Erasmus+ - Key Action 2

Capacity Building within the Field of Higher Education

eACCESS Project

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EU-Asia Collaboration for aCcessible Education in Smart Power Systems

WP 1	PREPARATION
TASK 1.2	Feasibility study of the implementation of new teaching modules
LEAD PARTNER	TUL
PARTICIPATING PARTNERS	TUL, KEC, PU, RUB, ATM, SCU

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EXECUTIVE SUMMARY

The deliverable D1.2 documents the procedure and results of the preparation of academic curriculum modernization plans for five partner universities (Task T1.2 Feasibility study of the implementation of new teaching modules).

Based on the outcomes of audits conducted as a part of Task 1.1, the methodology for the selection and specification of new or upgraded subjects and courses focusing on the most important aspects of the modern power system engineering has been developed.

Working together with European partners, the new curricula for electrical power engineering undergraduate and master course have been designed (KEC). For other partner universities (PU, RUB, ATM, SCU) which have already offered bachelor and/or master courses in the field of electrical power engineering, the necessary adaptation of new subjects and the scope for the modernization of the contents of already available subjects, have been decided.

The approval process for the introduction of new and modernized courses have been described including timelines concerning the implementation process and the risk analysis. The outcome shows that in normal operation conditions, full implementation of new courses would be possible (including formal approval process) within a two-year period. However, the current COVID-19 pandemic, has a serious impact on the daily operation of all partner universities and blocked and slowed down the administrative actions. On the top of that, for one partner university (KEC) which is going to implement brand new courses, major changes in the state (Nepal) higher education policy, created new regulations and obstacles, which invalidated early planned approval strategies for the new courses. The effective and feasible solutions to overcome these problems within the capacities and time framework of the eACCESS project have been suggested and agreed.

The selection of subjects for the development and modernization both at the undergraduate and master level resulted in between 9% and 30% new teaching material (assessment based on the allocated academic credits to the selected subjects) which will be prepared under the collaboration between European and Asian partners. The scope of this cooperation under the umbrella of the eACCESS project have been defined for each of the selected subjects, stimuli for the development or upgrading of subjects' contents have been explained, as well as necessary capacities including human resources already available or necessary (to be provided in the nearest future), as well as laboratory facilities, were described.

All together the eACCESS project and European partners will support development or modernization of the teaching contents of at least 3-4 different subjects at undergraduate and master study level of electrical engineering courses. These are predominately specialisation subjects of last study semesters (5-8 semester) dealing with advanced issues of power system operation and application of information and communication technologies in the process of the development and operation of modern power systems using sustainable, environment-friendly sources (renewables) and smart grid infrastructure, empowering end consumers, offering wide spread, easy access to electrical energy in undeveloped regions and to underprivileged social groups, and introducing transparency and fair competition rules to the power energy sector.

The analysis of the application process shows that the consortium needs two academic years to implement the new courses and/or modernized subjects and validated this process within regular teaching activities conducted at partner universities in normal operational conditions.

I. Introduction

The deliverable D1.2, Feasibility study of the implementation of new teaching modules makes part of the Pillar I of the eACCESS project dealing with the development and/or modernization of the academic curriculum at partner universities to introduce or improve courses relevant to the modern, smart power engineering knowledge and skills.

The primary objective of the deliverable D1.2 was the final selection of existing or new subjects which will be later on supported by experts from the European universities.

The selection process was based on the outcome of the deliverable D1.1, which provided the most important findings from the audits conducted at Asian partner universities which helped European partner universities to learn about the already available relevant courses and subjects, as well as teaching facilities.

Decisions concerning the scope of the modernization and development of new academic courses and modernization or the introduction of new subjects were driven by several aspects including expectations or requirements of the job market as regarding the power sector, available human and technical resources both at the Asian partner universities and at the assisting European partners, administrative issues (mainly related to the approval process of new courses and new subjects), financial feasibility and the implementation timeline. The last issue and thus the final selection of subjects and courses were very much constricted by the requirement established in the CBHE Program regulations to deliver to students the new or modernized course units and entire courses within the duration of the eACCESS project.

The following selection and implementation process (see Figure 1) has been developed and applied for the optimal, while feasible modernization process and which will further help to manage the complex procedures and deliverable preparation of the Pillar I of the eACCESS project. The Steps 1-6 have been resolved within the deliverables D1.1 and D1.2. The Steps 7-9b will be addressed by the deliverables of the work package WP2 and the Steps 9a-11 will be addressed by the deliverables of the work package WP3 and WP6. A detailed plan for the management of these steps will be developed by the coordinator of the Pillar 1 (PPC1, AUTH) of the eACCESS project.

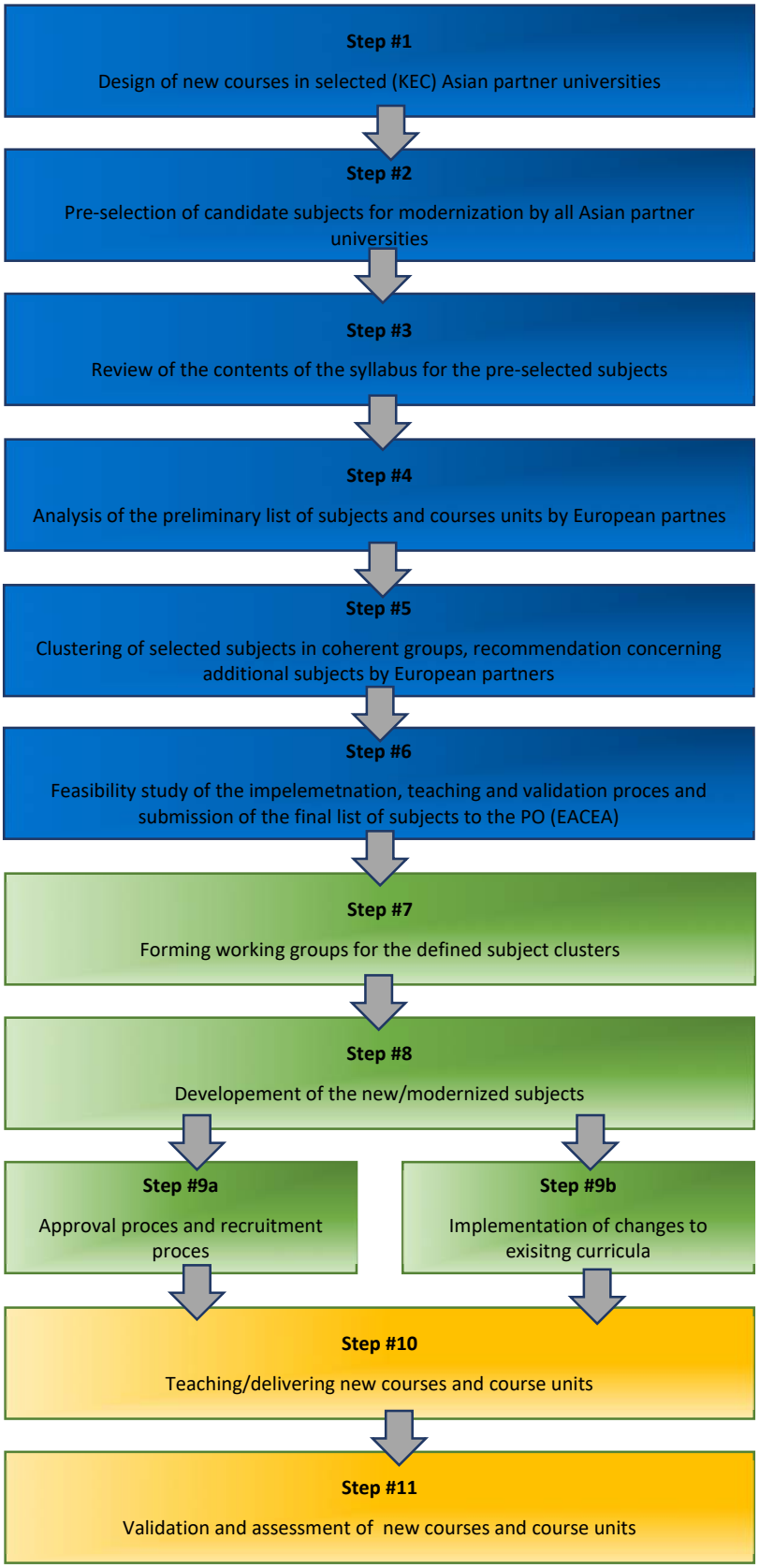

Figure 1 The processing algorithm for eACCESS curriculum modernization (Pillar I)

As regarding the internal (at partner university) and external (at the consortium level) analysis of the pre-selected subjects, the following aspects were considered:

a) **Learning outcome**. This feature was used to identify common characteristics and dissimilarities among pre-selected subjects for the clustering process.
b) **Teaching methods and learning activities**. The information helped to recognize different strategies in delivering the selected course units in the grouping process and it will help to manage the work within clusters in the future.
c) **Assessment methods**. The way the verification of expected learning outcomes is implemented influences the efficiency and credibility of any subject teaching. This aspect was used for the identification of differences in the internal assessments of learning outcomes because eACCESS project will be looking for standardization and accurate and comprehensive assessment procedures which will pave the way for student and teacher mobility, at domestic and regional levels.
d) **Motivations for the modernization of the curriculum**. This is the key aspect of the questionnaire which will help the consortium to manage future work (work packages Development, Steps 7-9), will help to identify the local drivers for changes in the curriculum. In the second stage of the work, this information will be used to chart a detailed plan for the scope of changes in the programs and the contents of individual subjects.
e) **Availability of teaching staff**. In this aspect, we were looking for possible vacancies in the academic staff which might make difficult future subject development, implementation and later on, also the teaching process. This information will help to monitor the progress at the partner universities regarding appointing new resources and remover any relevant obstacles as soon as possible (see also the next point concerning staff training requirements).
f) **Staff training requirements**. This information should help European partners to prepare a tailored training program for the academic staff at partner universities during the second stage of the project implementation. It will mostly influence the planning and implementation of the deliverable D2.8 which is dealing with the tutor training process.
g) **Requirements concerning the formal approval processes for new courses and changes to the existing curriculum**. This is very important evaluation benchmark as for some partners the formal approval process for new course units, but in particular for new courses, might be a time-consuming process, with some administrative and technical risk particularly in the case of small provincial universities. It will help partners to find the optimal solution to obtain the external approval (if necessary) and/or to prepare for the internal assessment.
h) **Preliminary implementation timeline and the key dates and deadlines**. This information is related to the implementation years of the project as it is necessary to accommodate both the delivery and evaluation steps within the project duration. It is a particularly important question in the current pandemic situation when many universities put on hold both the recruitment process and teaching activities. More to that, in the case of implementation of entire new courses, particularly undergraduate level lasting 7 or 8 semesters, it is hardly possible to validate the eACCESS contribution to the development of the selected course units scheduled for last semesters and complete this process before the end of the project. These factors will be taken into consideration in the planning of the second stage of the eACCESS project implementation.
i) **Technical support including provision of the necessary infrastructure**. The introduction of new courses and new or modernized subjects is sometimes linked with

necessary extension or development of teaching facilities like teaching equipment, teaching space, etc. The selection of subjects to be supported by eACCESS projects are in many cases related also to the third pillar of the project which is the development of laboratory infrastructures at partner universities, which will require coordination between the curriculum modernization process and the design of the new (or refurbished) laboratories.

j) **Scope of eACCESS support and collaboration**. The curriculum modernization and in particular new curriculum development may be a complex process, which involves several subjects not directly related to the power engineering domain. They are usually introductory subjects including science, general knowledge and soft skills complementary subjects, etc. Modernization of such subjects is beyond the scope of the eACCESS project and it often requires knowledge and experience not available within the eACCESS consortium. Therefore, for this point, Asian partners were to envisage possible engagement of eACCESS resources from European partners in the process of development or modernization of the pre-selected subjects.

k) **A preliminary study of the student recruitment processes**. This criterion was used to assess the expected number of students which will enrol for the new courses, will study the revised obligatory subjects or will select in the future the updated or new elective courses. Since many pre-selected course units are scheduled for last semesters the assessment was partially based on the past intakes and the regular figures observed for the targeted specializations.

l) **The possibility to use eACCESS e-learning platform**. In this point, Asian partner universities suggested the possible use of the planned eACCESS remote teaching platform for remote delivery of the preselected subjects, for management of the subjects, as well as for the learning outcomes assessment process. Some partner universities inform also that they are already using any form of e-learning in the case of some of the pre-selected subjects.

m) **Financial aspects of the implementation of the new subject or courses**. The partner universities were expected to evaluate financial consequences of the changes to the curriculum and indicate necessary sources of financing of related expenses outside eACCESS budget to show the preliminary sustainability and long-term viability of actions implemented within the access project. All-important outlays and incomes (tuition fees collected from students, any external regular and occasional sponsors).

The template of the questionnaire has been distributed among Asian partner universities and the complete set of inputs has been collected. The results of the pre-selection of subject recommended by the Asian partners have been presented in the following sections of this deliverable.

II. Kantipur Engineering College (KEC)

A. Curriculum modernization procedure at KEC

Nepal needs to develop quickly the high voltage transmission system. Nepal is planning to expand its transmission line with 1,409 km of 132 kV, 755 km of 200 kV and 1030 km of 400 kV till 2030. Till now, there are only few technically qualified and practically trained technical human resources and unfortunately, there are no such Higher Education (HE) programs and facilities to implement master's degree courses in the field of high voltage engineering. Further, there are no existing courses launched in Nepal in this field. The proposed course contains some basic courses, HV protection and testing techniques which is very important to prepare skilled manpower for the development of nation in this field.

The project will establish a high voltage lab and the master's program in High Voltage and Bachelor Programme in Electrical Engineering, thereby aiming to produce highly skilled manpower for the country.

Kantipur Engineering College (KEC), Nepal is planning to run bachelor's degree in Electrical Engineering and master's degree in High Voltage Engineering in the near future. Bachelor's degree in Electrical Engineering is in the final stage of approval from the Tribhuvan University and the college shall be ready to enrol students in this program from the next academic session (September 2021).

In the present situation, the two options for running master's degree in High Voltage Engineering at KEC are mentioned below:

a) Affiliation under Tribhuvan University (TU), Nepal
b) Affiliation under Polotsk State University (PSU), Belarus.

a) Affiliation of Tribhuvan University (TU), Nepal

Tribhuvan University (TU), established in 1959 is the largest and the oldest university of Nepal. It is the 10th largest university in the world in terms of number of student enrolment. Engineering education under TU is run under the guidelines of Institute of Engineering (IOE).

For running a new master's course in TU, the following approval steps are followed:

i) The KEC college has to request for the approval of new master's course to the Subject Committee.
ii) The Subject Committee coordinates with several experts and faculty to design a new course through several interactions and workshops.
iii) The Subject Committee then forwards the new course for approval to the Standing Committee.
iv) The Standing Committee consisting of experts of faculty and professionals of the particular area through several workshops and interactions finalizes the course and sends to the Faculty Board for the final approval.
v) The Faculty Board approves the new course and sends to the Dean's office for its implementation.
vi) After the finalization of the new course, the college again has to apply to run new master's program to the Planning Division of the university.
vii) The university then forms a Feasibility Study Committee consisting of faculty and experts to inspect whether the college fulfils all the requirements for the new program.

viii) The Feasibility Study Committee then recommends the Planning Division of the University for the Approval of the new program, if it finds all the requirements have been fulfilled by the college.
ix) Planning Division then forwards the report to the Dean's Office.
x) The Dean's Office then forwards the recommendation to the Faculty Board of the University for making further decisions.
xi) The Faculty Board recommends for approval to the Executive Council of the University.
xii) The Executive Councils makes the final decision.
xiii) The college then requires taking approval from Nepal Engineering Council.

The process is long and cumbersome. The approval of the course is not guaranteed in a given frame of time. Approval of the new course requires lots of time and inputs from the involved personnel of Subject Committee, Standing Committee, Faculty Board and Dean's Office. In practice, it may take 2-3 years in general to successfully launch a new course. In addition, due to the present scenario of COVID-19, the universities in Nepal are closed for infinite period of time. This might make the process even longer. The priorities of the universities might be in other areas like to tackle the effect of COVID-19. Moreover, TU till today has not offered any master's degree program to its affiliated colleges. Most importantly, the Government of Nepal is in the process of drafting a new Education Policy, which also needs to be approved by the parliament and for the mean time the Ministry of Education, Science and Technology has instructed the universities of Nepal to postpone their affiliation process further till the new Education Policy is approved from the parliament.

b) **Affiliation of Polotsk State University (PSU), Belarus.**

Kantipur Engineering College has already run bachelor's level in Civil and Industrial Engineering from 1998 to 2002 under the affiliation of Polotsk State University (PSU), Belarus. The college has already signed Memorandum of Understanding (MoU) with the PSU to run masters and PhD studies under the affiliation of PSU in Nepal. The college management has already communicated with the rector of the PSU and has mutually agreed to work together in implementing master's program in High Voltage Engineering in Nepal. For this KEC, PU and PSU are working collaboratively to design the course for the program (the course module is already in the stage of development). After the course and affiliation approval by PSU, the college only need approval (no objection letter) from the Ministry of Education, Science & Technology of Nepal and Nepal Engineering Council. The approval process from the ministry and engineering council is relatively easier and fast. Fortunately obtaining of affiliation from the foreign university has not been suspended by the Government of Nepal.

