More detail information of IT platform in which related to students are discussed in the following:

1. For academic access we use MyAtma (https://myatma.atmajaya.ac.id) which also available for Android App version. This address can be accessed by students, teaching staff, and administrator. We use this platform to manage courses such as attendance, schedule, student status (e.g. payment), creating study plan, course registration, and storing student academic records. All of these processes can be accessed both from home and on campus through mobile devices. MyAtma was live since 2016.
2. For prospective students who want to know information about registration and acceptance, can access http://admission.atmajaya.ac.id
3. For the teaching and learning process, AJCUI provides two online platforms: Moodle-based e-learning platform on http://elearning.atmajaya.ac.id and Open-edX-based platform on https://atmazeds.atmajaya.ac.id/

E-learning: Lecturers can provide material in the form of text, web, animation, multimedia, E-books, presentations, and online teaching/ learning processes such as online exams, online assignment gathering, discussions, etc. E-learning atmajaya also has several useful add-ons such as Panopto Videos to manage lecture videos, and Turnitin for plagiarism assessment.

AtmaZeds is an education online platform that offers online courses (Massive Open Online Courses). AtmaZeds concerns about interdisciplinarity. We offer future courses which incorporate inter-relation among subjects. AtmaZeds expands the learning opportunities for everyone interested in new method of learning and thinking. As a MOOC platform, our courses can be accessed wherever and whenever, for free. Courses in AtmaZeds were given by experts in their fields. AtmaZeds is also working with several partners, whether domestic or foreign partners. It could be a quality assurance of courses at AtmaZeds.

4. AJCUI provides digital library on https://lib.atmajaya.ac.id/ which supports searching, extending book loans period, submit book proposals, adding comments for current collection.

5. AJCUI provides career information for prospective graduates on http://help-studentcareer.atmajaya.ac.id

New legitimate courses or curriculum can be updated in the system (MyAtma). This process involves head of study program, Academic Administration Unit, Dean of Faculty of Engineering and Vice Rector.

5.2.6 Approval procedures for new course/program

New courses can be proposed by revising existing curriculum. The new curriculum is developed by the Curriculum Committee that is appointed by the head of the study program. Because the study program has already been accredited an 'A', so we do not need external approval (all the process will be carried out in the university level).

The procedure to revise a curriculum:

1. The new curriculum draft is developed by Internal Curriculum Committee (the member of this committee is from study program and faculty), considering the input or regulation from stakeholders:
   - Tracer study from alumni and users
   - National and International board/ association: Indonesia Forum of Electrical Engineering for Higher Education (FORTEI) and International Accreditation Board for Engineering Education (IABEE)
   - Ministry of Education regulation
2. The new curriculum draft forwarded by the faculty, to Unika Atma Jaya's Enhancement and Development Centre of Instructional Activities Bureau.

5.3 Entry requirements

Student selection criteria

General requirements for prospective students in electrical engineering undergraduate program:

1. Senior high school graduate from natural-science track, students must accustom to have sufficient logical and scientific reasoning to become a Bachelor of Engineering (sarjana teknik).
2. For Jalur Bebas Test (no examination required), prospective students must:
   - surpass minimum grade on 2,5-years high school record. The grade must be > 65.00 out of 100.00 for subjects: Mathematics, Physics and English Language. or,
   - be an achiever, and a part of certain school, institution, organization, that have a strong

partnership with AJCUI. The prospective students must fulfill certain requirement.

- be an achiever on non-academic programs, such as in sports, arts, humanities. The prospective students must fulfill certain requirement.
- Surpass the minimum average grade (67 out of 100) on national exam.
- For regular track, student must pass two examination process: English language test and Academic potential test.

Decision making is done by holding a meeting to determine the results of the selection of new students which is carried out consistently after the Entrance Examination is finished (around 12 times a year). This meeting was held to select students based on the merits that has been determined at each registration period by each study program. The meeting is attended by all parties related to the admission of new students such as head of study program and dean of faculty of engineering.

Planned Students Number

Considering the records of the last five years, our program planned 50 new students for intake 2020/2021 and 2021/2022.

Year	Capacity	New Students		Total Active Students	
		Regular	Transfer	Regular	Transfer
2015	80	41	0	194	0
2016	80	30	0	190	0
2017	80	35	0	167	0
2018	80	20	1	139	1
2019	80	51	0	141	0

5.4 Academic staff

Academic staff is planned based on the specific needs, considering study program development planning, special education staff criteria, students-lecturer ratio. The recruitment and selection system is carried out openly and transparently by the HR Burau. Job vacancy information is conveyed through alumni networks, lecturer colleagues, as well as advertisements in print and online media (e.g.,

www.jobstreet.com). To be a lecturer in Unika Atma Jaya, the employee candidate must possess at least master's degree to teach a bachelor program, and doctoral degree to teach a master program. Prospective employee also must hold the degree within the area of program study/courses needed. The selection process is described in the following:

1. Recruitment process is managed by University Recruitment team, consist of: Vice Rector 1, Vice Rector IV, Head of Human Resource Burau. Assisted by Head of Recruitment Division, Career and training center, and Dean of Faculty of Engineering or assigned person.
2. the interview process of employee candidate must be equipped by TOEFL certificate/result, medical check-up record and psychological test result.
3. TOEFL must be taken in Language Learning Centre in Unika Atma Jaya, with minimum score is 500.
4. Medical check up must be recorded in Unika Atma Jaya Hospital
5. Psychological test must be taken in professional institution outside Unika Atma Jaya

5.5 SWOT analysis

Internal factors

STRENGTHS:

1. Popular private university, positive reputation in the external community
2. Positive experience from users (company)
3. Acknowledge (accredited) as "A" nationally, and recognized by IABEE (International Accreditation Board of Electrical Engineering)
4. High number of partnerships with international university in Asia and Europe
5. Great campus facility within safe and innovative area

WEAKNESSES:

1. Ability to retain number of students
2. Traditional teaching/learning systems for most of the courses
3. Lack of research motivation for several academic staff
4. Student diversity of preparedness at entrance
5. Lack of professors and staff outbound

6. Low number of partnerships with industry (national and international)
7. Daunting administrative task for academic staff

External factors

OPPORTUNITIES:

1. Seek new market strategy to getting Gen-Z students
2. Expose academic staff to increase academic international experience
3. Tie more partnerships with industries
4. Applying many research and academic development grant
5. Increase interest in global exposure (student inbound)

THREATS:

1. Development of Competitor from other university within the same city
2. Qualitative achievement is not quite appreciated
3. Student perception of education shifting to only getting a degree
4. Negative public perception due to lack of knowledge about program study

◇◆◇

6 *Soegijapranata Catholic University*

Soegijapranata Catholic University was founded on August 5, 1982 as the continuation of Atma Jaya Catholic University Semarang and Semarang Catholic Institute of Technology. In its early days, Soegijapranata Catholic University was located at Jl. Pandanaran 100 Semarang and consisted of three faculties: the Faculty of Technology, Law, and Economics. In the mid-1990s, the university built a new campus in Bendan Duwur because of the increase of the student body. Since the mid-1990s, educational activities have been entirely centered in this campus. In 1992, the university also built a campus located on Jl. Menteri Supeno Semarang. This downtown campus building is used for the Centre for Language Training to provide English language classes for university students and the public.

The Department of Electrical Engineering Soegijapranata Catholic University opened on 4th February 1993 that is registered by the Director General of Higher Education (DIKTI) Ministry of National Education Republic of Indonesia with decree no. 881 / Dikti / Kep / 1993 with last accreditation scored B from 2011.

The development of electrical engineering studies could be varying with increasing demand in industry and advancement in science itself, so it needs to be developed in its own field of study, for example:

- Electrical Power Engineering
- Telecommunication and Informatics
- Electronics
- Industrial Application

Nowadays, Department of Electrical Engineering Soegijapranata Catholic University have 2 major programs, that are Industrial Electronics and Robotics Mechatronics, in which way the alumnae could supporting and developing their knowledge for the industrial and national developments.

Since 1 March 2012, Department of Electrical Engineering is joined with Faculty of Engineering, before was Faculty of Industrial Engineering.

6.1 Program aims and learning outcomes

Based on values of knowledge in electrical engineering, **Department of Electrical Engineering**, Faculty of Engineering, Soegijapranata Catholic University would be:

- enforcing education in field of electrical engineering with major on Industrial Electronics and Robotics Mechatronics that qualified academically
- committing researches in the field of electrical engineering, with major on Industrial Electronics and Robotics Mechatronics to develop science and technology for enhancements

in human welfare

- performing community services as application of electrical engineering studies generally and concentrate on Industrial Engineering and Robotic Mechatronics that have been developed in researches for social welfare
- developing networks with institutions that related with the field of electrical engineering in regional and International, in order to achieved improvement on educational quality with integrated researches and community services
- improving the curriculum of Department of Electrical Engineering, Faculty of Engineering continuously in order to increasing the quality of electrical engineering education.