School of Engineering of Pokhara University already has master's program in Power System and Electrical Engineering. The students of these programs will use the lab facilities of High Voltage Laboratory built in KEC. In addition, the students of bachelor's level of electrical engineering of KEC as well as other universities will also be allowed to access the laboratory facilities of KEC for their project and elective studies. KEC and PU will collaboratively use virtual classroom facility for effectively running of the programs. The PSU- High Voltage Engineering program will be used to develop similar course at KEC with the assistance from PU.

In the worst-case scenario, if the affiliation of PSU for master's program cannot be obtained, KEC and School of Engineering (PU) will work jointly to develop such master's program in Nepal. In this case, the master's students of Electrical Engineering and Power System of

PU will use the high voltage laboratory infrastructure and virtual learning platform of KEC for their electives, laboratory, and course works.

Conclusion: Due to the present corona virus scenario, long and tedious process to get affiliation and approval of master's degree course from Tribhuvan University, and the recent government decision to postpone new affiliation till the new educational policy is approved by the parliament of Nepal, KEC suggests to run the master's programme in High Voltage Engineering under the affiliation of Polotsk State University with the support of Pokhara University. In the worst-case scenario, KEC and PU shall work jointly to run the master's courses (Power System, Electrical Engineering and any new electrical engineering related programs) by utilizing the laboratory infrastructure and virtual learning platform of KEC.

The timeline for running master's programme under the affiliation of Polotsk State University, Belarus is as following:

Timeline:

· *End of February 2021*

The course modules and contents for the master's program in High Voltage Engineering will be finalized. The course module and contents will be finalized through series of interactions and workshops between Kantipur Engineering College and Pokhara University (PU). Several experts in the field of Electrical Engineering particular to High Voltage area will be involved for their feedback and input during workshops and accreditation.

· *End of May 2021*

The Masters course will be accredited from Polotsk State University, Belarus.

· *July-August 2021*

Approval from the Government of Nepal and Nepal Engineering Council will be received for the master's course.

· *August 2021*

Enrolment of 30 students.

· *September 2021*

The masters' programme will be run by Kantipur Engineering College with the support of PU under the affiliation of Polotsk State University, Belarus.

In the present situation, the approval process followed by the college for running bachelor's degree in Electrical Engineering at KEC is mentioned below:

Kantipur Engineering College (KEC) has already applied to run a bachelor's degree in Electrical Engineering under the affiliation of Tribhuvan University (TU). The detailed steps for approval of a bachelor's degree under TU are as follows:

i. The college applies for the approval of a bachelor's degree in any engineering program to the Planning Division of the TU.
ii. The university then forms a Feasibility Study Committee consisting of faculty and experts to inspect whether the college fulfils all the requirements for the new program.
iii. The Feasibility Study Committee then recommends the Planning Division of the University for the Approval of the new program, if it finds all the requirements have been fulfilled by the college.

iv. Planning Division then forwards the report to the Dean's Office.
v. The Dean's Office then forwards the recommendation to the Faculty Board of the University for making further decisions.
vi. The Faculty Board recommends for approval to the Executive Council of the University.
vii. The Executive Councils make the final decision.
viii. The college then requires taking approval from Nepal Engineering Council.

In the case of KEC, we are waiting for the decision from the Executive Council (step vii), which is the final stage of approval. After the approval of the Executive Council, the approval from Nepal Engineering Council is required (step viii). Nepal Engineering Council easily provides approval if it finds that the college fulfils all the requirements to launch a new program.

Note: The College fulfils all the requirements for running a bachelor's degree in Electrical Engineering.

Timeline:

End of May 2021

The college shall obtain approval from the Executive Council of Tribhuvan University to run a bachelor's degree in Electrical Engineering.

End of July 2021

The college shall obtain approval from the Nepal Engineering Council to run a bachelor's degree in Electrical Engineering.

September 2021

The bachelor's degree in Electrical Engineering will be run by Kantipur Engineering College under the affiliation of Tribhuvan University, Nepal.

B. Curriculum modernization procedure of Bachelor Level of Electrical Engineering

KEC will develop a teaching and learning materials for some subjects under eACCESS support which is called as development made in course. We have listed some subjects in which development is proposed and they are listed below:

Table 1

Semester 4	Power System Analysis I
Semester 5	Power System Analysis II
Semester 6	Switchgear and Protection
Semester 7	Power Electronics
Semester 8	High Voltage Engineering

Below there is included a completed list of all subjects of the new undergraduate course in Electrical Engineering with details including course units targeted by the eACCESS project.

Table 2

Engineering Mathematics I		
Existing Course Unit		Need to Modernize: No
Semester: 1st	Type: Core	Credits: 4
Course Objective	Provide students a sound knowledge of calculus and analytic geometry to apply them in their relevant fields.	
Learning Outcome	Apply calculus and analytic geometry for solving complex problems on relevant fields.	
Teaching methods/learning activities	Lecture, Tutorial	
Assessment methods	Internal Assessment, Final Exam	
Rational	It is essential to have the concept of mathematics for solving different problems related to the engineering. Mathematics forms the foundation for the engineering study.	
Teaching staff	Mrs. Anjana Devi Bhandari	

Table 3

Computer Programming		
Existing Course Unit		Need to Modernize: No
Semester: 1st	Type: Core	Credits: 6
Course Objective	To acquaint the student with computer software and high-level programming languages. Emphasis will be given on developing computer programming skills using computer programming in C and FORTRAN languages.	
Learning Outcome	Develop computer programs on C and FORTAN Language.	
Teaching methods/learning activities	Lecture, Tutorial, Practical	
Assessment methods	Internal Assessment, Lab exam, Final Exam, Assignments	
Rational	Concept of programming is required to solve the engineering problems using computer approaches.	
Teaching staff	Er. Prakash Kafle	

Table 4

Engineering Drawing I		
Existing Course Unit		Need to Modernize: No
Semester: 1st	Type: Core	Credits: 4
Course Objective	To develop basic projection concepts with reference to points, lines, planes and geometrical solids. To develop sketching and drafting skills to facilitate communication.	
Learning Outcome	Understand and sketch different engineering drawings.	
Teaching methods/learning activities	Lecture, Tutorial, Practical	
Assessment methods	Internal Assessment, Lab exam or Final Exam	
Rational	Engineering drawing is the fundamental behind the understanding of different drawing and sketching concepts that are associated with each of the engineering field.	
Teaching staff	Er. Amar Baral	

Table 5

Engineering Physics		
Existing Course Unit		Need to Modernize: No
Semester: 1st	Type: Core	Credits:6
Course Objective	To provide the concept and knowledge of physics with the emphasis of present-day application. The background of physics corresponding to Proficiency Certificate Level is assumed.	
Learning Outcome	Familiarize with basic topics of optics, electromagnetics and mechanics.	
Teaching methods/learning activities	Lecture, Tutorial, Practical	
Assessment methods	Internal Assessment, Lab exam, Final Exam, Assignments	
Rational	Engineering physics is necessary for the students to understand the concept of physics associated with different engineering aspects.	
Teaching staff	Mr. Maha Datta Paudel	

Table 6

Basic Electrical Engineering		
Existing Course Unit		Need to Modernize: No
Semester: 1st	Type: Core	Credits:5
Course Objective	After completion of this course the student will understand the fundamental concept of DC, AC & 3-phase electrical circuits.	
Learning Outcome	Understand the basic concepts of Direct Current, single phase and three phase Alternating Current in an electric system.	
Teaching methods/learning activities	Lecture, Tutorial, practical	
Assessment methods	Internal Assessment, Lab exam, Final Exam, Assignments	
Rational	Students of each faculty of engineering requires to have the basic knowledge of electrical system, single phase and three phase power.	
Teaching staff	Er. Avishek Sapkota	

Table 7

Applied Mechanics		
Existing Course Unit		Need to Modernize: No
Semester: 1st	Type: Core	Credits: 4
Course Objective	This course has been designed to provide basic knowledge of engineering mechanics to the students of all branches of engineering so that it would be helpful for them to understand structural engineering stress analysis principles in later courses or to use basics of mechanics in their branch of engineering.	
Learning Outcome	Gain basic knowledge and asses the static and dynamic nature of the engineering structures.	
Teaching methods/learning activities	Lecture, Tutorial	
Assessment methods	Internal Assessment, Final Exam, Assignments	
Rational	Students need to have the knowledge of static and dynamic systems associated with physical structures.	
Teaching staff	Er. Ima Nath Duwadi	

Table 8

Engineering Mathematics II		
Existing Course Unit		Need to Modernize: No
Semester: 2nd	Type: Core	Credits: 4
Course Objective	To develop the skill of solving differential equations and to provide knowledge of vector algebra and calculus. To make students familiar with calculus of several variables and infinite series.	
Learning Outcome	Solve the differential equations, vector algebra and the problems related to infinite series.	
Teaching methods/learning activities	Lecture, Tutorial	
Assessment methods	Internal Assessment, Final Exam, Assignments	
Rational	It is essential to have the concept of differential equations, vector algebra and infinite series as students will require to solve these related problems in later semester.	
Teaching staff	Mrs. Anjana Devi Bhandari	

Table 9

Engineering Drawing II		
Existing Course Unit		Need to Modernize: No
Semester: 2nd	Type: Core	Credits: 4
Course Objective	To make familiar with the conventional practices of sectional views. To develop basic concept and skill of pictorial drawing and working drawings. To make familiar with standard symbols of different engineering fields.	
Learning Outcome	Familiarize with sectional view and develop the concept of pictorial drawing and working drawing.	
Teaching methods/learning activities	Lecture, Tutorial, Practical	
Assessment methods	Internal Assessment, Final Exam, Lab exam Assignments	

Rational	Engineering drawing is the basis for understanding the various principles of drawing and sketching associated with each engineering field.
Teaching staff	Er. Amar Baral

Table 10

Basic Electronics Engineering		
Existing Course Unit		Need to Modernize: No
Semester: 2nd	Type: Core	Credits: 5
Course Objective	To understand the language of electronics, elements and their functionality Basic understanding of analogue systems and their applications Basic understanding of digital systems and their applications	
Learning Outcome	Understand construction and working of basic electronic components, analogue and digital systems with their respective applications.	
Teaching methods/learning activities	Lecture, Tutorial, Practical	
Assessment methods	Internal Assessment, Final Exam, Assignments, Lab exam	
Rational	Students require to have knowledge regarding the analogue and digital electronic system to develop the integrated circuits.	
Teaching staff	Er. Saroj Sharma	

Table 11

Engineering Chemistry		
Existing Course Unit		Need to Modernize: No
Semester: 2nd	Type: Core	Credits: 6
Course Objective	To develop the basic concepts of Physical Chemistry, Inorganic Chemistry and Organic Chemistry relevant to problems in engineering.	
Learning Outcome	Develop the understanding of physical, inorganic and organic chemistry that are relevant to the field of engineering.	

Teaching methods/learning activities	Lecture, Tutorial, Practical
Assessment methods	Internal Assessment, Final Exam, Assignments, Lab Exam
Rational	It is required for the engineers to have knowledge on physical, inorganic and organic materials that are used in engineering systems.
Teaching staff	Dr. Keshar Prasain

Table 12

Fundamental of Thermodynamics and Heat Transfer		
Existing Course Unit		Need to Modernize: No
Semester: 2nd	Type: Core	Credits: 5
Course Objective	To get student familiar with the basic concepts of laws od thermodynamics, heat transfer and their applications.	
Learning Outcome	Understand basic concepts and laws of thermodynamics and heat transfer and their applications as well.	
Teaching methods/learning activities	Lecture, Tutorial, Practical	
Assessment methods	Internal Assessment, Final Exam, Assignments, Lab exam	
Rational	The concept of heat transfer and thermodynamics are required to understand the working of different engineering system.	
Teaching staff	Er. Kritika Sharma	

Table 13

Workshop Technology		
Existing Course Unit		Need to Modernize: No
Semester: 2nd	Type: Core	Credits: 2
Course Objective	The subject aims at imparting knowledge and skill components in the field of basic workshop technology. It deals with different hand and machine tools required for manufacturing simple metal components and articles.	
Learning Outcome	Develop knowledge and skill about the various workshop components that are required for manufacturing and other engineering applications.	

Teaching methods/learning activities	Lecture, Practical
Assessment methods	Internal Assessment, Final Exam, Assignments, Projects, Lab exam
Rational	Basic knowledge on workshop materials and their applications is required for all the faculties of engineering.
Teaching staff	Mr. Ravi Sharma

Table 14

Engineering Mathematics III		
Existing Course Unit		Need to Modernize: No
Semester:3rd	Type: Core	Credits: 4
Course Objective	The purpose of this course is to round out the students' preparation for more sophisticated applications with an introduction to linear algebra, Fourier Series, Laplace Transforms, integral transformation theorems and linear programming.	
Learning Outcome	Develop in-depth knowledge regarding linear algebra, Fourier series, Laplace transforms, integral transformation theorems and linear programming.	
Teaching methods/learning activities	Lecture, Tutorials	
Assessment methods	Internal Assessment, Final Exam, Assignments	
Rational	Concepts related to linear algebra, Fourier series, Laplace transforms, integral transformation theorem and linear programming are widely applicable in solving complex engineering problems.	
Teaching staff	Mrs. Anjana Devi Bhandari	

Table 15

Object Oriented Programming		
Existing Course Unit		Need to Modernize: No
Semester: 3rd	Type: Core	Credits: 6

Course Objective	The objective of the course is to familiarize students with the C++ programming language and use the language to develop pure object-oriented programs.
Learning Outcome	Familiarize with the concept of C++ programming language and use it for the development of object-oriented programs.
Teaching methods/learning activities	Lecture, Tutorial, Practical
Assessment methods	Internal Assessment, Final Exam, Assignments, Lab exam
Rational	Concept of programming is required to solve the engineering problems using high-level programming approaches.
Teaching staff	Er. Anup K.C

Table 16

Electric Circuit Theory		
Existing Course Unit	Need to Modernize: No	
Semester: 3rd	Type: Core	Credits: 5
Course Objective	To continue work in Basic Electrical Engineering including the use of the Laplace Transform to determine the time and frequency domain responses of electric circuits.	
Learning Outcome	Understand the basic concepts about the transient response of electric circuit with the help of Laplace Transform and frequency response.	
Teaching methods/learning activities	Lecture, Tutorial, Practical	
Assessment methods	Internal Assessment, Final Exam, Assignments, Lab exam	
Rational	Electrical engineers are required to have knowledge on solving the electric circuits during the steady state and transients state. It is required to have the understanding of time and frequency response of electric circuit.	
Teaching staff	Er. Bishal Rimal	

Table 17

Electrical Engineering Material	
Existing Course Unit	Need to Modernize: No

Semester: 3rd	Type: Core	Credits: 4
Course Objective	To provide a basic understanding of the different materials used in electrical and electronics engineering.	
Learning Outcome	Understand the physical properties of different semiconductor materials used in electrical and electronics engineering. Understand the basics of Quantum Physics.	
Teaching methods/learning activities	Lecture, Tutorial	
Assessment methods	Internal Assessment, Final Exam, Assignments	
Rational	It is essential to have the knowledge on engineering material in order to have the understanding of their applications in the electrical systems.	
Teaching staff	Will be recruited later.	

Table 18

Electronic Devices and Circuits		
Existing Course Unit		Need to Modernize: No
Semester: 3rd	Type: Core	Credits: 5
Course Objective	To introduce the fundamentals of analysis of electronic circuits. To provide basic understanding of semiconductor devices and analogue integrated circuits.	
Learning Outcome	Develop basic understanding on analysis of electronic circuits, semiconductor devices and analogue integrated circuits.	
Teaching methods/learning activities	Lecture, Tutorial, Practical	
Assessment methods	Internal Assessment, Final Exam, Assignments, Lab exam	
Rational	The knowledge of various devices acquired by the students will help them to design, test, troubleshoot and repair basic electronic circuits.	
Teaching staff	Er. Saroj Sharma	

Table 19

Digital Logic		
Existing Course Unit		Need to Modernize: No
Semester: 3rd	Type: Core	Credits: 6
Course Objective	To introduce basic principles of digital logic design, its implementation and applications.	
Learning Outcome	Express basic concepts of logic circuits and simplify the logical statements. Develop the understanding of combinational and sequential circuits.	
Teaching methods/learning activities	Lecture, Tutorial, Practical	
Assessment methods	Internal Assessment, Final Exam, Assignments, Lab exam	
Rational	Most of the operation and control system associated with the electrical systems incorporate the digital logic concept in it.	
Teaching staff	Er. Rajesh Shah	

Table 20

Electromagnetics		
Existing Course Unit		Need to Modernize: No
Semester:3rd	Type: Core	Credits: 5
Course Objective	To provide basic understanding of the fundamentals of Electromagnetics.	
Learning Outcome	Understand the characteristics of electric and magnetic field interaction and familiarize with electromagnetic waves concept.	
Teaching methods/learning activities	Lecture, Tutorial, Practical	
Assessment methods	Internal Assessment, Final Exam, Assignments, Lab exam	
Rational	Understanding the concept and effect of electromagnetic and the field theory on the electric system is necessary for electrical engineers.	
Teaching staff	Er. Sujin Gwacha	

Table 21

Electric Machine-I		
New Course		Need to Modernize: No
Semester: 4th	Type: Core	Credits:5
Course Objective	To impart knowledge on constructional details, operating principle and performance of Transformers, DC Machines, and 3-phase Induction Machines.	
Learning Outcome	Understand the construction, operation and control of DC machines, induction machines and transformer.	
Teaching methods/learning activities	Lecture, Tutorial, Assignments, practical	
Assessment methods	Internal Assessment, Lab exam and Final Exam	
Rational	Electrical machines form the most integral part of electrical engineering systems and its understanding is of utmost importance.	
Teaching staff	Er. Sushil Paudel	

Table 22

Numerical Methods		
Existing Course Unit		Need to Modernize: No
Semester: 4th	Type: Core	Credits: 6
Course Objective	The course aims to introduce numerical methods used for the solution of engineering problems. The course emphasizes algorithm development and programming and application to realistic engineering problems.	
Learning Outcome	Develop the numerical and programming approach of solving the engineering problems.	
Teaching methods/learning activities	Lecture, Tutorial, Practical	
Assessment methods	Internal Assessment, Final Exam, Assignments, Lab exam	
Rational	The numerical approach of solving the engineering problems help to solve the tedious analytical problems with ease as it provides the option of incorporating the computer programming to solve the problem.	
Teaching staff	Er. Sunil Kumar Shrestha	

Table 23

Applied Mathematics		
Existing Course Unit		Need to Modernize: No
Semester: 4th	Type: Core	Credits: 4
Course Objective	This course focuses on several branches of applied mathematics. The students are exposed to complex variable theory and a study of the Fourier and Z-Transforms, topics of current importance in signal processing. The course concludes with studies of the wave and heat equations in Cartesian and polar coordinates.	
Learning Outcome	Fundamental understanding on optimization problems and understand the theory of differential equations and dynamic systems.	
Teaching methods/learning activities	Lecture, Tutorial	
Assessment methods	Internal Assessment, Final Exam, Assignments	
Rational	It is essential to have the concept of Fourier and Z-transforms for solving the optimization related problems.	
Teaching staff	Mrs. Anjana Devi Bhandari	

Table 24

Instrumentation I		
Existing Course Unit		Need to Modernize: No
Semester: 4th	Type: Core	Credits: 5
Course Objective	Comprehensive treatment of methods and instrument for a wide range of measurement problems.	
Learning Outcome	Understand the construction and operation of electro-mechanical measuring instruments, AC bridges, operational amplifiers and digital-analogue conversion system.	
Teaching methods/learning activities	Lecture, Tutorial, Practical	
Assessment methods	Internal Assessment, Final Exam, Assignments, Lab exam	

Rational	It is necessary for electrical engineers to understand the concept of instrumentation and measurement and their industrial application.
Teaching staff	Er. Bishal Rimal

Table 25

Power system Analysis I		
New Course Unit		Need: Development
Semester: 4th	Type: Core	Credits:4
Course Objective	The course aims to deliver the basic principle and fundamental analysis techniques for generation, transmission and distribution components of a power system as a first course in power system.	
Learning Outcome	Learn basic concepts of electrical power system and understand per unit system, power system components, transmission line modelling and their performance analysis.	
Teaching methods/learning activities	Lecture, Tutorial, Assignments	
Assessment methods	Internal Assessment, Final Exam, Assignments	
Development	Course material development process will develop a teaching material for effective delivery of the course and Developed course material will aid to interconnect the practical skills along with the theoretical content of the course. Detail course planning will help to allocate the optimized teaching hours for different chapters, the depth of content to be taught and evaluation criteria for internal assessments of their performance in classroom.	
Rational	Power system analysis forms the most integral part of electrical engineering systems and its understanding of utmost importance.	
Scope of eACCESS Collaboration:	Sharing of advance technical knowledge for the development of course material and course planning between different partner universities is expected.	
Teaching staff	Er. Sushil Paudel	
Approval Processes	Entire course will be approved after completion of approval process.	

Implementation	This content will be implemented in 4th semester of Bachelor's in electrical engineering. Student will exercise different tasks and study the course materials prepared for the subject.
Technical Support	Appropriate suggestions and knowledge sharing from the experts and the partner university is expected.
Capacity Building and Tutor Training requirements	Can be done by the teaching faculties and lab personnel in collaboration with partners.
e-Learning and the use of the eACCESS platform	Distance learning through the use of e-learning between different partner universities. Seminars and workshops conducted to the students can be shared between various partner universities.
Financial Aspects	Expenses are allocated on the remuneration to the faculties, conducting different seminars and workshops and setting up the HV lab.

Table 26

Microprocessors		
Existing Course Unit		Need to Modernize: No
Semester: 4th	Type: Core	Credits: 6
Course Objective	The objective of the course is to familiarize students with programming, hardware and application of microprocessor.	
Learning Outcome	Examine the construction of CPU and familiarize with the concept of register and bus system. Understand architecture, operation, programming and interfacing of typical microprocessors.	
Teaching methods/learning activities	Lecture, Tutorial, Practical	
Assessment methods	Internal Assessment, Final Exam, Assignments, Lab exam	
Rational	Most of the control strategy associated with electrical system uses microprocessors and its understanding is therefore necessary.	
Teaching staff	Er. Anup K.C	

Table 27

Electric Machines II

New Course Unit		Need to Modernize: No
Semester: 5th	Type: Core	Credits: 3
Course Objective	To impart knowledge on constructional details, operating principle and performance of 3-phase Synchronous Machines and Fractional Kilowatt Motors.	
Learning Outcome	Understand the construction, operation and control of synchronous and fractional kilowatt machines.	
Teaching methods/learning activities	Lecture, Tutorial, Practical	
Assessment methods	Internal Assessment, Final Exam, Assignments, Lab exam	
Rational	Electrical machines are applicable in generation of electrical energy and different industries and traction systems.	
Teaching staff	Will be recruited later.	

Table 28

Communication English		
Existing Course Unit		Need to Modernize: No
Semester: 5th	Type: Core	Credits: 5
Course Objective	To make the students capable of producing professional writings such as research articles, technical proposals, reports and project work. To familiarize the students with the native speakers' pronunciation with the use of audio-visual aids.	
Learning Outcome	Produce professional writings and familiarize with the native speakers' pronunciation.	
Teaching methods/learning activities	Lecture, Tutorial, Practical	
Assessment methods	Internal Assessment, Final Exam, Assignments, Lab exam	
Rational	Engineers require to have good command in written and verbal English as it is required for their professional practice.	
Teaching staff	Mr. Krishna Prasad Gautam	

Table 29

Probability and Statistics

Existing Course Unit		Need to Modernize: No
Semester: 5th	Type: Core	Credits: 4
Course Objective	To provide the students with particle knowledge of the principles and concept of probability and statistics and their application in engineering field.	
Learning Outcome	Develop the knowledge of principles and concept of probability and statistics along with their applications in engineering.	
Teaching methods/learning activities	Lecture, Tutorial	
Assessment methods	Internal Assessment, Final Exam, Assignments	
Rational	Understanding of probability and statistics is necessary to assess the stability and reliability of power systems network.	
Teaching staff	Mr. Deepak Dhas	

Table 30

Control System		
Existing Course Unit		Need to Modernize: No
Semester: 5th	Type: Core	Credits: 5
Course Objective	To present the basic concepts on analysis and design of control system and to apply these concepts to typical physical processes.	
Learning Outcome	Understand and design of analogue control system for the basic physical systems.	
Teaching methods/learning activities	Lecture, Tutorial, Practical	
Assessment methods	Internal Assessment, Final Exam, Assignments, Lab exam	
Rational	It is required to have understanding of stability and control of different physical system.	
Teaching staff	Will be recruited later.	

Table 31

Instrumentation II	
Existing Course Unit	Need to Modernize: No

Semester: 5th	Type: Core	Credits: 5
Course Objective	Continuation of INSTRUMENTATION I with emphasis on advance system design and case studies. To introduce and apply the knowledge of microprocessor, A/D, D/A converter to design Instrumentation system. To provide the concept on interfacing with microprocessor-based system and circuit design techniques.	
Learning Outcome	Understand the concept of interfacing with microprocessor-based system and apply the concept of microprocessors in designing instrumentation system.	
Teaching methods/learning activities	Lecture, Tutorial, Practical	
Assessment methods	Internal Assessment, Final Exam, Assignments, Lab exam	
Rational	Microprocessors and its integration are important part and under rapid development in the electrical network, especially in smart grids.	
Teaching staff	Er. Utsab Pokharel	

Table 32

Power system Analysis II		
New Course Unit	Need: Development	
Semester: 5th	Type: Core	Credits:4
Course Objective	The course aims to deliver the advance analysis of the interconnected power system including load flow, short circuit studies and stability analysis.	
Learning Outcome	Understand and analyse the interconnected power system network, fault analysis and their stability.	
Teaching methods/learning activities	Lecture, Tutorial, Assignments	
Assessment methods	Internal Assessment, Final Exam, Assignments	
Development	Course material development process will develop a teaching material for effective delivery of the course and Developed course material will aid to interconnect the practical along with the theoretical content of the course. Detail course planning will help to allocate the optimised teaching hours for different chapters, the depth of content to	

	be taught and evaluation criteria for internal assessments of their performance in classroom.
Rational	Fault analysis and stability of power system forms the basis for further study related to this field.
Scope of eACCESS Collaboration:	Sharing of advance technical knowledge for the development of course material and course planning between different partner universities is expected.
Teaching staff	Er. Bishal Rimal
Approval Processes	Entire course will be approved after completion of approval process.
Implementation	Developed course material will be implemented during the course of study in accordance with developed detail course planning. Detail course planning will guide us as a course descriptor. The depth of content will be delivered in accordance with the developed detail course planning
Technical Support	Appropriate suggestions and knowledge sharing from the experts and the partner university is expected.
Capacity Building and Tutor Training requirements	Can be done by the teaching faculties and lab personnel with collaboration with partners.
e-Learning and the use of the eACCESS platform	Distance learning through the use of e-learning between different partner universities. Seminars and workshops conducted to the students can be shared between various partner universities.
Financial Aspects	Expenses are allocated on the remuneration to the faculties, conducting different seminars and workshops and setting up the HV lab.

Table 33

Electric Machine Design		
New Course		Need to Modernize: No
Semester: 5th	Type: Core	Credits: 6
Course Objective	To impart knowledge on the principle of design of electrical machines like transformers, induction machines and DC machine.	

Learning Outcome	Understand the construction and design of transformers, DC machines and induction machines.
Teaching methods/learning activities	Lecture, Tutorial, Practical
Assessment methods	Internal Assessment, Final Exam, Assignments, Lab exam
Rational	Electrical machines form the most integral part of electrical engineering systems and its understanding is of utmost importance.
Teaching staff	Will be recruited later.

Table 34

Engineering Economics		
Existing Course Unit		Need to Modernize: No
Semester: 6th	Type: Core	Credits: 4
Course Objective	To introduce the concept of basic economic studies and use them for the evaluation of engineering projects.	
Learning Outcome	Conduct simple economic studies and make evaluation of engineering projects and decisions related to investment.	
Teaching methods/learning activities	Lecture, Tutorial	
Assessment methods	Internal Assessment, Final Exam, Assignments	
Rational	The engineering projects are always associated with economics. Therefore, electrical engineers need be acquainted with the basic economic and financial aspects.	
Teaching staff	Er. Sushil Rijal	

Table 35

Digital Control System		
Existing Course Unit		Need to Modernize: No
Semester: 6th	Type: Core	Credits: 5
Course Objective	To present the basic concepts on analysis and design of sampled data control system and to apply these concepts to typical physical processes.	

Learning Outcome	Gain the knowledge on the design of sampled data control system and apply it to the physical processes.
Teaching methods/learning activities	Lecture, Tutorial, Practical
Assessment methods	Internal Assessment, Final Exam, Assignments, Lab exam
Rational	Analysis and design of discrete data control system and its application on physical process is of utmost importance.
Teaching staff	Will be recruited later.

Table 36

Signal Analysis		
Existing Course Unit		Need to Modernize: No
Semester: 6th	Type: Core	Credits: 5
Course Objective	To provide understanding of basic concepts in signals and systems.	
Learning Outcome	Familiarize with the concept of signal and systems and their applications in electrical and electronics engineering.	
Teaching methods/learning activities	Lecture, Tutorial, Practical	
Assessment methods	Internal Assessment, Final Exam, Assignments, Lab exam	
Rational	Understanding signals and associated systems is necessary as it forms the basis for the control strategy of the electric networks.	
Teaching staff	Er. Sujin Gwacha	

Table 37

Switchgear and Protection		
New Course Unit	Need: Development	
Semester: 6th	Type: Core	Credits:5
Course Objective	To present fundamental knowledge on the protection system and its associated components in the power system.	
Learning Outcome	Understand construction, operation, working of fuses, C	
Teaching methods/learning activities	Lecture, Tutorial, Laboratory	
Assessment methods	Laboratory Assessments, Internal continuous Assessment and Final Board Exam	

Development	Effective Teaching course material and detail course planning report for proper implementation of syllabus will be developed. Course material development process will develop a teaching material for effective delivery of the course and Developed course material will aid to interconnect the practical exercises along with the theoretical content of the course. Detail course planning will help to allocate the optimized teaching hours for different chapters, the depth of content to be taught and evaluation criteria for internal assessments of their performance in classroom.
Rational	Power system protection and the switchgear associated with protection is must for an electrical engineer.
Scope of eACCESS Collaboration:	Sharing of advanced technical knowledge for the development of course material and course planning between different partner universities is expected. HV Lab implementation through eACCESS in KEC will facilitate students to determine CT knee point voltage with the help of excitation curve. More practical related to CT/PT will make students clear about instrument transformers.
Teaching staff	Will be recruited later.
Approval Processes	Entire course will be approved after completion of approval process.
Implementation	Developed course material will be implemented during the course of study in accordance with developed detail course planning. Effective lectures will be lectured in parallel with the practical related power system switchgear and protection. Detail course planning will guide us as a course descriptor. The depth of content will be delivered in accordance with the developed detail course planning
Technical Support	Appropriate suggestions, knowledge sharing and feedback from the experts and the partner university is expected.
Capacity Building and Tutor Training requirements	There is the requirement of different training for teaching staffs to improve their knowledge and understanding on the course. Training will help to improve the teaching methodologies for excellent delivery of lectures that helps for proper understanding the course. Faculties may require industrial field visit and advance training for interconnecting theoretical lectures with real engineering task.
e-Learning and the use of the eACCESS platform	Distance learning through the use of e-learning between different partner universities. Seminars and workshops conducted to the students can be shared between various partner universities.
Financial Aspects	Expenses are allocated on the remuneration to the faculties, conducting different training, seminars and workshops.

Table 38

Industrial Power distribution and Illumination	
New Course Unit	Need to Modernize: No

Semester: 6th	Type: Core	Credits:6
Course Objective	After completion of the course, the student will be able: - To have detailed knowledge in design electrical distribution and illumination system. - To understand relevant standards, rules and regulation system. - To apply appropriate measures to evaluate and improve energy efficiency.	
Learning Outcome	Have detailed knowledge in design electrical distribution and illumination system. Understand relevant standards, rules and regulation system. Apply appropriate measures to evaluate and improve energy efficiency.	
Teaching methods/learning activities	Lecture, Tutorial, Laboratory	
Assessment methods	Laboratory Assessments, Internal continuous Assessment and Final Board Exam	
Rational	It is require to understand the relevant rules and regulations of electrical distribution system and design a suitable illumination system.	
Teaching staff	Will be recruited later.	