The main competencies of Electrical Engineering graduates of the Soegijapranata Catholic University Semarang University are:

- able to adapt, have personality, be independent and have good leadership
- able to solve problems systematically through analysis and have good innovation power so that they can work professionally
- able to solve problems in the field of Industrial and Mechatronic-Robotic Applications, Electrical Energy Conversion and Alternative Energy, Static Converters, Electrical Machines, Industrial Automation, Analog and Digital Control, Electric Power Quality, Industrial Instrumentation, PLC, Embedded Programming and Computer Utilization to support existing systems in the industry, Computer Technology, Control, Internet Programming, Programming, Robotics, Mechatronics, Hardware Programming, Interface Systems, Multimedia Systems, Image and Sound Processing, Data Encoding and Encryption which are implemented computationally based.

The large number of foreign workers in Indonesia has encouraged Electrical Engineering graduates of the Soegijapranata Catholic University Semarang to be more equipped with supporting competencies. Because the Electrical Engineering discipline is universal, English is a must to master. English courses are given during the lecture period to provide supporting competencies. Another step taken is to use supporting materials for lectures (proceedings, journals or other material) in English. In lectures there are sometimes articles in the Electrical Engineering journal in English to be discussed and understood. Using international seminar media for students who want to graduate without a bachelor exam. Please note that students who make presentations at national / international seminar events will be exempt from undergraduate examinations.

The main competencies and supporters that have been described above become the foundation of graduate quality. On the other hand, the study program also provides additional competencies that are optional or optional by students. Additional competencies include deepening of microcontrollers, robotics and green energy. For this reason, the study program offers students the opportunity to take

part in extra-curricular teaching in the Upper Middle School related to microcontroller and robotics. Through research groups, the study program also includes students contributing to the implementation of research related to solar energy or other.

6.2 Program structure and resources

6.2.1 Credit system

One credit is equivalent with 170 minutes learning per week:

- 50 minutes in classroom (with lecturer)
- 60 minutes out of classroom learning (library, lab, etc.)
- 60 minutes for homework or project

The average number of credit unit per semester is 20. The students need a total of 144 credit units in 8 semesters to complete the bachelor program.

BACHELOR PROGRAM: *Electrical Engineering*		
Code	**Course Name**	**Credits**
UKS 101	Religion	2
UKS 102	Pancasila	2
UKS 103	Civic	2
UKS 109	English	2
TEE 101	Calculus	3
TEE 102	Physics	3
TEE 103	Basic Electrical Engineering	3
TEE 104	Basic Telecommunications	2

TEE 124P	Basic Electronics LAB	1
TEE 111	Differential Equation	3
TEE 112	Linear Algebra	2
TEE 113	Programming	4
TEE 114	Electromagnetic Field	3
TEE 115	Electric Energy Conversion	3
TEE 116	Electric Circuit Analysis	4
TEE 117P	Basic Telecommunication LAB	1
TEE 201	Electronics	4
TEE 202	Control System	2
TEE 203	Reseach Method	3
TEE 204	Electrical Instrumentation and Meansurement	4
TEE 205	Digital System	4
TEE 206P	Electric Circuit and Meansurement LAB	1
TEE 207P	Electric Energy Conversion LAB	1
	Probability and statistics	2
TEE 211	Microprocessor and Microcontrol	3
TEE 212 TEE232	Electric Motor Electric Machine	4

TEE 213	Power Electronics	4
TEE 214	Communication System	2
TEE 215 TEE235	Engineering Drawings (CAD) Engineering Drawings (CAD)	2
TEE 216 TEE236	Actuator and Sensor Energy Economy	2
TEE 217P	Electronics LAB	1
TEE 218	Complex Variable	2
TEE 219	Data Communication	2
TEE 301	Digital Signal Processing	4
TEE 302	Electric Transportation	4
TEE 303	Industrial Computation	4
TEE 304P	Microprocessor and Microcontrol LAB	1
TEE 305P	Digital LAB	1
TEE 306P	Control System LAB	1
TEE 307 TEE 337	Static Converter Design Converter Technology Design	4
TEE 308	Embedded System	2
TEE 311	Computer Organization	3
TEE 312	Entrepreneurship	2

TEE 313	Discrete Control	2
TEE 314P	Power Electronics LAB	1
TEE 315 TEE 335	Electric Drive Hydro and Wind Energy	4
TEE 316 TEE 336	Electric Power Supply Electric Power System	4
TEE 317P TEE337	Electric Drive LAB Renewable Energy LAB I	1
TEE 401	Environmental Science	2
TEE 402	KKN (Service Learning)	2
TEE 403	Internship	2
TEE 404	Electric Power Quality	4
TEE 405	Renewable Energy Applied PV	4
TEE 406P	Electric Power Suplly LAB Renewable Energy LAB II	1
TEE411	Thesis	4
TEE412	Bachelor Exams	4
	TOTAL:	144

6.2.2 Courses

BACHELOR PROGRAM: *Electrical Engineering*

[UKS 101] **RELIGION**

Objectives:

Provide insights to students about the general understanding of religious tolerance in society.

Methodology [hours/week]:

- Lecture: 1
- Tutorial: 2

[UKS 102] **PANCASILA**

Objectives:

Learn about the ideology of the state of Indonesia, namely Pancasila. Provide an understanding of the love of the motherland and the nation and anti-corruption education.

Methodology [hours/week]:

- Lecture: 1
- Tutorial: 2

[UKS 103] **CIVIC**

Objectives:

Learn about being a good citizen related to rights and obligations, among others; obey regulations, taxes and defend the country.

Methodology [hours/week]:

- Lecture: 1
- Tutorial: 2

[UKS 109] **ENGLISH**

Objectives:

Students master the skills to take the International English Test. The test includes listening skills, language structure and written expressions and comprehensive reading.

Methodology [hours/week]:

- Lecture: 2
- Tutorial: 2

[TEE 102] **PHYSICS**

Contents:

Kinematics in one and two dimension, dynamic, and Newton law concerning motion, uniform rectilinear motion, accelerated uniform motion, Free fall motion, Circular motion, gravitation, work and energy, temperature, heat, and thermodynamics law, Electric field discussing Coulomb's law, electric potential, capacitance, calculating direct current circuit and simple electric power.

Methodology [hours/week]:

- Lecture: 1
- Tutorial: 3

[TEE 101] **CALCULUS**

Contents:

Number systems (real and imaginary numbers), functions and graphics, Derivatives, applied derivatives, Integral, Applied integrals, transcendent functions, polar coordinates, sequences and sequences.

Methodology [hours/week]:

- Lecture: 1
- Tutorial: 3

[TEE 103] **BASIC ELECTRICAL ENGINEERING**

Contents:

Basic principle of electric electrical engineering, basic electrical conversion concept, basic electrical law

concept, simple control concept, motor concept, digital control concept.

Methodology [hours/week]:

- Lecture: 1
- Tutorial: 3

[TEE 104] **BASIC TELECOMMUNICATIONS**

Contents:

Fundamental of data communication, computer network and analogue modulation. Material discussed in this subject include layered approach on data communication network, data communication network devices and its configuration method, observation scheme on data communication network, analog amplitude modulation, angle modulation and phase modulation.

Methodology [hours/week]:

- Lecture: 1
- Tutorial: 2

[TEE 111] **DIFFERENTIAL EQUATION**

Contents:

Ordinary differential equations of order 1 and 2 with fixed, homogeneous and non-homogeneous coefficients accompanied by initial conditions, completion with Laplace transforms, lift series methods, Bessel functions, Fourier, Fourier integrals and function recognition, Legendre.

Methodology [hours/week]:

- Lecture: 1
- Tutorial: 3

[TEE 112] **LINEAR ALGEBRA**

Contents:

Vectors in R1, R2, and R3, vector algebra, systems of linear equations, Matrices, determinants and algebra matrices, matrix inverses, linear transformations, eigenvalues and eigenvectors, vector algebra, Green theorem, Gauss, Stokes, differential and Integral vectors, theorems about scalar fields.

Methodology [hours/week]:

- Lecture: 1
- Tutorial: 2

[TEE 113] **PROGRAMMING**

Contents:

Introduction to information technology, flowchart, and basic programming using Borland C. Basic programming in this course would discuss input/output statement, selection statement, looping statement, and function. Borland C ++ programming with array, string, structure, and Object-Oriented Programming (OOP) and visual programming.