Table 39

Hydropower		
New Course Unit		Need to Modernize: No
Semester: 6th	Type: Core	Credits: 5
Course Objective	To familiarize the basic concepts of Fluid flow and hydraulics and their application in the context of hydropower development. To make students acquainted with component of hydropower systems and their design principles	
Learning Outcome	Familiarize with the concept of fluid dynamics, hydrology, hydraulics and components associated with hydropower system.	
Teaching methods/learning activities	Lecture, Tutorial and Practical	
Assessment methods	Internal Assessment, Lab exam and Final Exam	
Rational	Hydropower is one of the sustainable and most feasible source of energy in the context of Nepal.	

Teaching staff	Mr. Kamal Katuwal

Table 40

Project Engineering		
Existing Course Unit		Need to Modernize: No
Semester: 7th	Type: Core	Credits: 4
Course Objective	To introduce the basic knowledge on project and project environment To make the students able to prepare feasibility study report and project proposal. To provide the sound knowledge of project planning, implementation and controlling. To provide knowledge on risk associated with the project To provide the knowledge of project finance and To provide the concept of modern trends and techniques of project management.	
Learning Outcome	Impart the knowledge of project and other aspects related to the project managements such as planning, implementation, control, risk assessment, and resource management.	
Teaching methods/learning activities	Lecture, Tutorial	
Assessment methods	Internal Assessment, Final Exam, Assignments	
Rational	Developing project management skill provides a foundation for developing the other skills required for effective leadership, communications, and strategic planning.	
Teaching staff	Will be recruited later.	

Table 41

Organization and Management		
Existing Course Unit		Need to Modernize: No
Semester: 7th	Type: Core	Credits: 4
Course Objective	Acquire knowledge in the field of organizational management and internal organization of companies required for managing an enterprise	

	Acquire knowledge in the field of personnel management, motivation and leadership for developing managerial skills Gain knowledge for starting a small-scale unit independently Gain knowledge on case study and management information system.
Learning Outcome	Understand the concept related to business. Demonstrate the roles, skills and function of management, analyse, diagnose, and solve optimal managerial decisions. Understand theories of motivation, leadership and entrepreneurship.
Teaching methods/learning activities	Lecture, Tutorial
Assessment methods	Internal Assessment, Final Exam, Assignments
Rational	Engineers during their professional career have to lead various organizations. Therefore, it is necessary for them to have adequate knowledge of the aspects associated with organizations and its management.
Teaching staff	Er. Rabindra Khati

Table 42

Technology Environment and Society		
New Course Unit	Need to Modernize: No	
Semester: 7th	Type: Core	Credits: 2
Course Objective	The course has been devised to provide knowledge of environment, technology and its impact on society. It would be helpful to the students to understand the global, national and local environmental issues and challenges of the information society.	
Learning Outcome	Understand the impact of engineering and technological changes on environment and other challenges associated with these impacts.	
Teaching methods/learning activities	Lecture, Tutorial	
Assessment methods	Internal Assessment, Final Exam, Assignments	
Rational	Technology always have direct impact on environment. Therefore, it is necessary for engineers to understand the	

	impact of technology on environment and society for sustainable development.
Teaching staff	Will be recruited later.

Table 43

Power Electronics		
New Course Unit		Need: Development
Semester: 7th	Type: Core	Credits: 5
Course Objective	To introduce various power electronics based circuits and their use in power system.	
Learning Outcome	Understanding of the theory of electrical energy conversion using power electronics system that performs AC-DC, DC-DC or DC-AC conversion.	
Teaching methods/learning activities	Lecture, Tutorial, Laboratory	
Assessment methods	Laboratory Assessments, Internal continuous Assessment and Final Board Exam	
Development	Effective Teaching course material and detail course planning report for proper implementation of syllabus will be developed. Course material development process will develop a teaching material for effective delivery of the course and Developed course material will aid to interconnect the practical exercises along with the theoretical content of the course. Detail course planning will help to allocate the optimized teaching hours for different chapters, the depth of content to be taught and evaluation criteria for internal assessments of their performance in classroom.	
Rational	Power electronic devices are some major components in power system generation, transmission and distribution network.	
Scope of eACCESS Collaboration:	Sharing of advance technical knowledge for the development of course material and course planning between different partner universities is expected. HV Lab implementation through eACCESS in KEC will facilitate students to access HV rectifier. Study of single-phase rectification can be made to improve the understanding of power electronics.	
Teaching staff	Er. Avishek Sapkota	

Approval Processes	Entire course will be approved after completion of approval process.
Implementation	Developed course material will be implemented during the course of study in accordance with developed detail course planning. Effective lectures will be lectured in parallel with the practical related to power electronics. Detail course planning will guide us as a course descriptor. The depth of content will be delivered in accordance with the developed detail course planning In HV lab, Student can observe load characteristics of rectifier. They will also measure the ripple factor of rectifier. Student will exercise these practical under their existing course to develop their practical knowledge.
Technical Support	Appropriate suggestions and knowledge sharing from the experts and the partner university is expected.
Capacity Building and Tutor Training requirements	There is the requirement of different training for teaching staffs to improve their knowledge and understanding on the course. Training might help to improve the teaching methodologies, so that excellent delivery of lectures helps students for proper understanding the course. Faculties may require industrial field visit and advance training for interconnecting theoretical lectures with real engineering task.
e-Learning and the use of the eACCESS platform	Distance learning through the use of e-learning between different partner universities. Seminars and workshops conducted to the students can be shared between various partner universities.
Financial Aspects	Expenses are allocated on the remuneration to the faculties, conducting different training, seminars and workshops.

Table 44

Utilization of Electrical Energy		
New Course Unit		Need to Modernize: No
Semester: 7th	Type: Core	Credits: 5
Course Objective	To present the basic concepts on utilization of electrical energy on various applications.	

Learning Outcome	Understand the utilization of electrical energy for the operation and control of electric drives, tractions, heating system and understand the concept of demand side management (DSM).
Teaching methods/learning activities	Lecture, Tutorial, Practical
Assessment methods	Internal Assessment, Final Exam, Assignments, Lab exam
Rational	Electrical engineers are to be acquainted with the different possible usage and control of electrical energy.
Teaching staff	Will be recruited later.

Table 45

Power Plant Equipment		
New Course Unit	Need to Modernize: No	
Semester: 7th	Type: Core	Credits: 5
Course Objective	To present information on the equipment used in power generating plant including electrical as well as mechanical.	
Learning Outcome	Understand the principle, operation and control of different type of power generating plants.	
Teaching methods/learning activities	Lecture, Tutorial, Practical	
Assessment methods	Internal Assessment, Final Exam, Assignments, Lab exam	
Rational	Generation is one of the important pillars of electrical energy and electrical engineers have to deal with different possible sources of energy generation. The generated energy from different energy source in a synchronised grids needs load-frequency and reactive power-voltage control system.	
Teaching staff	Will be recruited later..	

Table 46

Project I		
New Course Unit	Need to Modernize: No	
Semester: 7th	Type: Core	Credits: 2

Course Objective	To plan an electrical engineering project under the supervision of an instructor. During the project students have to design functional project.
Learning Outcome	Design a fully functioning electrical system for the completion of their project.
Teaching methods/learning activities	Practical
Assessment methods	Project Defence, Supervisor Evaluation
Rational	It is necessary for electrical engineers to undertake a project that incorporates the overall learning in the undergraduate level which also prepares the engineers for the professional practice.
Teaching staff	Will be recruited later.

Table 47

Electrical Energy System Management (Elective I)		
New Course Unit	Need to Modernize: No	
Semester: 7th	Type: Elective	Credits: 5
Course Objective	To study planning and management aspects of electrical energy supply and to gain some familiarity with demand characteristics and load forecasting.	
Learning Outcome	Plan and manage the supply aspect and demand aspect of electrical energy. Able to incorporate the forecasted load during the planning and management phase.	
Teaching methods/learning activities	Lecture, Tutorial, Assignments, Presentation, Practical	
Assessment methods	Internal Assessment, Lab exam, Final Exam	
Rational	Proper planning and scientific management of Electrical energy demand and supply is an essential aspect to be learned in Electrical Engineering.	
Teaching staff	Will be recruited later.	

Table 48

Reliability Engineering (Elective I)

New Course Unit		Need to Modernize: No
Semester: 7th	Type: Elective	Credits: 5
Course Objective	To strengthen the knowledge of probability theory by introducing the concept of reliability engineering applicable to the physical systems especially at different level of electric power systems.	
Learning Outcome	Understand the concept of reliability and its application on physical power system network.	
Teaching methods/learning activities	Lecture, Tutorial, Practical	
Assessment methods	Internal Assessment, Final Exam	
Rational	Reliability assessment of power system network is very essential for the uninterrupted and continuous supply for electric power.	
Teaching staff	Will be recruited later.	

Table 49

Rural Electrification		
New Course Unit		Need to Modernize: No
Semester: 7th	Type: Elective I	Credits: 5
Course Objective	To present a summary of rural livelihood and to present the basic concepts of rural electrification and its impact upon the development of rural communities	
Learning Outcome	Understand the different problems associated with rural electrification, design of rural power network and its protection. Familiarization with different grid based and isolated rural electrification technologies.	
Teaching methods/learning activities	Lecture, Tutorial, Practical, Field Visit	
Assessment methods	Internal Assessment, Lab exam, Final Exam	
Rational	Design and understand rural electrification technologies, identify environmental concerns and safety considerations, network operation and reliability indices in rural electrification is needed to electrify rural villages of Nepal.	

Teaching staff	Will be recruited later.

Table 50

Engineering Professional Practice		
Existing Course Unit	Need to Modernize: No	
Semester: 8th	Type: Core	Credits: 2
Course Objective	To familiarize the students with their roles in the society, ethical and legal environment in which engineering is practiced, contract administration, regulatory environment and contemporary issues in Engineering.	
Learning Outcome	Understand the ethical and legal environment for the practice of engineering and the contemporary issues related to engineering.	
Teaching methods/learning activities	Lecture, Tutorial	
Assessment methods	Internal Assessment, Final Exam, Assignments	
Rational	Proper knowledge of ethics and legal environment to practice the profession promptly and efficiently is required for engineers.	
Teaching staff	Will be recruited later.	

Table 51

High Voltage Engineering		
New Course Unit	Need: Development	
Semester: 8	Type: Core	Credits:4
Course Objective	To provide knowledge for: • Different causes and type of over voltage • Breakdown mechanism for gaseous, liquid and solid dielectrics • HVAC/HVDC and impulse testing of insulation • Safety against high voltage	
Learning Outcome	Understand about over voltage in power system, its cause and its effect on dielectrics along with safety measure while working with high voltages.	
Teaching methods/learning activities	Lecture, Tutorial, Assignments	
Assessment methods	Internal Assessment and Final Exam	
Scope of eACCESS Collaboration:	HV Lab implementation through eACCESS in KEC will facilitates students and researchers to develop practical knowledge and	

	understanding on HV equipment, generation and measurements along with safety concerns.
Development	Effective Teaching course material, detail course planning report and lab manual for proper implementation of syllabus will be developed. Course material development process will develop a teaching material for effective delivery of the course and Developed course material will aid to interconnect the practical exercises along with the theoretical content of the course. Detail course planning will help to allocate the optimized teaching hours for different chapters, the depth of content to be taught and evaluation criteria for internal assessments of their performance in the classroom. In addition, the Lab manual will help students to guide the procedure of laboratory activities to get a sound understanding on HV generation, measurement and safety concerns.
Rational	Understanding on HV equipment and Practical knowledge and safety concerns on high voltage is very essential for electrical power engineers
Scope of eACCESS Collaboration:	Sharing of advance technical knowledge for the development of course material and course planning between different partner universities is expected. HV Lab implementation through eACCESS in KEC will facilitates students and researchers to develop practical knowledge and understanding on HV equipment, generation and measurements along with safety concerns.
Teaching staff	Will be recruited later on.
Approval Processes	Entire course will be approved after completion of approval process.
Implementation	Developed course material will be implemented during the course of study in accordance with developed detail course planning. Effective lectures will be lectured in parallel with the practical related to High voltage. Detail course planning will guide us as a course descriptor. The depth of content will be delivered in accordance with the developed detail course planning In HV lab, Student can generate and measure the high voltage.
Technical Support	Appropriate suggestions and knowledge sharing from the experts and the partner university is expected.
Capacity Building and Tutor Training requirements	There is the requirement of different training for teaching staffs to improve their knowledge and understanding on the course. Training might help to improve the teaching methodologies, so that excellent delivery of lectures helps students for proper understanding the course. Faculties may require industrial field visit and advance training for interconnecting theoretical lectures with real engineering task. There is the requirement of training to operate HV laboratory equipment to the Lab personal.

e-Learning and the use of the eACCESS platform	Distance learning through the use of e-learning platform between different partner universities. Seminars and workshops conducted to the students can be shared between various partner universities.
Financial Aspects	Expenses are allocated on the remuneration to the faculties, conducting different training, seminars and workshops.

Table 52

Power Plant Design		
New Course Unit		Need to Modernize: No
Semester: 8th	Type: Core	Credits: 6
Course Objective	To study technical requirements and economic principles related to design of power plant, electrical systems, switchyards and plant design guidelines.	
Learning Outcome	Understand the technical and economic requirements for the design of power plant and electrical systems.	
Teaching methods/learning activities	Lecture, Tutorial, Practical	
Assessment methods	Internal Assessment, Final Exam, Assignments, Lab exam	
Rational	Generation is one of the important pillars of electrical energy and electrical engineers have to deal with design aspects of power plant.	
Teaching staff	Will be recruited later.	

Table 53

Transmission and Distribution Design		
New Course Unit		Need to Modernize: No
Semester: 8th	Type: Core	Credits: 6
Course Objective	To address general matters of electrical power and energy demand load characteristics, technical requirements and economic principles related to design of transmission lines and distribution systems.	
Learning Outcome	Design of overhead transmission and distribution of electrical systems. Understanding the concept of load forecasting and electrical load characteristics.	

Teaching methods/learning activities	Lecture, Tutorial, Practical
Assessment methods	Internal Assessment, Final Exam, Assignments, Lab exam
Rational	Transmission and distribution systems allow electrical energy to transmit from generation to utility points and their knowledge is required for the reliable and efficient system design.
Teaching staff	Will be recruited later.

Table 54

Project II		
New Course Unit		Need to Modernize: No
Semester: 8th	Type: Core	Credits: 4
Course Objective	To complete an electrical engineering project Planned in Project – I under the supervision of an instructor. During the project students have to come up with final output.	
Learning Outcome	Design a fully functioning electrical system with final output.	
Teaching methods/learning activities	Lecture, Tutorial, Practical	
Assessment methods	Internal Assessment, Final Exam, Assignments, Lab assessment	
Rational	Continuation of project I. It is necessary for electrical engineers to undertake a project that incorporates the overall learning in the undergraduate level which also prepares the engineers for the professional practice.	
Teaching staff	Will be recruited later.	

Table 55

Advance Power System Analysis (Elective II)		
New Course Unit		Need to Modernize: No
Semester: 8th	Type: Elective	Credits: 5
Course Objective	To present the advance understanding on power system transmission network, its stability, its compensation using conventional and using power electronics devices and its computer-based simulation.	

Learning Outcome	Understand the compensation on transmission line using modern power electronics devices and its computer-based simulation.
Teaching methods/learning activities	Lecture, Assignments, Tutorial, Practical
Assessment methods	Internal Assessment, Lab Assessment, Final Exam
Rational	Advance Power is the matter of foremost importance to learn about the behaviour and other associated aspects of power system networks to have depth knowledge in power system.
Teaching staff	Will be recruited later.

Table 56

Biomedical Instrumentation (Elective II)		
New Course Unit	Need to Modernize: No	
Semester: 8th	Type: Elective	Credits:5
Course Objective	To provide specific engineering and instrumentation methods and principles to the task of obtaining basic knowledge of design, application and maintenance of different biomedical instruments.	
Learning Outcome	Understand the basic working principle and methodology of different biomedical instrument and detailed design and application of these instruments increase the capability for maintenance of biomedical instruments.	
Teaching methods/learning activities	Lecture, Assignments, Tutorial, Practical	
Assessment methods	Internal Assessment, Lab Assessment, Final Exam	
Rational	Engineering principle associated with biology and medicine is an essential understating for an engineer to work with biomedical instruments.	
Teaching staff	Will be recruited later.	

Table 57

Applied Photovoltaic Engineering (Elective II)		
New Course Unit	Need to Modernize: No	
Semester: 8th	Type: Elective	Credits: 5

Course Objective	To be familiar with solar Photovoltaic principle, design and application.
Learning Outcome	Understand the principle of solar photovoltaic and its design for different application
Teaching methods/learning activities	Lecture, Report, Assignments, Tutorial, Practical
Assessment methods	Internal Assessment, Lab Assessment, Final Exam
Rational	Installation of Solar PV as a renewable energy source can support us to achieve clean energy. Design of solar PV in different field and information on equipment and global trend on solar PV is the most, for an energy engineer.
Teaching staff	Will be recruited later.

Table 58

Micro Hydro (Elective III)		
New Course Unit	Need to Modernize: No	
Semester: 8th	Type: Elective	Credits: 5
Course Objective	To introduce operation, maintenance and design aspect of Micro Hydro power plant including basic hydrology and geology.	
Learning Outcome	Design a micro hydro plant and its distribution line. Understand the basic principles for operation and work out for maintenance of micro hydro plant. Evaluate the tariff scheme and deal social issues of micro hydro.	
Teaching methods/learning activities	Lecture, Assignments, Field visit, Tutorial, Practical	
Assessment methods	Internal Assessment, Lab Assessment, Final Exam	
Rational	Detail design procedure and equipment selection on the basic of demand requirement, hydrology and geology is crucial task for an electrical engineer. Knowledge on operation and maintenance of micro hydro is very essential.	
Teaching staff	Will be recruited later.	

Artificial Neural Network (Elective III)

New Course Unit		Need to Modernize: No
Semester: 8th	Type: Elective	Credits: 5
Course Objective	To introduce the concept of artificial network as an alternative option for solving engineering problems.	
Learning Outcome	Understand to work with different available data, optimization problem and technique in order to apply ANN in Electrical Engineering.	
Teaching methods/learning activities	Lecture, Tutorial, Practical	
Assessment methods	Internal Assessment, Lab Assessment, Final Exam	
Rational	Knowing and applying methods of neural network and to be able to formalize the problem and solve it by using an artificial neural network (ANN), which can be good alternative to solve several engineering projects.	
Teaching staff	Will be recruited later.	

Table 59

Wind Energy Conversion System (Elective III)		
New Course		Need to Modernize: No
Semester: 8th	Type: Elective	Credits: 5
Course Objective	To introduce the technology, grid integration and energy assessment for the wind power system to the final year BE student	
Learning Outcome	Understand the wind energy technology as a clean energy. Knowledge on global trend and potential of wind energy and its grid integration	
Teaching methods/learning activities	Lecture, Field visit, Assignment, Tutorial, Practical	
Assessment methods	Internal Assessment, Lab Assessment, Final Exam	
Rational	Design and Installation of wind energy conversion system in energy generation is important aspect to achieve clean energy. Information on global potential and trend of wind energy is must, for an energy engineer.	
Teaching staff	Will be recruited later.	

C. Curriculum development procedure of Master of Science in High Voltage Engineering

Below is the detailed table for each of the course that will be taught in new Master of Science in High Voltage Engineering at Kantipur Engineering College. We have decided to develop following four courses in collaboration with the eACCESS program at KEC whose detailed table are included below. The list of subjects in Master Program in High Voltage Engineering is as follow:

Table 60

Semester 1	High Voltage Generation and Measurement
Semester 1	Computer Aided Power System Analysis
Semester 2	Insulation System Design Diagnostic and Testing
Semester 3	Power System Planning and Reliability

Approval Process is ongoing. KEC will obtain affiliation and approval of master's degree course from Tribhuvan University. Since the country is in transition phase, if approval within the country is not possible KEC will run master's program in High Voltage Engineering under the affiliation of Polotsk State University with support of PU.

Financial aspects of each course will depend upon expenses are allocated on the remuneration to the faculties, conducting different seminars and workshops, and setting up the HV lab. Fee collected from students will be used to meet our Lecture, Practical expenses and infrastructure development. (See: Economic Feasibility for Masters Programme)

Table 61

High Voltage Generation and Measurement		
New Course Unit		Need to Modernize: No
Semester: 1st	Type: Core	Credits: 4
Course Objective	To impart students means, methods and techniques of high voltage generation. To review measurement philosophy, electrical measurement techniques and methods of measuring high voltages using direct and indirect approaches. To help students to acquaint with recent advances in digital measurement systems employed in high and extra high voltage circuits	
Learning Outcome	Revise and understand the methods of generation of high voltages using rotary generators and static generators (cascaded connections of capacitors).	

	Familiarize with the methods and techniques including measurement of voltages in high and extra high voltages circuits including transmission lines, generators, transformers, bus bars etc. Familiarize with the measurement philosophy, measuring techniques and devices based on digital instruments including software-based measurement.
Teaching methods/learning activities	Lectures, Laboratory Exercise, Tutorials
Assessment methods	Written Examination, Presentation, Lab exams, Assignments
Rational	Transmission of both bulk AC and DC power is done at high voltage (HV), therefore it is necessary to have insights on its generation and measurement.
Scope of eACCESS Collaboration:	The high voltage lab at KEC can be used by undergraduate and graduate students at Pokhara University. Lectures from the visiting professors from Pokhara University.
Teaching staff	Dr. Basanta Kumar Gautam, PhD, High Voltage Engineering.
Approval Processes	Process ongoing. See: Section C descriptions for details.
Implementation	This curriculum will be implemented the first year, first semester student of the new program of Master of Science in High Voltage Engineering.
Technical Support	Appropriate suggestions and knowledge sharing from the experts and the partner university is expected.
Capacity Building and Tutor Training requirements	There is the requirement of training of the laboratory equipment to the Lab personal. Faculties may require field visit and training for the generation and measurement of high voltage.
e-Learning and the use of the eACCESS platform	Distance learning through the use of e-learning between different partner universities. Seminars and workshops conducted to the students can be shared between various partner universities.

Table 62

Optimization Technique

New Course Unit		Need to Modernize: No
Semester: 1st	Type: Core	Credits: 4
Course Objective	To provide students optimization skills to solve engineering problems To provide students with advanced knowledge on algorithms associated with range of optimization techniques applicable in solving engineering problems	
Learning Outcome	Understand the theories, methods and techniques associated with optimization. Develop competency in developing algorithms to solve complex mathematical problems. Come up with robust and efficient solution techniques to solve real and applied engineering problems including that from broad domain of high voltage engineering.	
Teaching methods/learning activities	Lectures, Tutorials	
Assessment methods	Written Examination, Presentation, Assignments	
Rational	Incorporating the applications of AI into the mathematical modelling of the power system is subject of growing attention.	
Scope of eACCESS Collaboration:	Lectures from the visiting professors from Pokhara University. Online lectures and knowledge sharing by the experts from different partner universities.	
Teaching staff	Mrs. Anjana Devi Bhandari	
Approval Processes	Process ongoing. See: Section C for details.	
Implementation	This curriculum will be implemented the first year, first semester student of the new program of Master of Science in High Voltage Engineering.	

Table 63

Computer Aided Power System Analysis		
New Course Unit		Need to Modernize: No
Semester: 1st	Type: Core	Credits: 4

Course Objective	To review the general concepts, theories and analyses tools used in power system analysis. To provide students with advanced knowledge on modelling of power system network, solution of load flow problems including Gauss Seidel, Newton Raphson and Fast Decoupled Power Flow techniques. To acquaint students with Z-Bus building algorithm, symmetrical and unsymmetrical fault analysis using Z-Bus. To deliver contents on power system contingency, its evaluation techniques and application in power system planning and operation.
Learning Outcome	Revise the theories, methods and techniques associated modelling and analyses of power system under steady state condition. Build Z-bus matrix for a power system including node and branch addition and removal and carry out fault analysis under balanced as well as unbalanced condition using Z-Bus matrix. Understand power system contingencies and analyses and come up with remedial measures to alleviate the impact of contingency on operation of a power system.
Teaching methods/learning activities	Lectures, Tutorials, Seminars
Assessment methods	Written Examination, Presentation, Assignments
Rational	It is the matter of foremost importance to learn about the behaviour and other associated aspects of power system networks before we go in depth about the high voltage system.
Scope of eACCESS Collaboration:	Lectures from the visiting professors from Pokhara University. Online lectures and knowledge sharing by the experts from different partner universities.
Teaching staff	Er. Jiwan Kumar Mallik
Approval Processes	Process ongoing. Entire course will be approved after completion of approval process.
Implementation	This curriculum will be implemented the first year, first semester student of the new program of Master of Science in High Voltage Engineering.

Technical Support	Appropriate suggestions and knowledge sharing from the experts and the partner university is expected.
Capacity Building and Tutor Training requirements	Faculties may require field visit of different power sub-stations and transmission system for detailed study of the present situation.
e-Learning and the use of the eACCESS platform	Distance learning through the use of e-learning between different partner universities. Seminars and workshops conducted to the students can be shared between various partner universities.

Table 64

Electromagnetic Field Computation and Modelling		
New Course Unit	Need to Modernize: No	
Semester: 1st	Type: Core	Credits: 4
Course Objective	To review the students' fundamental knowledge and understanding electromagnetics and associated theories and concepts. To impart enhanced knowledge on various mathematical modelling and computational methods, tools and approaches used in computation of electromagnetic fields. To provide the students with knowledge on recent advances in computational techniques applicable to electromagnetic fields	
Learning Outcome	Strengthen knowledge about electromagnetic fields including its origin. Carry out electromagnetic field calculation in a single circuit as well as in a multi-circuit environment. Understand modelling and analysis methods of an electric power system for its electromagnetic fields computation and be able to interpret the results correctly.	
Teaching methods/learning activities	Lectures, Tutorials, Lab Exercise	
Assessment methods	Written Examination, Presentation, Assignments, Lab exams	
Rational	The subject provides comprehensive knowledge on fields from High Voltage.	
Teaching staff	Will be recruited later.	

Approval Processes	Process ongoing. Entire course will be approved after completion of approval process.
Implementation	This curriculum will be implemented the first year, first semester student of the new program of Master of Science in High Voltage Engineering.

Table 65

Insulation System Design Diagnostic and Testing		
New Course Unit	Need to Modernize: No	
Semester: 2nd	Type: Core	Credits: 4
Course Objective	To review the general concepts and theories on insulation system, its design and diagnostics. To emphasize the significance of insulation in smooth operation of power system. To acquaint students with instrumentation system for insulation diagnostics and deliver contents on recent advances in the field To acquaint the students with high voltage testing concepts, theories, methods and instrumentation systems.	
Learning Outcome	Understand the significance of insulation and the physics of its failure and gauge the impact on smooth operation of power system. Get acquainted with insulation measurements and diagnostics in high and extra high voltage power generation and transmission system. The diagnostics includes the instrumentation system involved and its operational philosophy. Understand methods and approaches pertaining to the testing of high and extra high voltage insulation system of power apparatuses and systems.	
Teaching methods/learning activities	Lectures, Tutorials, Lab exercise	
Assessment methods	Written Examination, Presentation, Assignments, Lab exams	
Rational	Insulation is an important part of electrical transmission system. It bears more concern when it comes to high voltage usage. Therefore, it is of basic requirement for the high voltage engineers to have basic knowledge on insulation and its design for high voltage.	

Scope of eACCESS Collaboration:	Lectures from the visiting professors from Pokhara University. Online lectures and knowledge sharing by the experts from different partner universities.
Teaching staff	Prof. Dr. Navaraj Karki
Approval Processes	Process ongoing.
Implementation	This curriculum will be implemented the first year, second semester student of the new program of Master of Science in High Voltage Engineering.
Technical Support	Appropriate suggestions and knowledge sharing from the experts and the partner university is expected.
Capacity Building and Tutor Training requirements	There will be the need of training to the lab personnel on the electromagnetic field theory labs.
e-Learning and the use of the eACCESS platform	Distance learning through the use of e-learning between different partner universities. Seminars and workshops conducted to the students can be shared between various partner universities.

Table 66

Extra HVAC Transmission		
New Course Unit	Need to Modernize: No	
Semester: 2nd	Type: Core	Credits: 4
Course Objective	To provide students with knowledge on engineering and philosophy of power transmission technologies at AC extra and ultra-high voltage levels. To bolster the students' knowledge on challenges and difficulties of Extra High Voltage (EHV) and Ultra High Voltage (UHV) AC power transmission and possible remedial measures. To provide the students with methods and techniques to evaluate electromagnetic fields around EHV and UHV AC lines, their possible adverse impacts on environments and possible remedial measures to limit the adverse impact on human and other living organisms. To provide students with enhanced knowledge of overvoltage phenomenon and remedial measures against them.	
Learning Outcome	Revise and understand the philosophy of power transmission at EHV and UHV AC voltage level including the tower structures,	

	insulator, line parameters and their impact on power transfer capability of the lines. Understand and carry out modelling and analyses of EHV and UHV lines including variation of voltage and currents in the system. Evaluate the impact of EHV and UHV AC system on phenomenon like corona, audible noise generation, radio interference in the vicinity of the lines. Compute the overvoltage levels at various points of power system and suggest/choose required remedial measure to protect the system and limit the adverse impact
Teaching methods/learning activities	Lectures, Tutorials, Seminars
Assessment methods	Written Examination, Presentation, Assignments
Rational	Electric Power is either transmitted as EHVAC or EHVDC.
Teaching staff	Will be recruited later.
Approval Processes	Process ongoing.
Implementation	This curriculum will be implemented the first year, second semester student of the new program of Master of Science in High Voltage Engineering.

Table 67

Project		
New Course Unit		Need to Modernize: No
Semester: 3rd	Type: Core	Credits: 4
Course Objective	To plan an electrical engineering project under the supervision of an instructor. During the project, students have to design functional project or simulate the system.	
Learning Outcome	The students are expected to design a fully functioning electrical system for the completion of their project.	
Teaching methods/learning activities	Lectures, Tutorials, Seminars	
Assessment methods	Project Defence, Presentation, Supervisor Evaluation	

Teaching staff	Will be recruited later.
Approval Processes	Process ongoing.
Implementation	This curriculum will be implemented the second year, third semester student of the new program of Master of Science in High Voltage Engineering.

Table 68

Thesis		
New Course Unit	Need to Modernize: No	
Semester: 4th	Type: Core	Credits: 16
Course Objective	To plan an electrical engineering project under the supervision of an instructor. During the project students have to research on research gap topic with genuine problem statement.	
Learning Outcome	Meet the problem statement fulfilling the research gap.	
Teaching methods/learning activities	Supervisor Interaction, Lecturers, Seminars, Workshops etc...	
Assessment methods	Thesis defence, Paper presentation, Supervisor Evaluation	
Rational	The primary focus of thesis is on enhancing research skills, formulating problem statement, identifying research gap, and adding value to the society.	
Teaching staff	Prof. Dr. Navaraj Karki, Assoc. Prof. Badrudoza, Er. Jiwan Kumar Mallik, Diwakar Bista,	
Approval Processes	Process ongoing.	
Implementation	This curriculum will be implemented the second year, fourth semester student of the new program of Master of Science in High Voltage Engineering.	

Table 69

HVDC Power Transmission		
New Course Unit	Need to Modernize: No	
Semester: 2nd	Type: Elective	Credits: 4
Course Objective	To provide the students fundamental knowledge and understanding of HVDC power transmission.	

	To impart knowledge on various modalities of HVDC power system – monopolar, bipolar and homopolar, and their techno-economic analyses. To provide the students with knowledge on converter and inverter technologies used at the interface of AC and DC systems.
Learning Outcome	Understand the underlying principles behind choice of HVDC power transmission over existing HVAC system. Understand the technology and philosophy behind different HVDC power transmission schemes: monopolar, bipolar and homopolar; carry out techno-economic analyses to accept/reject a particular technology for a concerned power system. Understand modelling, operation and analysis of various converter/inverter topologies used at the start/termination of the HVDC transmission system.
Teaching methods/learning activities	Lectures, Tutorials, Seminars, Conferences
Assessment methods	Written Examination, Presentation, Assignments
Rational	The electric power is transmitted either as EHVAC or EHVDC.
Teaching staff	Will be recruited later.
Approval Processes	Process ongoing.
Implementation	This curriculum will be implemented the first year, second semester student of the new program of Master of Science in High Voltage Engineering as an elective subject.

Table 70

Flexible AC Transmission System		
New Course Unit	Need to Modernize: No	
Semester: 2nd	Type: Elective	Credits: 4
Course Objective	To review the issues and challenges related to the highly interconnected power systems with increasing penetration of intermittent generations and increased usage of loads drawing non-sinusoidal currents. To impart the students with knowledge on various types of power electronics devices used to enhance/control power transmission capability.	