Methodology [hours/week]:

- Lecture: 2
- Tutorial: 4

[TEE 114] **ELECTROMAGNETIC FIELD**

Contents:

Electric field discussing Coulomb's law, electric potential, capacitance, calculating direct current circuit and simple electric power. Magnetic field discussing magnetic force, magnetic induction, Faraday and Lenz law, inductance concept, understanding and solving simple alternate current circuit. Electromagnetic field basic concepts such as electrostatics, magneto statics and field. Electromagnetic based on Maxwell equation formulation. Time varying fields, Maxwell contribution for displacement current. Electromagnetic application relevant with discussion concepts.

Methodology [hours/week]:

- Lecture: 1
- Tutorial: 3

[TEE 115] **ELECTRIC ENERGY CONVERSION**

Contents:

The basis of energy conversion, from mechanics to electricity and vice versa, from light to electricity and vice versa, from chemistry to electricity and vice versa, from electric to electric through the power

electronic component.

Methodology [hours/week]:

- Lecture: 1
- Tutorial: 3

[TEE 116] **ELECTRIC CIRCUIT ANALYSIS**

Contents:

Unit system of charge, current, voltage, power, energy, resistor, resistor in series/parallel size or Δ-Y relations, voltage divider and current divider, capacitor, and inductor. Ohm's Law and Kirchoff's Law, KCL and KVL, resistive circuits, transient order-1 circuits (RC and RL), transient order-2 circuits (series/parallel RLC), and circuit analysis using node method, mesh method and various technique that can be used in performing circuit analysis, such as superposition theorem, source transformation, Thevenin's and Norton's equivalent circuits, Sinusoidal function, complex and phasor and phasor diagram. Circuit analysis with various method and power on circuits with sinusoidal source. Frequency response, quality factor. Apparent power, reactive power, real power, power factor, maximum power transfer. Three phases voltage source. Load on 3 phases system, magnetically coupled/transformer circuits.

Methodology [hours/week]:

- Lecture: 1
- Tutorial: 4

[TEE 201] **ELECTRONICS**

Contents:

Semiconductor material, diode characteristic and diode circuit's application, introduction to transistor and FET characteristic, transistor and FET biasing method, logic gate circuits and amplifier operational circuits. Class A, B and AB power amplifier, one level/more amplifier using BJT and FET with various configuration. Low, medium and high frequency response of amplifier circuits followed with amplifier circuit analysis with negative feedback and oscillator circuits.

Methodology [hours/week]:

- Lecture: 2
- Tutorial: 4

[TEE 202] **CONTROL SYSTEM**

Objectives:

The objective of this module will introduce the fundamental principles of analysis and design of control systems using linear methods, time and frequency responses. The simulation will familiarize actual control techniques.

Contents:

Introduction of control system, Concept model, Reduction system, Bang-bang controller, Proportional controller, Proportional plus integral controller, Proportional plus integral plus differential controller, Stability analysis.

Methodology [hours/week]:

- Lecture: 1
- Tutorial: 2
- Practical: 0
- Independent: 0

[TEE 203] **RESEARCH METHOD**

Objectives:

The aim of research method is to know and understand the steps that will be taken in a study: knowledge of Science, research methodology, formulation of research problems, frameworks and hypotheses, variables and methods of measurement, research objects and methods, sources and techniques of data collection, data analysis, conclusion making, scientific writing and reports.

Methodology [hours/week]:

- Lecture: 1
- Tutorial: 3

[TEE 204] **ELECTRICAL INSTRUMENTATION AND MEASUREMENT**

Contents:

Electric measurement tools usage and its application mastering within circuits. Fundamental of measurement technique, electric measurement tool active working principle, Construction and

electric measurement tools working requirement, Galvanometer, electrical indicator instrument, wattmeter, integrating instrument. Circuits for: resistance, voltage, current and power measurement, alternate current measurement, alternate current source for measurement.

Methodology [hours/week]:

- Lecture: 2
- Tutorial: 4

[TEE 205] **DIGITAL SYSTEM**

Contents:

Number system, Boole algebra, truth table, logic gates of AND, OR, NOT, NAND, NOR, XOR and XNOR. Boole function, Boole function simplification algebraically, Karnaugh map, tabulation. Combinational logic circuit design, Circuits of adder, sub tractor, comparator, code changer, odd/even parity, decoder, encoder, multiplexer and de-multiplexer. Analysis and synthesis of sequential, register, counter circuits, memory, ADC and DAC.

Methodology [hours/week]:

- Lecture: 2
- Tutorial: 3

[TEE 208] **PROBABILITY AND STATISTICS**

Contents:

Set theory, probability principle, random changes, distribution functions, average values, variance, first, second and third moments, standard deviations, Estimates, Expectations, Regression, random processes, density functions.

Methodology [hours/week]:

- Lecture: 1
- Tutorial: 2

[TEE 211] **MICROPROCESSOR AND MICROCONTROL**

Objectives:

To develop the basic concepts on the constructional details, working principle of microprocessor and

microcontroller, conceptual design, simulation and hardware implementation.

Contents:

Overview of microprocessors and microcontrollers, data bus, address bus and control bus, the memory, program counter, register, flag, microprocessor programming, Microcontroller, input and output ports, microcontroller programming, The interface, communication between systems: parallel and serial.

Methodology [hours/week]:

- Lecture: 2
- Tutorial: 4

[TEE 212] **ELECTRIC MOTOR**

Objectives:

To develop the basic concepts on the constructional details, working principle of DC motor, induction motor, Stepper Motor, BLDC Motor, Switched Reluctance Motor, conceptual analysis and control, simulation and hardware implementation.

Methodology [hours/week]:

- Lecture: 1
- Tutorial: 4

[TEE 232] **ELECTRIC MACHINE**

Objectives:

To develop the basic concepts on the constructional details, working principle of DC Motors and Generators, AC Motors and AC Generators, BLDC Motors and BLDC Generators, Switched Reluctance Motors and Generators.

Methodology [hours/week]:

- Lecture: 1
- Tutorial: 4

[TEE 213] **POWER ELECTRONICS**

Objectives:

To develop the basic concepts on the constructional details, working principle, electric to electric conversion via power semiconductor, conceptual analysis, simulation and hardware implementation.

Contents:

Introduction of power electronic, Power semiconductor devices, Uncontrolled rectifier, Controlled rectifier, DC-DC Converter, Inverter, AC Chopper, Gate driver design.

Methodology [hours/week]:

- Lecture: 1
- Tutorial: 4

[TEE 214] **COMMUNICATION SYSTEM**

Contents:

In this lecture, models and elements of digital communication systems are discussed: sources information, transmitters, channels and receivers, information and channel capacity: BW transmission, transmission rate, BER, bit energy, white noise (AWGN), Shannon's theorem, Signal conversion analog to digital and vice versa, Digital base band signal transmission, Digital modulation: ASK, FSK, BPSK, QPSK, OQPSK, MSK, Type of interference in digital transmission, Signal detection in noise environments: Matched filter, Synchronization and Introduction to Communication Systems spread spectrum.

Methodology [hours/week]:

- Lecture: 1
- Tutorial: 2

[TEE 215] **ENGINEERING DRAWINGS (CAD)**

Objectives:

Students master skills related to electrical drawing either manually or using computer facilities (CAD): symbols of electrical and electronic images, drawing electronic diagrams, PCBs, and electrical installations.

Methodology [hours/week]:

- Lecture: 1

- Tutorial: 2

[TEE 216] **ACTUATOR AND SENSOR**

Contents:

Resistive censors, inductive censors, capacitive censors, magnetic censors, light censors, pneumatic actuators, DC motor, stepping motor, servo motor, and driver controller.

Methodology [hours/week]:

- Lecture: 2
- Tutorial: 2

[TEE 236] **ENERGY ECONOMY**

Contents:

Energy Policy, Load analysis, Energy savings, Load requirements analysis.

Methodology [hours/week]:

- Lecture: 1
- Tutorial: 2

[TEE 218] **COMPLEX VARIABLE**

Contents:

Complex number systems, functions with complex variables, complex function integrals, integrals in complex fields, residual theory and their applications, conformal mapping.

Methodology [hours/week]:

- Lecture: 1
- Tutorial: 2

[TEE 219] **DATA COMMUNICATION**

Objectives:

To develop the basic concepts and advance on the conceptual design, simulation of data

communication.

Contents:

Introduction, Communication model, Digital & Analog transmission, Multiplexing, Transmission Media, Circuit switching, Packet switching, OSI model, Layer: 1,2,3, Networking, Wide area network, Frame relay, ATM, ISDN, LAN, Protocol.