	To provide modelling and analysis tools and mathematical skills required to carry out system analysis incorporating FACTS devices.
Learning Outcome	Enhance their knowledge regarding different pertinent issues that are the root causes of inefficiency, underutilization and inflexible control of existing power system facilities. Simulate and analyse various types of FACTS devices currently available in the marketplace as well as those with potential to be marketed in the near future. Model and design an appropriate type of FACTS for a given power system based on both the technological aspects as well as economical aspects.
Teaching methods/learning activities	Lectures, Tutorials
Assessment methods	Written Examination, Presentation, Assignments
Rational	FACTS devices can be useful in power flow control, loop-flow control, voltage regulations, enhancement of transient stability, and mitigation of system oscillations in power system.
Teaching staff	Will be recruited later.
Approval Processes	Process ongoing.
Implementation	This curriculum will be offered to the first year, second semester student of the new program of Master of Science in High Voltage Engineering as an elective subject.

Table 71

Power System Planning and Reliability		
New Course Unit	Need to Modernize: No	
Semester: 3rd	Type: Electives	Credits: 4
Course Objective	To review the general probability concepts, theories and their applications in engineering sciences. To deliver concept of reliability, its significance and application in electric power systems. To provide students with modelling and analyses techniques of engineering systems from system reliability assessment perspectives.	

	To deliver the mathematical tools and methods applicable in evaluating reliability of complex engineering systems, their comparative analyses.
Learning Outcome	Revise probability theories and able to apply these techniques to solve real time engineering problems. Carry out modelling of engineering systems with focus on power systems and assess the reliability of the system using different methods. Understand power system reliability issues, its significance and need to assess it correctly for optimal system operation and planning.
Teaching methods/learning activities	Lectures, Tutorials
Assessment methods	Written Examination, Presentation, Assignments
Rational	Reliability evaluation is an important and integral feature of the planning, design and operation of power engineering system.
Scope of eACCESS Collaboration:	Lectures from the visiting professors from Pokhara University. Online lectures and knowledge sharing by the experts from different partner universities.
Teaching staff	Will be recruited later.
Approval Processes	Process ongoing.
Implementation	This curriculum will be offered to the second year, third semester student of the new program of Master of Science in High Voltage Engineering as an elective subject.
Technical Support	Appropriate suggestions and knowledge sharing from the experts and the partner university is expected.
Capacity Building and Tutor Training requirements	Requirement of knowledge sharing from the experts through seminars or conferences to the faculties in this subject matter. Requirement of workshop and training of the subject specific software for the faculty.
e-Learning and the use of the eACCESS platform	Distance learning through the use of e-learning between different partner universities. Seminars and workshops conducted to the students can be shared between various partner universities.

Table 72

Power Systems Dynamic and Stability		
New Course Unit		Need to Modernize: No
Semester: 3rd	Type: Elective	Credits: 4
Course Objective	To provide the students with broader understanding of stability issues in power systems. To impart the students' knowledge about mathematical modelling of various power system components: synchronous machines, transformers, static loads, transmission lines, asynchronous machines. To provide modelling tools and mathematical skills required to carry out small signal stability in power systems. To provide the students with modelling and analysis tools and skills pertaining to large scale power swings during 3-phase faults, disconnection of large load and generator in the system. To impart knowledge on voltage stability, its origin, significance, modelling and simulation tools, measures to enhance voltage stability in a power system.	
Learning Outcome	Carry out modelling and stability analysis during small disturbances in a single and multi-machine environment. Understand the issues related to, model and analyse transient stability of a single machine connected to infinite bus and repeat the same in multi-machine environment. Simulate and analyse voltage stability issues in a power system; suggest/take appropriate measures to enhance voltage stability of the system.	
Teaching methods/learning activities	Lectures, Tutorials	
Assessment methods	Written Examination, Presentation, Assignments	
Rational	Provides knowledge on stability of power system network.	
Teaching staff	Will be recruited later.	
Approval Processes	Process ongoing.	

Implementation	This curriculum will be offered to the second year, third semester student of the new program of Master of Science in High Voltage Engineering as an elective subject.

Table 73

Power System Operation and Control		
New Course Unit	Need to Modernize: No	
Semester:3rd	Type: Elective	Credits: 4
Course Objective	To review the general operation and control procedures in a power system. To deliver general concept of electric power dispatch leading to the concept of economic load dispatch, methods of carrying out ELD and its application in hydro-dominated system. To provide students with modelling and analyses techniques relevant to power system control: two area control, multi-area control, dependence of power and frequency. To deliver the mathematical tools and methods applicable in power system state estimation.	
Learning Outcome	Revise general concepts of power system operation and control. Carry out unconstrained and constrained optimal solutions for matching a given demand on the system including knowledge of Electronic Load Dispatch (ELD). Carry out power flow studies including OPF and SCOPF in a standard network, for example, IEEE Test Systems.	
Teaching methods/learning activities	Lectures, Tutorials	
Assessment methods	Written Examination, Presentation, Assignments	
Rational	Provides knowledge on general concepts of power system operation and control. Load flow techniques provide broader knowledge on power system operations.	
Teaching staff	Will be recruited later.	
Approval Processes	Process ongoing.	

Implementation	This curriculum will be offered to the second year, third semester student of the new program of Master of Science in High Voltage Engineering as an elective subject.

Table 74

Power Electronics and Electric Drives		
New Course Unit	Need to Modernize: No	
Semester: 3rd	Type: Elective	Credits: 4
Course Objective	To review the general understanding of power electronics devices used in power system. To impart knowledge on flexible control of power electronic devices using microcontrollers, built-in chips and software. To provide enhanced modelling, simulation and analyses skills for flexible control and operation of modern electric drives	
Learning Outcome	Revise and enhance their understanding of power electronics and electric drives. Simulate and design power electronics-based operation and control schemes for modern electric drives. Simulate, model and build power customized power electronics-based controllers for various end use applications	
Teaching methods/learning activities	Lectures, Tutorials	
Assessment methods	Written Examination, Presentation, Assignments	
Rational	Power electronic devices and electric drives can be incorporated into a power system network in order to enhance the performance of the network and its efficiency.	
Teaching staff	Will be recruited later on.	
Approval Processes	Process ongoing.	
Implementation	This curriculum will be offered to the second year, third semester student of the new program of Master of Science in High Voltage Engineering as an elective subject.	

Table 75

Artificial Intelligence		
New Course Unit		Need to Modernize: No
Semester: 3rd	Type: Elective	Credits: 4
Course Objective	To provide the students with basic understanding of AI techniques and their significance in design, construction and operation of modern engineering systems. To deliver contents on ANN, GA, Fuzzy Logic, PSO, MFO, ACO used in electrical engineering. To prepare the students to develop algorithms and write codes to solve electrical engineering problems.	
Learning Outcome	Learn and understand various optimization tools based on artificial intelligence. Write codes for various AI techniques to solve real engineering problems and understand why a particular technique is suited or not for a particular type of problem.	
Teaching methods/learning activities	Lectures, Tutorials	
Assessment methods	Written Examination, Presentation, Assignments	
Rational	Artificial intelligence is one of the most researched area and its incorporation in power system helps to enhance its performance.	
Teaching staff	Will be recruited later.	
Approval Processes	Process ongoing.	
Implementation	This curriculum will be offered to the second year, third semester student of the new program of Master of Science in High Voltage Engineering as an elective subject.	

Table 76

Design of Substations		
New Course Unit		Need to Modernize: No
Semester: 3rd	Type: Elective	Credits: 4
Course Objective	To understand types of substation type and purposes.	

	To identify equipment, design features, specifications and mechanical aspects of substation design.
Learning Outcome	Knowledge of substation design is important in electrical engineering because substations are major components of high voltage network.
Teaching methods/learning activities	Lectures, Tutorials
Assessment methods	Written Examination, Presentation, Assignments
Rational	Sub-stations are the integral part of power system and proper designing of sub-stations helps in control, maintenance and performance enhancement of power system.
Teaching staff	Will be recruited later.
Approval Processes	Process ongoing.
Implementation	This curriculum will be offered to the second year, third semester student of the new program of Master of Science in High Voltage Engineering as an elective subject.

Table 77

Micro Grids		
New Course Unit	Need to Modernize: No	
Semester: 3rd	Type: Elective	Credits: 4
Course Objective	To impart the students with knowledge about distributed generation technology and its significance in modern electricity supply system. To deliver about concept of Microgrids, various types and control philosophy of Microgrids. To provide modelling and analysis tools and mathematical skills required to carry out design, operation and control of Microgrids.	
Learning Outcome	Understand the concept of Microgrids. Simulate, design and build a Microgrid, carry out its performance analyses under normal and fault condition within or external to the Microgrid. Provide localized solutions to various planning, design and operational issues related to Microgrids in a professional manner.	

Teaching methods/learning activities	Lectures, Tutorials
Assessment methods	Written Examination, Presentation, Assignments
Rational	Incorporation of automatic and anticipative system into power network has increased the need of smart grid technology in today's world.
Teaching staff	Will be recruited later.
Approval Processes	Process ongoing.
Implementation	This curriculum will be offered to the second year, third semester student of the new program of Master of Science in High Voltage Engineering as an elective subject.

Table 78

Industrial Automation		
New Course Unit		
Semester:3rd	Type: Elective	Credit: 4
Course Objective	To impart the Knowledge of the industrial drives and control mechanism To deliver the knowledge of the electronics component used in industrial drives To impart the knowledge of industrial Power supply	
Learning Outcome	The learner will able to work in industrial automation and in designing industrial power supply.	
Assessment Methods	Written Examination, Presentation, Assignments	
Rational	Knowledge of industrial drives and its control, power supply is inevitable for power engineers.	
Teaching Staff	Will be recruited later.	
Approval Processes:	Process ongoing.	
Implementation	This curriculum will be offered to the second year, third semester student of the new program of Master of Science in High Voltage Engineering as an elective subject.	

D. Vocational Training Module Development in KEC

KEC will be conducting vocational training as a part of eACCESS collaboration targeting to the electrical technical personnel. KEC will provide certificates to participants after completion of the training course. However, there is no such system of providing credits to the training courses in Nepal and transfer of such credits are not taken in consideration in any existing courses. Two training units shall be prepared and are listed below:

Vocational Training Unit-1:

Current Transformer/Potential Transformer (CT/PT) Testing with Analyzer:

CT/PT are the major components of the power system protection network that helps to measure current and voltage variables at the point of their locations. This training unit targets the technicians working on electrical network of Nepal and provides a degree of practical knowledge and understanding on various tests: CT Excitation curve, turn ratio test, ratio and phase error test, polarity test, winding resistance test, secondary burden test using CT/PT analyser kit.

Vocational Training Unit-2:

Insulation Testing:

High voltage measurement and testing is of profound importance for electrical engineers. In this training unit KEC will be training engineers working on the high voltage network that will help them in the measurement of dielectric strength of solid and liquid insulators used in electrical system. In proposed eACCESS-HVL, 100 kV AC can be generated which will be used for Disruptive discharge voltage test for glass disc insulator, ceramic line post insulator and composite line post insulator. Lighting impulse disruptive discharge test for above insulators will be provided on training under this unit.

E. Human Resources

The lists of faculties involved in the preparation of the new courses and course units, together with their CV are put down below:

Mrs. Anjana Devi Bhandari has completed Elements of Advanced Algebra from Universita degli Studi Roma Tre Roma, Italy in 2018. She completed her Master of Science in Mathematics from Bishop Choolaparambil Memorial College for Women, Mahatma Gandhi University, Kottayam, Kerala, India in 2007. Currently she is the Deputy Head of Department of Engineering Science and Humanities in Kantipur Engineering College. She has been working as a faculty member in Kantipur Engineering College since April 2011. Her research interests are Applied Mathematics, Optimization Techniques.

Er. Prakash Kafle is a Computer Engineering graduate from Kantipur Engineering College, Tribhuvan University in 2014 A.D. He has been working as a faculty member in Kantipur Engineering College since April 2014. His research interests are Big Data, Cyber Security etc.

Er. Amar Baral is a Mechanical Engineering graduate from Pulchowk Campus, IOE, Tribhuvan University in 2016 A.D. He has been working as a faculty member in Kantipur Engineering College since April 2017 A.D.

Mr. Maha Datta Paudel has completed his master's degree in Physics from University Campus, Tribhuvan University, Kirtipur, Nepal in 2002.He has been working as a faculty member in Kantipur Engineering College since April 2003 A.D. His research interests are Material Science & Nanotechnology and Condensed Matter Physics. Currently, he is the Head of Department of Engineering Science and Humanities.

Er. Avishek Sapkota is a Lecturer in the Department of Computer and Electronics Engineering at Kantipur Engineering College. Mr.Sapkota is an electrical engineering graduate from Pulchowk Campus, IOE, Tribhuvan University in 2018 A.D. He has been working as a faculty member in Kantipur Engineering College since April 2019. His research interest are Electric Vehicle and Battery Storage System, Power electronics, Electric Drives, Renewable Energy Technologies, Power Systems etc. He is eACCESS team member from KEC. His responsibilities in eACCESS project are handle and manage all aspects of Master Level Course in High Voltage Engineering.

Er. Ima Nath Duwadi is a Civil Engineering graduate from Kantipur Engineering College, Tribhuvan University in 2010 A.D. He has been working as a faculty member in Kantipur Engineering College since April 2012 A.D. His research interests are Construction technology and tools for planning of construction projects based on construction time.

Er. Saroj Sharma is a graduate in Electronics and Communication Engineering. He has been working as a faculty member in Kantipur Engineering College since April 2017 A.D. His research interest is Power Efficient Telecommunication Networks.

Dr. Keshar Prasain completed his master's degree in Chemistry from Tribhuvan University, Nepal in 2001. Dr. Prasain then joined Kantipur Engineering College as a Lecturer from June 25, 2001. Dr. Prasain got an opportunity to pursue his PhD degree in Kansas State University, USA and graduated in 2013. His research interests are Biodegradable Polymers, Protein Kinase C, Anticancer Drugs, Laccase Inhibitors, Anti-Viral Drugs, Organic Synthesis. Currently, he is the **Vice –Principal** of Kantipur Engineering College. Number of Research Publications: 7.

Er. Kritika Sharma is a Mechanical Engineering graduate from CSVTU- India in 2014 A.D. She has been working as a faculty member in Kantipur Engineering College since April 2015 A.D.

Mr. Ravi Sharma is working as Deputy Instructor in the workshopof Kantipur Engineering College for the last 18 years. He has extensive work experience of Machinery Mechanic (Maintenance), Foreman (Head Mechanic), Manufacturer of turbine, structure lab, fluid lab, hydraulics lab, thermo lab for many colleges like in Nepal.

Er. Anup K.C is an Electronics and Communication Engineering graduate from Kantipur City College, Purwanchal University in 2011 A.D. He has been working as a faculty member in Kantipur Engineering College since April 2013 A.D. His research interests are AI, Deep Learning, Machine Learning and Data Science. Currently he is the **Deputy Head** of Department of Computer and Electronics Engineering at Kanitpur Engineering College.

Er. Bishal Rimal is a Lecturer in Department of Computer and Electronics Engineering at Kanitpur Engineering College. He has completed his bachelor's in electrical engineering from, Paschimanchal Campus, IOE, TU in 2017. He is currently pursuing his master's degree in Renewable energy engineering from Pulchowk Campus, IOE, TU. He has been teaching various electrical subjects in KEC since 2017. He has research interest on Electric Vehicles and Power system. He has participated in various conference, seminar and training inside and outside the country representing KEC. He has published two research papers in national and international conferences. He is eACCESS team member from KEC. His responsibilities in eACCESS project are handle and manage all aspects of Undergraduate Level Course development and Laboratory Pillar of eACCESS project.

Er. Rajesh Shah has received his Bachelor's in Electronics and Communication Engineering from IOE Pulchowk Campus in 2015 A.D. He has been working as a full-time faculty in Kantipur Engineering College since November 2018. His Research interests are Signal and Image Processing, Robotics and AI.

Er. Sujin Gwacha has earned a bachelor's degree in Electronics and Communication Engineering from Purbanchal University in 2011 A.D. He has been working as a faculty member in Kantipur Engineering College since April 2013 A.D. His Research interests are solid state devices and various communication systems.

Er. Sushil Paudel (Lecturer), completed his MSc. In Renewable Energy Engineering in 2019 and Bachelor of Electrical Engineering from Pulchowk Campus, Institute of Engineering (IOE), Tribhuvan University (TU) in 2016. He has been working as a faculty member in Kantipur Engineering College since March 2017. Since then, Mr. Paudel has been delivering lectures, organizing closed sessions and conducting laboratories of different subjects of Electrical Engineering in KEC. He is eACCESS team in charge from KEC. His responsibilities in eACCESS project are handle and manage progress of eACCESS project with consultations with Principal, Vice-principal and Head of Department of College.

Er. Sunil Kumar Shrestha has earned a master's degree in Master of Science in Information Technology from the University of East London, Stratford. He is a graduate of Kantipur Engineering College in Electronics and Communication Engineering in 2008.He has been working as a faculty member in Kantipur Engineering College since April 2013 A.D. His Research interest is information security.

Mr. Krishna Prasad Gautam is a Lecturer in Kantipur Engineering College. Mr. Gautam has earned master's degree in English Education from Tribhuvan University and M.Phil. in English Literature from Pokhara University. He has been engaging in dealing with the college level students and also, participating in teaching Proficiency Tests such as IELTS, TOEFL & SAT for almost a decade in various institutions located in Kathmandu

Mr. Deepak Dhas completed his master's degree in Mathematics from Kerala University, in 2003. Mr. Dhas then joined Kantipur Engineering College as a Lecturer from 2013 A.D. His research interest is in 3D Matrices and possibility of its application in data storing.

Er. Utsab Pokharel completed his master's degree in information and Communication Engineering in 2013 from IOE, Tribhuvan University. He has been working as a faculty member in Kantipur Engineering College since April 2018 A.D. His research interests are Business Intelligence, Big Data, Blockchain, Natural Language Processing.

Er. Sushil Rijal, Lecturer in the Department of Civil Engineering at Kantipur Engineering College since 2019. He has completed MSc in Construction Management from Pulchowk Campus, Tribhuvan University in 2018, MA in Economics from Patan Multiple Campus, Tribhuvan University in 2018 and Bachelor in Civil Engineering from Pulchowk Campus, Institute of Engineering, TU in 2014.He teaches Engineering Economics, Building Technology, Strength of Material, Applied Mechanics (Statics and Dynamics). His research interests include Infrastructure and their returns and Transportation planning.

Mr. Kamal Katuwal, Lecturer in Department of Civil Engineering in KEC has completed M.Sc. Interdisciplinary Water Resource Management (IWRM) running, Nepal Engineering College. Bachelor's in civil engineering, Cosmos College of Management and Technology, Pokhara University. He has played a lead role in organizing KEC conference 2018 and 2019.

Er. Rabindra Khati, Associate Professor and currently the **Head of Department** of Computer and Electronics Engineering and working at Kantipur Engineering College since 2006. He has earned his M.Sc. Eng. From Moscow, Russia and master's in computer application (MCA) from India. He teaches subjects Operating System, Information System, Software Engineering, Database Management System, Organization and Management. His research interests include Software Engineering, Databases, Real Time Systems etc.

F. Preliminary feasibility study of the undergraduate and master course

Risk of Operational Feasibility for Bachelor's and Master's Level:

Risk of Human Resources and Hiring Procedure: It has been a trend that the people after graduating with an engineering degree from Nepal plan to pursue their higher education abroad. Even the faculty working in colleges are applying for government jobs in Nepal or higher education abroad. This makes the availability of qualified faculty difficult generally in the technical field. However, with our good reputation and transparent system, we are still able to attract the best graduates in the teaching position.

Economic Risk: The lower salary for teaching position is the other factor that the graduates available in Nepal have lower interest in teaching. The number and salary of teachers and staff depends on the college income which is only the fee the college collects from the students. With

the limited number of students enrolled, the revenue generated by the college is just enough to sustain the college functioning. Since, the college has already completed the construction of infrastructure required for the classrooms and few labs (two labs need to be built) for the bachelor's programme, the economic risk to sustain the program is minimum. However, if we cannot enrol sufficient numbers of students (at least 30 for bachelor's and 20 students' in master's) the sustainability of the programme is difficult to achieve in the first four years. The college shall focus on motivating prospective students to join KEC through several ways that include open house, special sessions and advertisements.

Political Risk: Though we are in the final stage of getting approval for BE in Electrical Engineering from the Tribhuvan University, the approval cannot be guaranteed in our provided time frame. The slow process of approval, political uncertainty and lack of transparency may hinder the approval process. In this regard, the college management is in close contact and regular communication with the TU officials. Moreover, for master's level, due to the pending of Education Policy of Nepal, the approval of the course from PSU may be hindered. The slow process of approval, political uncertainty and lack of transparency may further hinder the approval process. In this regard, the college management is in close contact and regular communication with the respective officials from PSU and the government of Nepal.

COVID 19: The present COVID 19 situations in Nepal is even getting worse. Due to lockdown of universities and colleges, the approval process is even getting delayed. The financial condition of the students to pursue an engineering degree by paying is getting worse. Due to these two reasons, the enrolment number of students for the first two years might be highly affected. Furthermore, the equipment must be ordered from abroad and can only reach us after the situation is normal in India and China as well. Construction of the lab also might take some time. In the present scenario, due to the economic recession, the country's policies might be stricter in importing expensive equipment from abroad.

Economic Feasibility for Undergraduate Program

Here we highlight the financial analysis of the first four years of bachelor's Programme in Electrical Engineering. The college will compensate all the expenditure covered in the first teaching cycle of the program (first four years), if it goes according to the planning.

Total Number of students admitted (Yearly) = 48
Number of students with scholarship = 8 (As per the government policy of Nepal)
Number of paying students = 40
Total Fee for each student (Batch I) = 8000 Euro
Total Fee for each student (Batch II) = 8200 Euro
Total Fee for each student (Batch III) = 8400 Euro
Total Fee for each student (Batch IV) = 8600 Euro

(All figures in thousands of Euro)

Table 79

	Year I	Year II	Year III	Year IV	Total

Estimated Revenue	Batch I	Batch II	Batch I	Batch III	Batch II	Batch I	Batch IV	Batch III	Batch II	Batch I	
Tuition Fee	128	131,2	64	134,4	65,6	64	137,6	67,2	65,6	64	**921,6**
External Grants and Contacts	0	0	0	0	0	0	0	0	0	0	**0**
Others	0	0	0	0	0	0	0	0	0	0	**0**
Total Revenue											**921,60**
	Year I	**Year II**		**Year III**			**Year IV**				**Total**
Estimated Expenditure	Batch I	Batch II	Batch I	Batch III	Batch II	Batch I	Batch IV	Batch III	Batch II	Batch I	
Salary and other benefit of Faculty and Staff	19,2	20	20	21	21	21	22	22	22	22	**174,2**
Learning Resources	1	1,1	1,1	1,2	1,2	1,2	1,4	1,4	1,4	1,4	**13,2**
Laboratory Setup and Maintenance	20	150	5	150	6	6	100	6	6	7	**456**
Stationary	2	2	2	2,5	3	3	3,5	3,5	4	4	**30**
Others	20	20	20	20	20	20	20	20	20	20	**200**
Total Expenditure											**873,4**
Difference (Revenue-Expenditure)											**48,2**

Note: Each class of 48 students need an average of 4-5 full time teachers and we need 2 additional staff in total for the Bachelor level in electrical engineering. Others in the above table also include the resources that the staff and faculty use.

Economic Feasibility for Masters Programme

Here we highlight the financial analysis of the first two years of the master's Programme in High Voltage Electrical Engineering. The college will compensate all the expenditure (exception to the establishment of the High Voltage Laboratory) covered in the first teaching cycle of the program (First two years), if it goes according to the planning.

Total Number of students admitted (Yearly) = 30
Number of students with scholarship = 3 (As per the government policy of Nepal)
Number of paying students = 27
Total Fee for each student (Batch I) = (45000 + 40000) / 27 = 3200 Euro
Total Fee for each student (Batch II) = (47000 +42000) / 27 = 3300 Euro

(All figures in thousands of Euro)

Table 80

	Year I	Year II		Total Year II
Estimated Revenues	Batch I	Batch I	Batch II	
Tuition Fees	45	40	47	**87**
External Grants and Contacts	0	0	0	**0**
Others	0	0	0	**0**
Total Revenue	**45**	**45**	**47**	**87**
	Year I	**Year II**		**Total Year II**
Estimated Expenditures	Batch I	Batch I	Batch II	
Salary and other benefits of Faculty and Staff	28	30	30	**60**
Learning Resources	2	1	1	**2**
Laboratory Maintenance	8	4	4,5	**8,5**
Stationary	2	2,5	2,5	**5**
Others	3	2	2	**4**
Total Expenditure (In Euro)	**43**	**39,5**	**40**	**79,5**
Differences (Rev - Exp)	**2**			**7,5**

Note: Each class of 30 students need an average of 4-5 full time teachers and we need 3 additional staff in total for the master's Level in electrical engineering. Others in the above table also include the resources that the students, staff and faculty use.

Feasibility for the Vocational Training:
After the establishment of High Voltage Laboratory and start of the master's level education in High Voltage Engineering, vocational trainings will be offered in the following fields:

i) CT/PT Testing with Analyzer.
ii) Insulation Testing

However, the vocational training will be conducted as per the demand of the trainee; therefore, the subjects might change as per the need assessment. The faculty and staff involved in bachelors and master's level plus experts will be responsible for training. The high voltage

laboratory and audio-visual classroom facility will be used for the training. The remuneration to be provided to the experts shall be covered by the participant.

III. Pokhara University (PU)

A. Curriculum modernization procedure at PU

For new curriculum development or modernization of existing curriculum, the Office of the Dean, Faculty of Science and Technology, Pokhara University and Curriculum Development Centre (CDC), Pokhara University are responsible. The existing curriculum of Bachelor of Electrical and Electronics Engineering was developed and implemented in 2011. There is the need to improve (modernize) the existing curriculum of Bachelor of Electrical and Electronics Engineering program. On this regard, The Office of the Dean has already formed the task committee recommended from Subject committee. The committee for the need assessment will recommend the necessary steps for the curriculum development and on the basis of the recommendation of the committee Office of the Dean and CDC will organize the following steps for the curriculum development. Similarly, there is the need to develop some elective courses and modification of existing course module of Master of Science in Electrical Engineering in Power System.

- Organize meeting / workshop between academia/experts of industry / Utility company people to finalize the structure of curriculum
- Hire experts to develop the draft copy of detail curriculum
- Organize meeting/workshop between academia/experts of industry / Utility company people to get the feedback from stake holders finalize detail curriculum
- Subject committee will recommend the curriculum and forwarded to dean office for the necessary action
- Dean office will recommend to the academic council of Pokhara University for the final approval of the curriculum.

Curriculum of Pokhara University will generally be revised after completion of one cycle.

B. Curriculum development and modernization of Bachelor of Electrical and Electronics Engineering

Bachelor of Electrical and Electronics program Curriculum will be revised for 2021 intake (September 2021). Committee is already formed / this committee will develop new structure with justification and submit report to dean office via Subject Committee. The committee will plan to introduce new curriculum as well as to modernization of existing curriculum. Faculty of Science and Technology, Pokhara University and Curriculum Development Centre is interested to develop and modernize following course module for the Bachelor level program under the eACCESS project collaboration. Pokhara University adopts the L.T.P (Lecture: Tutorial: Practical) approach of teaching and learning.

Table 81

S. No	Course	Credit (Hours per week) (L.T.P)	Course Type	Remarks
1	High Voltage Engineering	3.1.2	Core	Laboratory based Course

2	Industrial Automation	3.1.2	Elective	Simulation exercise based
3	Renewable Energy and grid Integration	3.1.2	Core	Simulation exercise based
4	Special Machine and Controller	3.1.2	Elective	Simulation Exercises
5	Simulation and Modelling	3.1.2	Elective	

Table 82

<table>
<tr><td colspan="4">eACCESS proposed module: High Voltage Engineering</td></tr>
<tr><td colspan="3">Existing Course Unit: High Voltage Engineering</td><td>Need to Modernize: Yes</td></tr>
<tr><td>Semester: 8th</td><td colspan="2">Type: Core: Yes</td><td>Credits: 3.1.2</td></tr>
<tr><td>Course Objective</td><td colspan="3">To impart the knowledge of need of high voltage power transmission and high voltage generation and measurements.

To impart the knowledge of overvoltage generation and propagation in electrical power transmission lines and its impacts on station equipment

To impart the knowledge of breakdown phenomena of the insulation used in electrical power system

To impart the knowledge of insulation coordination among the electrical apparatus used in power system networks and need of surge diverters to protect systems from overvoltage</td></tr>
<tr><td>Learning Outcome</td><td colspan="3">The learner will be able to explain the need of HV transmission as well as generation and measurements of HV

The learner will be able to describe the phenomenon related to insulation failure, protection of it and coordination of insulation used in electrical power system

The learner will be able to describe the different types of overvoltage encountered and its propagation as well as impact on station devices and protection required</td></tr>
<tr><td>Teaching methods/learning activities</td><td colspan="3"><table><tr><th>Approach</th><th>Hours per week</th><th>Total contact hours per semester</th></tr><tr><td>Lecture</td><td>3</td><td>45</td></tr><tr><td>Tutorial</td><td>1</td><td>15</td></tr></table></td></tr>
</table>

<table>
<tr><td></td><td></td><td colspan="2">Practical</td><td>2</td><td colspan="2">30</td></tr>
<tr><td></td><td></td><td colspan="4">Total</td><td>90</td></tr>
<tr><td rowspan="6">Assessment methods</td><td>S. No.</td><td colspan="3">Mode of Assessment</td><td>Nos.</td><td>Marks Allocated</td></tr>
<tr><td>1</td><td colspan="5">Internal Assessment</td></tr>
<tr><td>1.1</td><td colspan="3">Internal assessment I</td><td>1</td><td>20</td></tr>
<tr><td>1.2</td><td colspan="3">Laboratory Evaluation</td><td>1</td><td>20</td></tr>
<tr><td>1.4</td><td colspan="3">Class Performance/Attendance</td><td>1</td><td>10</td></tr>
<tr><td>2</td><td colspan="3">Semester End Examination: 3 hrs duration, closed book</td><td>1</td><td>50</td></tr>
<tr><td>Changes</td><td colspan="6">Development of Practical Conduction (Exercises)</td></tr>
<tr><td>Rational</td><td colspan="6">Since the electrical Power is transmitted in high voltage and all electrical power apparatus must withstands different overvoltage

Testing and condition monitoring of insulation of apparatus will becoming challenging due to lack of testing laboratory within the country</td></tr>
<tr><td>Scope of eACCESS Collaboration</td><td colspan="6">Training to the faculty and technical staffs on assigned course module
Laboratory works will be conducted in Kantipur Engineering College (Bachelor students will do regular experiments as well as specific experiments in Kantipur Engineering College)
Resource person sharing
Compendium/course manual will be developed which will be common for Kantipur Engineering College and PU
Web based teaching is possible between PU and Kantipur Engineering College</td></tr>
<tr><td>Teaching staff</td><td colspan="6">Dr. Basant Kumar Gautam- Visiting Associate Professor-more than 20 years of teaching and research experience</td></tr>
<tr><td>Approval Processes</td><td colspan="6">Recommendation from Subject committee and final approval from Pokhara University Academic Council</td></tr>
<tr><td>Implementation</td><td colspan="6">The new curriculum will be applied to current 8th semester students' i.e. course will be implemented to 2021 intake.</td></tr>
<tr><td>Technical Support</td><td colspan="6">Required Suggestion and feedback from Experts of Partner institute during course module development and implementation</td></tr>
<tr><td>Capacity Building and Tutor Training requirements</td><td colspan="6">Junior Teaching staff of the Faculty of Engineering, Pokhara University needs to be trained during curriculum development and training session on High Voltage Laboratory development. They will gain extra knowledge, create networking with national/international experts, motivate towards the quality education system. It is the part of the Sustainability and Capacity Building in HEI.</td></tr>
<tr><td>e-Learning and the use of the</td><td colspan="6">Use of Moodle Platform and zoom if required for teaching and evaluation/demonstration but it is not mandatory</td></tr>
</table>

eACCESS platform	
Financial Aspects	Pokhara University has allocated the budget for curriculum upgrading and modernization. The allocated budget will be utilized for curriculum development workshop, meeting allowances and remuneration. Pokhara University and eACCESS Project Funding will be utilized for Curriculum Development, Training to staff and organization of seminar/conference.