Methodology [hours/week]:

- Lecture: 1
- Tutorial: 2

[TEE 301] **DIGITAL SIGNAL PROCESSING**

Objectives:

To develop the basic concepts and advance on the conceptual design and simulation of Digital signal processing.

Contents:

Theory of sampling, Fourier analysis, Transformation z, Fourier transform, Digital Filter, FIR filter, Filter IIR, Analog Filter, Implementation of Filters.

Methodology [hours/week]:

- Lecture: 2
- Tutorial: 4

[TEE 302] **ELECTRIC TRANSPORTATION**

Objectives:

To introduction the basic concepts and advance on the conceptual design and control of electric transportation.

Contents:

Traction Motor, Regenerative Braking, Dynamic Braking, Electric and Hybrid Electric Vehicle, Electric Railways, Battery, Fuel Cell**.**

Methodology [hours/week]:

- Lecture: 1

- Tutorial: 4

[TEE 303] **INDUSTRIAL COMPUTATION**

Objectives:

To develop the basic concepts and advance on the conceptual design and control, simulation of industrial control based on PLC.

Contents:

Introduction of industrial control, Industrial censors, Industrial actuators, Boolean algebra, Relay contactor control, Ladder diagram, Pneumatic language, PLC, Advance programming, HMI.

Methodology [hours/week]:

- Lecture: 2
- Tutorial: 4

[TEE 307] **STATIC CONVERTER DESIGN**

Objectives:

Learn, simulate and implement: AC-DC Converter, DC-DC Converter, DC-AC Converter, AVR, Grid Connected System.

Methodology [hours/week]:

- Lecture: 1
- Tutorial: 4

[TEE 337] **CONVERTER TECHNOLOGY DESIGN**

Contents:

Learn, simulate and implement a new of technology: PWM Rectifier, DC-DC Converter, DC-AC Converter, Active Power Filter, Grid Connected System.

Methodology [hours/week]:

- Lecture: 1
- Tutorial: 4

[TEE 308] **EMBEDDED SYSTEM**

Objectives:

To develop the basic concepts and advance on the conceptual design and control, simulation of digital control.

Contents:

Introduction to Embedded Computing, Embedded System Architecture, Designing Embedded Computing Platform, Programming Embedded Systems, Operating System, Interfacing, Sensor and actuator, Communication and Network Based, Embedded Control Applications, Embedded System Development.

Methodology [hours/week]:

- Lecture: 1
- Tutorial: 2

[TEE 311] **COMPUTER ORGANIZATION**

Objectives:

This course studies the relationship between the main components of the development of a computer system in processing based on the classification of computer architecture and techniques used to improve the performance of computer system processing.

Contents:

Computer Architecture, Functions and Structure of Computer Architecture, CPU, ALU, Control Unit (CU), I/O system, Bus system, pipelining, set instruction, memory.

Methodology [hours/week]:

- Lecture: 1
- Tutorial: 3

[TEE 312] **ENTREPRENEURSHIP**

Objectives:

In essence, entrepreneurship is not just talent that is carried from birth and can be just practiced in

the business field. Entrepreneurship in addition can be learned, too must be widely internalized through the education process. Individuals who have entrepreneur spirit is an individual who knows his potential well, learns develop the potential to see and create opportunities to realize his ideals.

Methodology [hours/week]:

- Lecture: 1
- Tutorial: 2

[TEE 313] **DISCRETE CONTROL**

Objectives:

The objective of this module is to introduce the fundamental principles of analysis and design of digital control systems methods, the simulation will familiarize actual control techniques.

Contents:

Introduction to digital control system, Digital Bang-bang controller, Digital Proportional controller, Digital Proportional plus integral controller, Digital Proportional plus integral plus differential controller, State Space Control and analysis, Fuzzy Logic.

Methodology [hours/week]:

- Lecture: 1
- Tutorial: 2

[TEE 315] **ELECTRIC DRIVE**

Objectives:

To develop the basic concepts and advance on the conceptual design and control, simulation of DC motor and induction motor.

Contents:

DC Motor Drive, AC Motor Drive Volt per Hertz, Space Vector Modulation, AC Motor Drive DTC, Micro stepping in Stepper Motor, Basic of BLDC Motor Drive, Basic of SRM Motor Drive.

Methodology [hours/week]:

- Lecture: 1
- Tutorial: 4

[TEE 316] **ELECTRIC POWER SUPPLY**

Objectives:

To develop the basic concepts on the constructional details, working principle of electric power supply, conceptual analysis and control, simulation and hardware implementation.

Contents:

Basic Power Supply, Linear Power Supply, Switching Power Supply, HF transformer, Forward Converter, Fly back Converter, Push-Pull Converter, Half-Bridge Converter, Full-Bridge Converter

Methodology [hours/week]:

- Lecture: 1
- Tutorial: 4

[TEE 335] **HYDRO AND WIND ENERGY**

Contents:

Dam Requirements, Water Turbine Type, Governor, Hydroelectric Generator, Wind Turbine, PLTB Generator, Voltage regulation.

Methodology [hours/week]:

- Lecture: 1
- Tutorial: 4

[TEE 336] **ELECTRIC POWER SYSTEM**

Contents:

Electric energy generation systems, transmission systems, distribution, power system analysis and power system stability.

Methodology [hours/week]:

- Lecture: 1
- Tutorial: 4

[TEE 401] **ENVIRONMENTAL SCIENCE**

Objectives:

Give students the ability to: understand basic concepts about the environment, understand and analyze existing environmental problems, both on a local, regional and scale globally, understanding the importance of concepts sustainable development and environmentally friendly facing all activities related to the environment, knowing alternative solutions to environmental problems with an ecological approach and technological touch.

Methodology [hours/week]:

- Lecture: 1
- Tutorial: 2

[TEE 402] **KKN**

Objectives:

Implementing theoretical science/lecturing use in common society. Student makes some project according selected topic or observing field/industrial micro condition and projects result reported in form of report and presentation.

Methodology [hours/week]:

- Lecture: 1
- Tutorial: 2

[TEE 403] **INTERNSHIP**

Objectives:

Implementing theoretical science/lecturing use with industrial field conditions. Student makes internship on suitable company according selected topic. Observing field/industrial condition or Observation result reported in form of report and presentation.

Methodology [hours/week]:

- Lecture: 1
- Tutorial: 2

[TEE 404] **ELECTRIC POWER QUALITY**

Objectives:

To introduction the basic concepts and advance on the conceptual design and control of power quality based on simulation.

Contents:

Basic Power Quality Problems. PQ Disturbance, Harmonics and Nonlinear Loads, Power theory related to PQ, Active Power Filter, Dynamic Voltage Restorer, Other Compensators.

Methodology [hours/week]:

- Lecture: 1
- Tutorial: 4

[TEE 405] **RENEWABLE ENERGY**

Objectives:

This course studies the concepts of an energy produced from sources that do not deplete or can be replenished within a human's lifetime. The most common examples include wind, solar, geothermal, biomass, and hydropower.

Contents:

Photovoltaic, Wind turbine, Fuel cell, Biomass, Micro hydro, hybrid system, batteries and storage system, Off grid design, On grid design.

Methodology [hours/week]:

- Lecture: 1
- Tutorial: 4

[TEE 423] **APPLIED PV**

Contents:

Solar Panel, MPPT, Battery, Standalone operation, PV-Grid Connected System, PV system design.

Methodology [hours/week]:

- Lecture: 1
- Tutorial: 4

[TEE 411] **THESIS**

Objectives:

Make a final project about certain material that can include: System analysis, software design and hardware implementation in laboratory and making thesis report.

Methodology [hours/week]:

- Lecture: 1
- Tutorial: 4

[TEE 412] **FINAL EXAM**

Objectives:

Testing about certain material from the final project results which can include; system analysis, hardware or software design or alternative exams with IEEE indexed scientific publications.

Methodology [hours/week]:

- Lecture: Team
- Tutorial: 4

6.2.3 Teaching facilities

With the eACCESS program implemented, the additional facilities will be needed so that the new learning program (new courses) can be implemented well. The Soegijapranata Catholic University already has an online learning system under cyber.unika.ac.id which allows distance learning to be carried out by modifying learning material that is integrated with the online system. Currently, the 5 teaching rooms construction has standards as follows:

- Minimum space capacity of 50 students
- Wifi facilities
- LCD projectors
- Computers

This room can be operated from 08:00 to 20:00 GMT. This facility is considered to have met the readiness of the program to be carried out.

Preparation of laboratory room has been provided to implement the Microgrid Laboratory, which is integrated with the Electrical Energy Conversion Laboratory, Power Electronics Laboratory and Electric Drive Laboratory. The capacity of available laboratory can accommodate 20 students per practicum

which is normally done for 3 hours. The laboratory room can serve practicum from 08:00 to 16:00 GMT, so the ability of this laboratory is very adequate.

6.2.4 Laboratory facilities

The Faculty of Engineering, Soegijapranata Catholic University, Semarang, Indonesia is operating at the moment the following physical laboratory facilities included in the Electrical Engineering Undergraduate Program:

BASIC ELECTRONIC LABORATORY

Description:

The objective of this laboratory is to developed practical skills in the design, prototyping and testing basic electronic circuits: micro controller based Led Blinking, micro controller based 7 segments, micro controller-based LCD display.

Figure 6.1: Basic Electronics Laboratory

Experiment	Objectives	Outcome
Design of PCB PIC Microchip	• To draw using TARGET software package, etching, soldering and	Students are capable to design the PCB for Microchip PIC microcontroller.

	testing of the designed circuits	
Design of Led blinking module	• To design the PCB for Led blinking control	Students acquire skills to design and assemble the PCB for LED Blinking.
Design of LCD Module	• To design the PCB for LCD	
Design of 7 segment Module	• To design the PCB for 7 segments	

Equipment:

- TARGET software
- MikroC software
- Debugger PICKIT2 software

Responsible Person: Prof. Slamet Riyadi, Academic Staff
AnjarTriyanto, Technician

Capacity: 20 students

ELECTRIC CIRCUIT AND MEASUREMENT LABORATORY

Description:

Students observe and analyze the circuit configurations and do the measurements.

Figure 6.2: Electric Circuit and Measurements Station

Experiment	Objectives	Outcome
Ohm Law, Series and Parallel Circuit	• To analyse the current and voltage of the circuits that are series and parallel connected	Students can design, setup and analyse basic electrical circuits.
Magnetic Coupling Circuit	• To analyse the current direction and voltage polarity of the magnetic coupling circuits	Students can build and analyse operation of magnetic circuits.
Power in AC Circuit	• To learn how to measure power in AC circuits	Students knows how to use watt meter, how to measure power in single phase circuit, how to measure power in three phase circuit.
Lagging and Leading Circuit	• To analyse the relationship between current and voltage on RL and RC circuits	Students can analyse the current and voltage on RL and RC circuits.

Equipment:

- Resistors
- AC power supply units
- Voltmeters, amperemeters
- Oscilloscopes
- Jumpers
- Watt meters, VAr meters

Responsible Person: Prof. Slamet Riyadi, Academic Staff
Anjar Triyanto, Technician

Capacity: 20 students

ELECTRIC DRIVE LABORATORY

Description:

Students learn how to control and analyze operation of various electric drives.

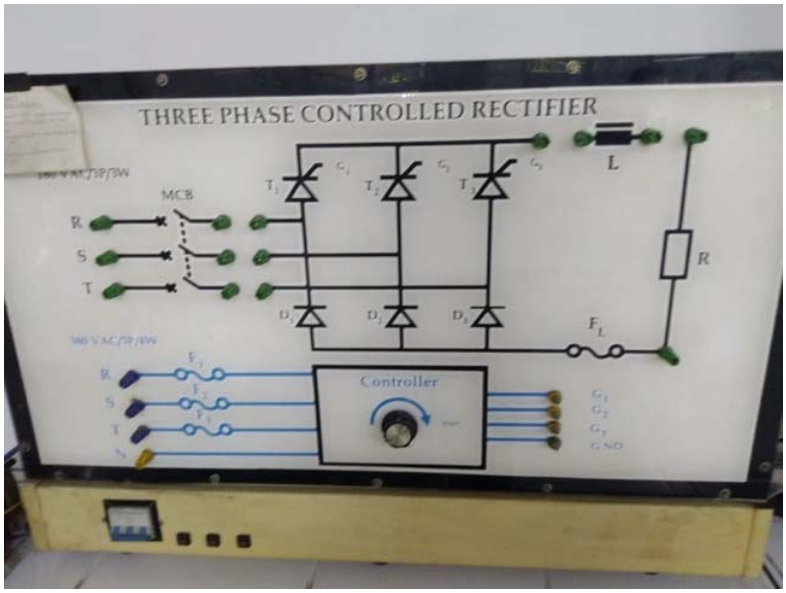

Figure 6.3: Electric Drive Station

Experiment	Objectives	Outcome
DC Motor Drive	• To operate and analyse the DC motor Drive using Chopper	Students can analyze the operation principle of DC motor Drive. They understand the relationship between the voltage and speed signals.
AC Induction Motor Drive	• To operate and analyse the AC motor drive using VVVF Inverter	Students can analyze and understand the operation characteristics of AC motor drive. They understand the relationship between the voltage, frequency and speed
Stepper Motor Drive	• To operate and analyse the Stepper motor drive L298 Driver	Students can operate stepper motor in full step mode, in half step mode and in micro step mode.
SRM Motor Drive	• To operate and analyse the SRM motor drive	Students can operate SRM motor and they are capable of programming dsPIC for SRM motor control.

Equipment:

- AC supply
- Power Rectifier

- DC-DC Chopper
- DC Motor
- Voltmeter, Amperemeter
- Tachometer
- Jumpers
- VVVF Inverter
- AC Induction Motor
- SRM Motor
- L298 Driver
- Oscilloscope
- BLDC Motor
- Current sensor
- Miller Converter

Responsible Person: Prof. Slamet Riyadi, Academic Staff

Capacity: 20 students

POWER SUPPLY LABORATORY

Description:

In this physical laboratory students design, develop and tests various types of power electronic converters.

Figure 6.4: Power Supply Laboratory Station

Experiment	Objectives	Outcome
Forward Converter	• To design and test the forward converter	Students are capable of designing forward converter type switching power supply. They can test and analyse operation of the developed device.
Flyback Converter	• To design and test the flyback converter	Students are capable of designing flyback converter. They can test and analyse operation of the developed device.
Push-Pull Converter	• To design and test the push-pull converter	Students are capable of designing the push-pull converter. They can test and analyse operation of the developed device.
Half-Bridge Converter	• To design and test the half-bridge converter.	Students can design, implement and test the half-bridge converter. They can analyse operation of the developed device

Equipment:

- DC supply
- Voltmeter, Amperemeter
- Oscilloscope
- Jumpers
- Half-bridge converter
- Full-bridge converter
- Push-pull converter
- Flyback converter
- Forward converter

Responsible Person: Prof. Slamet Riyadi, academic staff

Capacity: 20 students

ENERGY CONVERSION LABORATORY

Description:

In this laboratory students have the possibility to study in practice operation of DC motors, DC generators, synchronous generators, induction motors, universal motor and power transformers.

Figure 6.5: Energy Conversion Station Laboratory

Experiment	Objectives	Outcome
Starting induction motor	• To operate induction motors	Students understand motor wiring diagram. They know principles of the motor protection design and settings. They can to test motor protection operation
Power transformer	• To familiarize students with the impact of the design and parameters of power transformers	Students understand wiring schemes, principles of operation and the influence of technical parameters of power transformers. They can perform basic transformer tests.
DC motor and generator	• To familiarize students with the design and parameters of DC motors and generators	Students understand wiring of DC motors and generators, operation principles and parameters. They are able to control DC motor and generator. They can perform basic DC motor tests.
Synchronous generator	• To familiarize students with the design and parameters of synchronous generators	Students understand operation connection diagram, principles of synchronous generators and the impact of their technical parameters. They are able to control synchronous machines.
Universal motor	• To familiarize students with the design and parameters of universal motors	Students understand the wiring, design and technical parameters of universal motors. They can perform basic tests.

Equipment:

- Induction motor
- Induction motor starting module
- Power transformer
- Power supply unit
- Power meter
- Amperemeter, Voltmeter
- Load
- DC motor-generator
- Synchronous generator
- Universal motor

Responsible Person: Leonardus Heru Pratomo, Dr Eng.

Capacity: 20 students

POWER ELECTRONIC LABORATORY

Description:

In this laboratory students have the possibility to study in practice operation and control methods of AC-DC, DC-DC, DC-AC and AC-AC converters.

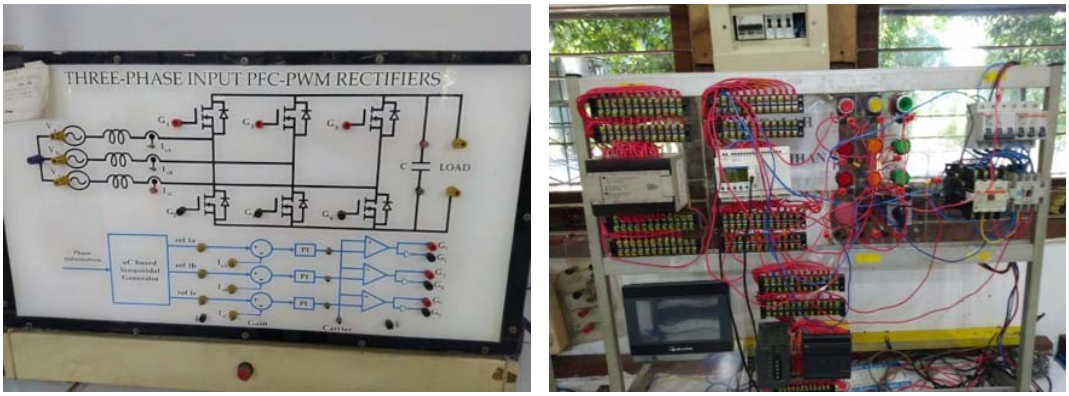

Figure 6.6: Power Electronics Station

Experiment	Objectives	Outcome
AC-DC	• To familiarize students	Students understand operation of AC-DC converters

Rectifier	with principles of the operation of AC-DC rectifiers	including single phase AC-DC converter, three phase AC-DC converter, 12-pulse rectifier. They can perform basic technical tests on these devices.
DC-DC Converter	• To familiarize students with principles of the operation of DC-DC converters	Students understand operation of DC-DC converters including buck chopper, boost chopper, buck-boost chopper converters. They can perform basic technical tests on these devices.
DC-AC Converter	• To familiarize students with principles of the operation of DC-AC inverters	Students understand operation of DC-AC single phase and 3-phase inverters. They can perform basic technical tests on these devices.
AC-AC Converter	• To familiarize students with principles of the operation of AC-AC converters	Students understand operation of AC-AC converters. They can perform basic technical tests on these devices.

Equipment:

- AC-DC, DC-DC, DC-AC and AC-AC converters
- Loads
- Oscilloscope
- Power supply unit

Responsible Person: Leonardus Heru Pratomo, Dr Eng.

Capacity: 20 students

CONTROL SYSTEM LABORATORY

Description:

In this laboratory students have their hands-on experience regarding control system including bang-bang control, P, PI, PD and PID controller design, settings and operation.

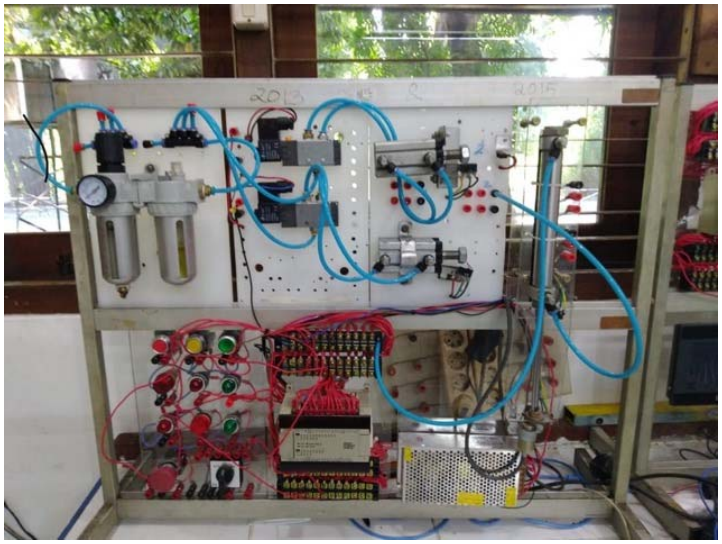

Figure 6.7: Control Laboratory Station

Experiment	Objectives	Outcome
Op-Amp Circuits	• To teach students practical aspects of the design and operation of basic control system components	Students understand operation principles and can operate the following devices inverting amplifier, non-inverting amplifier, error detector, summing amplifier, comparator, comparator, zero offset controller.
Controller	• To learn the practical aspects of the design and operation of basic closed loop and open look controllers	Students understand operation principles and can operate the following controllers: proportional controller, integral controller, differential controller, bang-bang controller. They can adjust parameters and perform basic performance tests.
Combinational Controller	• To learn the practical aspects of the design and operation of advanced closed loop controllers	Students understand operation principles and can operate the following controllers: PI, PD, PID. They can adjust parameters and perform basic performance tests.

Equipment:

- Op-amp module
- Proteus/PSIM voltmeter
- Oscilloscope

- PI, PD, PID control units

Responsible Person: Leonardus Heru Pratomo, Dr Eng.

Capacity: 20 students

ELECTRONIC LABORATORY

Description:

In this laboratory students have the possibility to experiment with the basic electronic components.

Figure 6.8: Electronics Laboratory Station

Experiment	Objectives	Outcome
Diode	• To study practicalities concerning diode application	Students understand operational characteristics and limitations of various diode components (general purpose diode, fast diode, Zener diode, clamping diode, cutting diode, rectifier diode). They can use diodes in practical implementations, measure and assess diode parameters.
Transistor	• To study practicalities concerning transistor application	Students understand operational characteristics and limitations of various transistor components (BJT transistor MOSFET transistors). They can use diodes in practical implementations (transistor amplifier,

		MOSFET amplifier), and measure and assess transistor parameters.
Op-Amp	• To study operational characteristics an implementation of op-am p components	Students can determine op-am parameters, including frequency response (wideband amplifier). They know basic applications using this electronic component.

Equipment:

- Diode components
- Transistor components
- Proteus/PSIM
- Oscilloscope

Responsible Person: Prof. Slamet Riyadi, Academic Staff
Anjar Triyanto, Technician

Capacity: 20 students

MICROPROCESSOR LABORATORY

Description:

The purpose of this laboratory is to give students the opportunity to work with microprocessor components, design systems based on microprocessors and to develop programming skills.

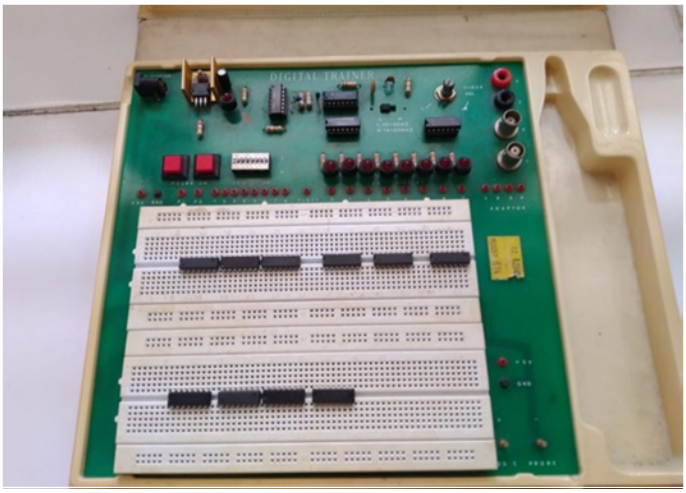

Figure 6.9: Trainer for Microprocessor and Microcontroller

Experiment	Objectives	Outcome
Microprocessor	• To study basic, operational characteristics and implementation of Microprocessor (Z80)	Students understand microprocessor basic, characteristics and programming. They understand many aspects of microprocessor including: ◦ part of microprocessor ◦ assembly programming ◦ addressing ◦ memory access ◦ input output system
Microcontroller	• To study basic, operational characteristics and implementation of Microcontroller (ATMega8385)	Students understand microcontroller basic, characteristics and programming. They understand many aspects of microcontroller including: ◦ part of microcontroller ◦ C programming using CVAVR ◦ PORT ◦ memory access ◦ input output system (LED, Keypad, dot-matrix display, LCD display)

Equipment:

- Z80 assembler
- Z80 simulator
- Proteus
- CAVR

Responsible Person: Florentinus Budi Setiawan, Dr Eng.

Capacity: 20 students

BASIC TELECOMMUNICATION LABORATORY

Figure 6.10: Basic Telecommunication Laboratory Station

Experiment	Objectives	Outcome
Analog filter	• To study theory, characteristics and implementation of analogue filter	Students understand basic filter. They understand many aspects of analogue filter including: ◦ Low Pass Filter ◦ High Pass Filter ◦ Band Pass Filter ◦ Band Stop Filter
Modulation	• To study theory, characteristics and implementation of analogue modulation	Students understand analog modulation basic. They understand many aspects of analogue modulation and demodulation including: ◦ AM DSB FC ◦ AM DBS SC ◦ AM SSB ◦ FM

Equipment:

- Filter station

- Modulator Station
- Signal generator
- Oscilloscope

Responsible Person: Florentinus Budi Setiawan, Dr Eng.

Capacity: 20 students

6.2.5 Learning/administration management system

Procedure for taking courses until they get grades

1. Department announces courses to be held in the current semester.
2. Students fill courses to be taken through the application sitak.unika.ac.id/mahasiswa
3. Lecturers do acc courses through the application sintak.unika.ac.id/staff/
4. It is possible for students to revise their courses by proposing changes to the lecturer
5. Lectures were held 14 times
6. After 7 meetings, a midterm will be held
7. After the next 7 meetings, the final semester exam will take place
8. After two weeks of final semester examinations, the grades of the courses must be reported through sintak.unika.ac.id/staff/
9. The grades that have been submitted are announced to students and after there are no complaints, they will be authorized by the head of department then submitted to the university's academic administration bureau
10. The accumulated grades of courses that have been taken can be seen in full in sintak.unika.ac.id/mahasiswa/

Procedure for using lecture classrooms

1. The head of the department makes class schedules and rooms that are used through the application sintak.unika.ac.id/staff/
2. If a schedule is changed, the lecturer must report the change to the head of department for acc

Standard room facilities

1. Wi-Fi in every classroom
2. LED projector in every classroom
3. Air Conditioner in every classroom
4. Sound system in every classroom
5. Fire extinguishers
6. White board with the accessories

Standard lecturer facilities

1. Laptop
2. Laser pointer
3. Login password for Wi-Fi with excellent facilities

Learning System

The Faculty, through the Chair of the Study Program, monitors and evaluates the learning process from the Minutes of Lectures of each lecturer. Each lecturer is required to complete a complete Minutes of Lecture. In the Minutes of Lecture, the columns are listed for the number of lectures (face-to-face) that have been carried out, the beginning and end of the lecture, the lecture material, the number of students present, lecturer initials, initials of the student, the necessary information.

Every 2 months after the lecture begins and 2 months before the lecture ends various lecture problems are discussed in the meeting and look for a solution, so that the number of lectures can reach a maximum, which is 14 weeks (lecture duration = 2 hours per week for 2 credit hours; 3 hours per course weeks for courses 3 credits; and 4 hours per week for courses 4 credits).

The learning system is built based on relevant planning to achieve goals and realize the vision and mission of the faculty. Learning is carried out using a variety of challenging strategies and techniques, encouraging students to think critically, explore, create and experiment by utilizing various sources. The implementation of learning has a mechanism to monitor, study, and periodically improve lecture activities (the presence of lecturers and students), preparation of lecture material, and assessment of learning outcomes. The mechanism used to monitor lectures, including the presence of lecturers and students, as well as lecture material is carried out by each Study Program using tools in the form of student lecture attendance, minutes of lectures and lecture evaluations.

Lecture Presence

Lecture attendance is a means of monitoring student attendance in lectures. Lecture presentations are arranged for each course class. The lecture attendance form contains the names and NIM of students who are entitled to attend the course and the blank column is the number of meetings planned to be held. The student's name and ID are printed in the presence as a control system in determining students who are entitled to attend the lecture. The empty column is the number of meetings used for the place where students give their signatures as proof of their attendance at the lecture concerned. The number of lectures that must be held by each subject class is a minimum of 14 meetings in one semester.

Other information presented in the presence sheet is a description of the courses that are held, the semester and academic year, the faculty and study programs of the organizer. This information is seen at the top of the lecture presence. With this information, errors in signing as proof of attendance will be reduced and the presence will be well documented.

Minutes of Lecture

Minutes of lectures is a means of controlling the implementation of lectures which contains information about: Subjects carried out, names of lecturers, meeting dates, planned material given and how they are realized, the number of students present at the time and signature of lecturer attendance. Minutes of lectures serve as a means of controlling several things related to the course of lectures.

First, the minutes of the lecture will show the suitability of the material taught with the syllabus of the lecture set at the beginning of the lecture. This is indicated by the suitability of material realization.

Second, the minutes of lectures will show the suitability of the number of meetings held with the minimum number of lectures that must be held. Periodically the lecture date data that has been held will be compared with the academic calendar, so that the Faculty can give a warning (if any) to lecturers who have not yet held the planned number of meetings. Thus, at the end of each semester, a total of 14 meetings can be held.

Third, the minutes of lectures will show the suitability of the number of students who take part in lectures held with attendance signatures.

Fourth, the minutes of lectures will show evidence of the presence of lecturers in the lectures concerned. This was indicated by the lecturer signature in the Minutes of Lecture.

In accordance with the procedures in the Quality Assurance System, minutes of lectures are mandatory to be filled in every lecture. So that the minutes of this event can be trusted, in each meeting there must be a student representative who gives a signature that what is written in the minutes of the event already reflects the conditions that occur in class.

Lecture Evaluation

Evaluation of lectures is an evaluation of the ongoing lecture process. This evaluation is given in the form of a questionnaire containing an evaluation of the lectures that have been going on. Questionnaires were given to students to evaluate the organization of lectures in each course.

6.2.6 Approval procedures for new course/program

The curriculum review mechanism is as follows:

- The Dean or Chair of the Study Program appoints a Task Force to conduct a comparative study at universities that have Electrical Engineering study programs to see the existing curriculum. It also can be done by looking at data or information through an existing website.
- Conduct a Study Program meeting to follow up and discuss data related to the curriculum that

has been obtained.

- Ordered the Task Force to prepare a new curriculum.
- Conduct a Study Program meeting to discuss the curriculum design that has been prepared.
- Hold a discussion by inviting outsiders.
- Make revisions to the curriculum design based on input from interested parties.
- Conduct a Study Program meeting related to an improved curriculum which is subsequently endorsed by the Chancellor.

6.3 Entry requirements

Student selection criteria

- Graduated High School / Vocational High School (SMA / SMK).
- Pass the Selection Test.
- Not color blind for applicants who want to enter the Medical Study Program, Architecture, Visual Communication Design, Psychology, Electro Engineering, Energy Technology, Food Technology and Nutrition, and Culinary Technology.
- No physical disabilities that can interfere with fluency and psychological disorders for registrants who want to enter the Medicine and Psychology study program.
- Free from drug use or addiction to drugs / alcohol (Registrants are required to complete the declaration provided at the time of re-registration).
- Free of criminal acts (Registrants are required to complete a statement that has been provided at the time of re-registration).
- Able to obey the provisions in force at Soegijapranata Semarang University.

Planned Students Number

50 students per semester.

6.4 Academic staff

Teaching and/or Laboratory Staff Recruitment Procedure

This procedure (069/Unika/FTI/QSP/XI/08) is established as a guide for the appointment of new or permanent Teaching and Laboratory Staff in the Electrical Engineering Study Program of SCU environment so that teaching and learning activities can be well-formed.

1. The head of Electrical Engineering Program looks at the needs of teaching and/or laboratory staff.
2. The head of Electrical Engineering Program proposes to the dean of the faculty of engineering.
3. Faculty deans meet the needs of teaching and/or laboratory staff through faculty meetings.
4. Based on the results of the faculty meeting, the dean proposed to the SCU rector.
5. The SCU rector will consider teaching and/or laboratory staff needs then create job vacancies
6. After there are a number of people applying for teaching and/or laboratory staff, then the tests include: graduate grade (minimum master's degree for teaching staff and Bachelor degree for Laboratory staff), field suitability, ability, psychological test and English language (Minimum ITP Toefl 500).
7. Test results are given to the dean of the faculty to determine the selection
8. The dean of the faculty through the meeting determines his choice with the head of Electrical Engineering Program.
9. The results are given to the SCU rector and selected applicants can start their work.

Laboratory Assistant Recruitment Procedure

This procedure (032/Unika/FTI/QSP/IV/08) is established as a guide for laboratory assistant recruitment in the Electrical Engineering Program so that the practicum process can run orderly and smoothly.

1. The head of Electrical Engineering Program looks at the needs of laboratory assistance.
2. The head of Electrical Engineering Program announced the recruitment of laboratory assistant with the criteria: have completed courses related to the minimum grade of Good.
3. After a number of people have applied for laboratory assistant, the head of Electrical Engineering Program determines the choice together with practicum supporting lecturer.
4. The selected laboratory assistant can start their work.

6.5 SWOT analysis

Internal factors

STRENGTHS:

1. The Apostolix ex Corde Ecclisie constitution as a guideline in the organization of Soegijapranata Catholic University is very possible for the development of the Electrical Engineering Study Program of the Faculty of Engineering, including in the development and development of human resources for character building.
2. The use of "Soegijapranata" as the name of the University, this provides inspiration in implementing the Tridharma of higher education that is imbued with the spirit of struggle and devotion to the homeland and the nation.
3. The Electrical Engineering Study Program has specialized areas of expertise, namely the Industrial Application field and the Renewable Energy field.
4. Accredited Electrical Engineering Study Program B.
5. The Electrical Engineering Study Program of the Faculty of Engineering, Soegijapranata Catholic University, is increasingly recognized and recognized for its excellence among stakeholders.
6. Vision to be superior in every Tridharma component of higher education supported by the development of cooperation and always trying to improve themselves.
7. The mission is to carry out all the components of the Tridharma of higher education, cooperation and willingness to carry out continuous improvement.
8. The democratically elected leadership of the study program has had a positive impact on existing human resources to race to give their best. The Chair of the chosen Study Program will be directly evaluated by the voters themselves.
9. The transfer of authority from the university to the study program has a shorter impact on the bureaucracy.
10. Already have ISO Quality System Procedures.
11. Having a permanent lecturer with a minimum of S-2 and a relatively ideal lecturer-student ratio (ratio 1: 15,11), can support student activities.
12. Relationships between lecturers and students are collegial and democratic.
13. Admission of new students tends to increase.

14. Relatively adequate infrastructure and facilities to support student activities, both academic and non-academic.
15. The availability of Student Personality Development Training Program (PPKM) for the development of students' personality and academic abilities. The training program is known as ATGW (Awakening The Giant Within).
16. There are student activity units at the study program level that channel and support the interests / talents of students.
17. Student organizations (Faculty Student Senate and Faculty Student Executive Board) exist and are running well.
18. Support of facilities and infrastructure that are relatively adequate for student activities, including sports fields and student secretaries, canteens, student counseling institutions, and spiritual services.
19. A well-organized recruitment and selection system.
20. All Electrical Engineering study program lecturers hold a minimum of a Masters degree and most have received educator certification.
21. the existence of performance evaluations both academic and educational personnel have had a standardized system, for example KPO, EWMP, AEP.
22. There are institutions that aim to facilitate human resource development and employee welfare, such as LPSDM, CTL, LPT, and Clinic.
23. The achievements of the Electrical Engineering Study Program lecturer, namely as a model lecturer at the Kopertis VI region.
24. The number of research grants obtained by lecturers, such as Hiber, Dikti, Research and Technology, etc.
25. The existence of the Staffing Regulations and the Code of Ethics and Campus Association
26. Have a curriculum with characteristics and content that support each other.
27. Have competencies that have been adjusted to market needs.
28. Having a concentration in the field of expertise that encourages students to deepen their competence and develop themselves.
29. Learning methods vary.
30. Have SAP.
31. The final project is supported by making hardware (prototypes) giving more practical ability.

32. Supporting lecture facilities.
33. The interaction between lecturers and lecturers-students takes place well through informal discussions and meetings.
34. Lecturers and students play an active role in national seminars, symposia and others, this shows the ability to compete.
35. Graduates have relatively short waiting times in obtaining employment.
36. The response back from the graduate users who gave very good value for the abilities of the alumni.
37. Has a prototype work that is quite a lot as support in developing innovation capabilities.
38. Have 2 500 kVA generator sets.
39. Management and accountability of the use of funds is quite good.
40. Budgeting always involves a study program.
41. Budgeting is based on activity based, so that the use of the budget can be efficient and effective.
42. Means of learning in the classroom are already using netbooks, LCD projectors and audio systems.
43. Each lecturer gets computer facilities and is connected to the internet.
44. Available information systems with adequate capacity.
45. Availability of adequate hotspot facilities.
46. Many institutions provide funding for research and service.
47. The lecturers have good research skills, seen from the success in obtaining research funding from various institutions.
48. Availability of routine funds from the university for research and community service.
49. Having a network of cooperation with external parties so as to provide a good opportunity to conduct research and community service.
50. Has several students who are interested in developing research and community service:
    - A broader partnership with stakeholders can contribute to the development of study programs.
    - Collaboration in terms of research with government agencies such as Balitbang Central

Java Province and Dikti.

WEAKNESSES:

1. As experienced by most private universities in general, the quality of students who are accepted is relatively lacking to realize the goal requires a lot of energy and thought.
2. The geographic location of the city of Semarang is not very supportive because it is not one of the major education cities with leading tertiary institutions.
3. The low structural allowance makes it difficult for lecturers with good human resources to participate in filling structural positions.
4. The small number of lecturers makes a double position so that makes it work overloaded.
5. Unequal distribution of student participation in student activities.
6. The activity preferences of some students lead to certain activities which do not support academic activities.
7. A centralized budget with a proportional system can limit the scope for developing student activities.
8. The culture of seniority still often impedes the organization.
9. The number of lecturers is relatively small
10. Limitations on the number of students in college concentration becomes an obstacle in the implementation of lectures.
11. Making a prototype as a supporter of the Final Project involves higher costs.
12. The active role of lecturers and students in national level scientific meetings requires financial support.
13. Study programs do not have the authority to manage their own finances.
14. Budgeting is based on the number of students who enrolled.
15. The use of one internet provider, so that when the provider experiences an interruption, internet access stops.
16. Lecturer activities are still dominated by the teaching sector, for the fields of research, publications, and community service, it is still not evenly distributed among all lecturers.
17. Collaboration with foreign institutions other than universities.

External factors

OPPORTUNITIES:

1. The autonomy policy for universities has given freedom in developing study programs according to the abilities and demands of the community.
2. The maximum age limit for the Chair of the Study Program 50 years has been reviewed by the University so that the selection of candidates for the Chair of the Study Program can be followed by HR more competitive.
3. The existence of ISO Quality System Procedures, makes management more uniform and has standardized standards.
4. There are still many high schools, mainly public schools, that have not been touched by promotion programs in the context of new student admissions.
5. Technological developments and wide and dynamic employment opportunities provide opportunities to develop reasoning.
6. There are institutions such as the Ministry of Research and Technology and Higher Education, the Association of Catholic Colleges (APTIK), and companies that offer training and self-development programs and scholarships.
7. Open opportunities for collaboration with institutions that aim to develop the quality of lecturers.
8. There is an opportunity to develop the ability of lecturers by participating in scientific seminars, workshops, workshops and exhibitions that are conducted regularly.
9. The curriculum is open for maximum development for 5 years.
10. Can freely enter local and special content in concentration courses.
11. Each subject can choose the appropriate learning method.
12. Laboratory equipment that helps design Final Project prototypes according to their area of expertise.
13. The average age of lecturers who are young has a spirit of competition.
14. Establish funding collaboration with other agencies / companies for various programs of activities that benefit both parties.
15. Alumni can be involved to raise cooperation that brings in funds.
16. The available information system can be utilized to improve the competence of lecturers, especially in updating lecture materials.

17. The possibility of conducting lectures and guidance by utilizing the information system that is already available.
18. The opportunity to cooperation with outside parties is wide open.

THREATS:

1. The number of differentiation of electrical engineering that is increasingly evolving demands to be able to develop more fixed scientific disciplines in society.
2. The very striking difference in structural allowances from public universities can trigger a reluctance of HR with high ability to occupy structural positions.
3. Increasing competition between universities.
4. Exploring external funds requires creativity.
5. There are still many lecturers who have not been actively involved in professional organizations.
6. A more detailed understanding of concentration courses requires students to study hard
7. The number of concentration courses requires that lecturers have additional expertise and must always be developed.
8. Competition between universities which is getting tougher will affect the income of funds through students.
9. Procurement and maintenance costs are quite large, while information technology is growing
10. The development of information systems and internet-based elearning applications requires a very large internet bandwidth.
11. Must compete with State Universities in building cooperation and partnerships.

◇◆◇

7 Conclusions

The eACCESS partner universities exhibit a sufficient background with respect to their existing educational programs regarding Electrical Engineering. They all possess initial infrastructure, course structures and staff upon which eACCESS can build to enhance their educational offerings.

On the other hand, in all partner universities there are aspects reported as weaknesses or threats that hinder their respective viability and prospects for further growth. For example, infrastructure is in some cases inadequate or outdated. At the same time, the teaching/learning systems are not able to follow the rapid advancements in electrical engineering technology, creating thus threats regarding the competitive edge of the universities in the job market. Moreover, in some cases the administrative processes are not supported by adequate information systems, resulting thus in a prohibiting burden for the respective staff involved.

These weaknesses pose as an opportunity for the eACCESS project to help strengthen the respective existing partner university educational offerings. More specifically, eACCESS can contribute to the modernization of the partner university course programs and teaching techniques as well as to the enhancement of the supporting infrastructure. At the same time, the project can also offer assistance in the modernization of the respective administrative procedures, through the provision of an effective information system.

FINAL REMARKS	
1	
2	
3	
4	
ETC	