Table 83

eACCESS proposed module: Industrial Automation		
New Course: Yes		Need to Modernize: No
Semester: 7th/8th	Type: Elective	Credits: 3.1.2
Course Objective	To impart the Knowledge of the industrial drives and control mechanism To deliver the knowledge of the electronics component used in industrial drives To impart the knowledge of industrial Power supply	
Learning Outcome	The learner will get the knowledge about the different energy efficient drive systems of the industries The learner will able to design the power supply and motor drive of the industries The learner will able to describe the electronics devices, sensors and control used within the industry and different communication protocol used for data transmission and display	

Teaching methods/learning activities

Approach	**Hours per week**	**Total teaching hours per semester**
Lecture	3	45
Tutorial	1	15
Practical	2	30
Total		**90**

Assessment methods

Sl. No.	***Mode of Assessment***	***Nos.***	***Marks Allocated***	***Marks (%)***
1	**Internal Assessment**			
1.1	Internal assessment I	1	20	**35**
1.2	Laboratory Evaluation	1	20	
1.4	Class Performance/Attendance	1	10	

	2	**Semester End Examination**: 3 hrs duration, closed book	1	**50**
Changes	New Course development			
Rational	Since the industry is major energy consumer and the most of industries utilizes the energy efficient drive system and automation. This course is introduced aiming that graduates of program will be able to work in production industries within the country as well as abroad			
Scope of eACCESS Collaboration	• Curriculum development process and it's effective collaboration • Training based on course module to faculty and laboratory staff • Resource person sharing within partner university • Compendium / course manual will be developed which will be common for Kantipur Engineering College and PU in future			
Teaching staff	Lalit Bickrum Rana-Permanent Associate Professor, Program Coordinator of Master of Science in Electrical Engineering, more than 20 years of teaching and researching experience in University.			
Approval Processes	Recommendation from Subject committee and final approval from Pokhara University Academic Council			
Implementation	The new curriculum will be applied to current $7^{th}/8^{th}$ semester students' i.e. course will be implemented for 2021 intake.			
Technical Support	Required Suggestion and feedback from Experts of Partner institute during course module development and implementation			
Capacity Building and Tutor Training requirements	Young Faculty of Pokhara University needs to be trained during curriculum development and other relevant training session. They will gain extra knowledge, create networking with national/international experts, motivate towards the quality education system. It is the part of the Sustainability and Capacity Building in HEI.			
e-Learning and the use of the eACCESS platform	Use of Moodle Platform and zoom if required for teaching and evaluation/demonstration but it is not mandatory			
Financial Aspects	Pokhara University has allocated the budget for curriculum upgrading and modernization. The allocated budget will be utilized for curriculum development workshop, meeting allowances and remuneration. Pokhara University and eACCESS Project Funding will be utilized for Curriculum Development, Training to staff and organization of seminar/conference.			

Table 84

<table>
<tr><th colspan="4">eACCESS proposed module: Renewable Energy and grid Integration</th></tr>
<tr><td colspan="2">New Course: Yes</td><td colspan="2">Need to Modernize: No</td></tr>
<tr><td>Semester: 7th/8th</td><td colspan="2">Type: Core</td><td>Credits: 3.1.2</td></tr>
<tr><td>Course Objective</td><td colspan="3">To impart the knowledge of Energy generation from Renewable resources and converter topologies for power conditioning

To study about the integration of various renewable energy sources into the grid,

To analyse the grid integration issues of renewable generation and dynamic performance of the network</td></tr>
<tr><td>Learning Outcome</td><td colspan="3">The learner will be able to describe about technology of energy production from various renewable resources

The learner will be able to describe methods and challenges in grid integration of RT

The learner will be able to describe the impact of RT in existing grid</td></tr>
<tr><td>Teaching methods/learning activities</td><td colspan="3"><table>
<tr><th>Approach</th><th>Hours per week</th><th>Total contact hours/week</th></tr>
<tr><td>Lecture</td><td>3</td><td>45</td></tr>
<tr><td>Tutorial</td><td>1</td><td>15</td></tr>
<tr><td>Practical</td><td>2</td><td>30</td></tr>
<tr><td>Total</td><td></td><td>90</td></tr>
</table></td></tr>
<tr><td>Assessment methods</td><td colspan="3"><table>
<tr><th>Sl. No.</th><th>Mode of Assessment</th><th>Nos.</th><th>Marks Allocated</th></tr>
<tr><td>1</td><td colspan="3">Internal Assessment (50%)</td></tr>
<tr><td>1.1</td><td>Internal assessment</td><td>1</td><td>20</td></tr>
<tr><td>1.2</td><td>Laboratory evaluation</td><td>1</td><td>20</td></tr>
<tr><td>1.4</td><td>Class Performance/Attendance</td><td>1</td><td>10</td></tr>
<tr><td>2</td><td>Semester End Examination: 3 hrs duration, closed book (50%)</td><td>1</td><td>50</td></tr>
</table></td></tr>
<tr><td>Changes</td><td colspan="3">New Curriculum development</td></tr>
<tr><td>Rational</td><td colspan="3">Clean and Sustainable energy and becoming promising future energy sources. Huge Job market in national and international level</td></tr>
</table>

Scope of eACCESS Collaboration	Generally, this course offered in electrical engineering program of national and international universities. Energy conversion laboratory established in partner university will be utilized in future
Teaching staff	Dr. Suresh Baral-Permanent Assistant Professor, Former Deputy Controller of Examination-Pokhara University, more than 10 years of teaching and researching experience in University.
Approval Processes	Recommendation from Subject committee and final approval from Pokhara University Academic Council
Implementation	The new curriculum will be applied to current 4th year students' i.e. course will be implemented for 2021 admission batch students.
Technical Support	Required Suggestion and feedback from Experts of Partner institute during course module development and implementation
Capacity Building and Tutor Training requirements	Young Faculty of Pokhara University needs to be trained during curriculum development and training session on power system. They will gain extra knowledge, create networking with national/international experts, motivate towards the quality education system. It is the part of the Sustainability and Capacity Building in HEI.
e-Learning and the use of the eACCESS platform	Use of Moodle Platform and zoom if required for teaching and evaluation/demonstration but it is not mandatory
Financial Aspects	Pokhara University has allocated the budget for curriculum upgrading and modernization. The allocated budget will be utilized for curriculum development workshop, meeting allowances and remuneration. Pokhara University and eACCESS Project Funding will be utilized for Curriculum Development, Training to staff and organization of seminar/conference.

Table 85

eACCESS proposed module: Special Machine and Controller		
New Course: Yes		Need to Modernize: No
Semester: 7th/8th	Type: Elective	Credits: 3.1.2
Course Objective	To impart the knowledge of current trends of machine technology for the industries and other domestic applications. To impart the knowledge of operations and applications of different special electrical machine. To impart the knowledge of power electronics and control required for those machines	

<table>
<tr><td></td><td>for efficient operation. To impart the knowledge of mathematical modelling of those machines</td></tr>
<tr><td>Learning Outcome</td><td>The learners will be able to describe the principle and modelling of different special machines

The learner will be able to demonstrate the working principle and analysis of the power electronics converter and control used in efficient operation of those machines</td></tr>
<tr><td>Teaching methods/learning activities</td><td>
<table>
<tr><th>Approach</th><th>Hours per week</th><th>Total credit hours</th></tr>
<tr><td>Lecture</td><td>3</td><td>45</td></tr>
<tr><td>Tutorial</td><td>1</td><td>15</td></tr>
<tr><td>Practical</td><td>2</td><td>30</td></tr>
<tr><td>Total</td><td></td><td>90</td></tr>
</table>
</td></tr>
<tr><td>Assessment methods</td><td>
<table>
<tr><th>Sl. No.</th><th>Mode of Assessment</th><th>Nos.</th><th>Marks Allocated</th></tr>
<tr><td>1</td><td colspan="3">Internal Assessment</td></tr>
<tr><td>1.1</td><td>Internal assessment</td><td>1</td><td>20</td></tr>
<tr><td>1.2</td><td>Laboratory works</td><td>1</td><td>20</td></tr>
<tr><td>1.4</td><td>Class Performance/Attendance</td><td>1</td><td>10</td></tr>
<tr><td>2</td><td>Semester End Examination: 3 hrs duration, closed book</td><td>1</td><td>100</td></tr>
</table>
</td></tr>
<tr><td>Changes</td><td>New Course development</td></tr>
<tr><td>Rational</td><td>Intensive research is going on to enhance the power density of the machine

In addition to traditional machine high power density machine are becoming promising in different application.</td></tr>
<tr><td>Scope of eACCESS Collaboration</td><td>Energy conversion laboratory established in partner university will be utilized in future</td></tr>
<tr><td>Teaching staff</td><td>Dr. Bishal Silwal-Visiting Faculty/Full Time Contract, more than 10 years of teaching and research experience in national and international Universities.</td></tr>
<tr><td>Approval Processes</td><td>Recommendation from Subject committee and final approval from Pokhara University Academic Council</td></tr>
<tr><td>Implementation</td><td>The new curriculum will be applied to current 4th year students' i.e. course will be implemented for 2021 admission batch students.</td></tr>
</table>

Technical Support	Required Suggestion and feedback from Experts of Partner institute during course module development and implementation
Capacity Building and Tutor Training requirements	Young Faculty of Pokhara University needs to be trained during curriculum development and training session on power system. They will gain extra knowledge, create networking with national/international experts, motivate towards the quality education system. It is the part of the Sustainability and Capacity Building in HEI.
e-Learning and the use of the eACCESS platform	Use of Moodle Platform and zoom if required for teaching and evaluation/demonstration but it is not mandatory
Financial Aspects	Pokhara University has allocated the budget for curriculum upgrading and modernization. The allocated budget will be utilized for curriculum development workshop, meeting allowances and remuneration. Pokhara University and eACCESS Project Funding will be utilized for Curriculum Development, Training to staff and organization of seminar/conference.

Table 86

eACCESS proposed module: Simulation and Modelling				
New Course: Yes				Need to Modernize: No
Semester: 7th/8th	Type: Elective			Credits: 3.1.2
Course Objective	To impart the knowledge of different tools and techniques to simulate electrical systems. To impart the knowledge of COMSOL software and its application to visualize electrical, magnetic and thermal loading in different parts of electrical machine. To impart the knowledge of Simulink technique using MATLAB /ETAP and other software. To impart the basic concept of mathematical modelling of electrical systems and simulation knowledge of electrical power networks. To impart the introductory knowledge of other professional software to analyse and design electrical systems.			
Learning Outcome	The learner will be able to use commercially available software to simulate electrical power network The Learner will be able to analyse the electrical systems under disturbances using commercially available software			
Teaching methods/le		**Approach**	**Hours per week**	**Total credit hours**
		Lecture	3	45

<table>
<tr><td>arning activities</td><td></td><td colspan="4"><table>
<tr><td>Tutorial</td><td>1</td><td>15</td></tr>
<tr><td>Practical</td><td>2</td><td>30</td></tr>
<tr><td>Total</td><td colspan="2">90</td></tr>
</table></td></tr>
<tr><td>Assessment methods</td><td colspan="4"><table>
<tr><th>Sl. No.</th><th>Mode of Assessment</th><th>Nos.</th><th>Marks Allocated</th></tr>
<tr><td>1</td><td colspan="3">Internal Assessment</td></tr>
<tr><td>1.1</td><td>Internal assessment</td><td>1</td><td>20</td></tr>
<tr><td>1.2</td><td>Laboratory Evaluation</td><td>1</td><td>20</td></tr>
<tr><td>1.4</td><td>Class Performance/Attendance</td><td>1</td><td>10</td></tr>
<tr><td>2</td><td>Semester End Examination: 3 hrs duration, closed book</td><td>1</td><td>50</td></tr>
</table></td></tr>
<tr><td>Changes</td><td colspan="4">New Course development</td></tr>
<tr><td>Rational</td><td colspan="4">Since the Mathematical modelling and simulation technique are required to analyse and design electrical apparatus and electrical systems before hardware realization. Most of the production industries will test the systems and apparatus in software before fabrication.</td></tr>
<tr><td>Scope of eACCESS Collaboration</td><td colspan="4">Energy conversion (Power Electronics) and Power System laboratory established in partner university will be utilized in future</td></tr>
<tr><td>Teaching staff</td><td colspan="4">Dr. Bishal Silwal-Visiting Faculty/Full Time Contract, more than 10 years of teaching and research experience in University, Lalit Bickrum Rana-Permanent Associate Professor, Program Coordinator of Master of Science in Electrical Engineering, more than 20 years of teaching and researching experience in University.</td></tr>
<tr><td>Approval Processes</td><td colspan="4">Recommendation from Subject committee and final approval from Pokhara University Academic Council</td></tr>
<tr><td>Implementation</td><td colspan="4">The new curriculum will be applied to current 4th year students' i.e. course will be implemented for 2021 admission batch students.</td></tr>
<tr><td>Technical Support</td><td colspan="4">Required suggestion and feedback from experts of Partner institute during course module development and implementation</td></tr>
<tr><td>Capacity Building and Tutor Training requirements</td><td colspan="4">Young Faculty of Pokhara University needs to be trained during curriculum development and training session on power system. They will gain extra knowledge, create networking with national/international experts, motivate towards the quality education system. It is the part of the Sustainability and Capacity Building in HEI.</td></tr>
</table>

e-Learning and the use of the eACCESS platform	Use of Moodle Platform and zoom if required for teaching and evaluation/demonstration but it is not mandatory
Financial Aspects	Pokhara University has allocated the budget for curriculum upgrading and modernization. The allocated budget will be utilized for curriculum development workshop, meeting allowances and remuneration. Pokhara University and eACCESS Project Funding will be utilized for Curriculum Development, Training to staff and organization of seminar/conference.

C. Curriculum modernization of Master of Electrical Power System Engineering (PU)

For New Curriculum development or Modernization of existing curriculum the Office of the Dean, Faculty of Science and Technology, Pokhara University and Curriculum Development Centre (CDC), Pokhara University are responsible. Pokhara University has already started Master of Science in Electrical Engineering in Power System program. There is the need to develop some elective courses and modification of existing course module of Master of Science in Electrical Engineering in Power System.

- Organize meeting / workshop between academia/ experts of industry / Utility company people to finalize the structure of curriculum
- Hire experts to develop the draft copy of detail curriculum
- Organize meeting / workshop between academia/ experts of industry / Utility company people to get the feedback from stake holders finalize detail curriculum
- Subject committee will recommend the curriculum and forwarded to dean office for the necessary action
- Dean office will recommend to the Academic Council of Pokhara University for the final approval of the curriculum.

Curriculum of Pokhara University will be generally revised after completion of one cycle. Master of Science in Electrical Engineering in Power System curriculum will be revised for March 2021 Intake. Subject Committee of Pokhara University will recommend to the Office of the Dean, Faculty of Science and Technology, Pokhara University for the Curriculum modernization. Since the elective courses designed for the M.Sc. program is not enough Dean office and CDC will be planning to introduce more electives for March 2021 intake as well as modernization of some core courses. So, our expectance is to get feedback, technical and financial support for development of new elective syllabus like followings.

Faculty of Science and Technology and Curriculum Development Centre is interested to develop and modernize following course modules under the eACCESS project collaboration.

Table 87

S/N	Module Title	Type	Credit Hours per week (L.T.P)	Remark

1	Advanced High Voltage Engineering	Core	4.0.0.	Laboratory Work based
2	Electrical Transients in Power System	Elective	3.0.0	Simulation Exercise based
3	Electromagnetic Field Computation and Modelling	Elective	3.0.0	Simulation Exercise based
4	Soft Computing Techniques	Elective	3.0.0	Simulation Exercise based
5	Smart Power Grid	Elective	3.0.0	Simulation Exercise based
6	Energy Management System and SCADA	Elective	3.0.0	Simulation Exercise based

Table 88

<table>
<tr><td colspan="4">eACCESS proposed module: Advanced High Voltage Engineering</td></tr>
<tr><td colspan="3">Existing Course: Advanced High Voltage Engineering</td><td>Need to Modernize: Yes</td></tr>
<tr><td>Semester: 2nd</td><td colspan="2">Type: Core</td><td>Credits: 4.0.0</td></tr>
<tr><td>Course Objective</td><td colspan="3">To impart the in-depth knowledge of need of HV transmission and HV generation and measurements in laboratory. To impart the knowledge of breakdown phenomena of different insulation material used in electrical apparatus. To impart the in-depth knowledge of overvoltage and its propagation along the Transmission line and its impact on the station equipment. To impart the knowledge of insulation coordination among the equipment used in HV power transmission.</td></tr>
<tr><td>Learning Outcome</td><td colspan="3">The learners will be able to design insulations requirements for the HV apparatus used in electrical power transmission. The learner will be able to describe the mechanism of insulation breakdown as well as its mitigations. The learners will be able to design size and placements of surge diverters in Power Transmission lines</td></tr>
<tr><td>Teaching methods/learning activities</td><td colspan="3"><table>
<tr><th>Approach</th><th>Hours per week</th><th>Total credit hours</th></tr>
<tr><td>Lecture and Laboratory works</td><td>4</td><td>60</td></tr>
<tr><td>Assignment Practices</td><td>0</td><td>0</td></tr>
<tr><td>Practical</td><td>0</td><td>0</td></tr>
<tr><td>Total</td><td></td><td>60</td></tr>
</table></td></tr>
</table>

Assessment methods	***Sl. No.***	***Mode of Assessment***	***Nos.***	***Marks Allocated***
	1	**Internal Assessment**		
	1.1	Internal assessment	1	30
	1.2	Laboratory Evaluation	1	20
	1.4	Class Performance/Attendance/Presentation	1	10
	2	**Semester End Examination**: 3 hrs duration, closed book	1	**40**
Changes	Laboratory component will be introduced, and Laboratory developed in KEC will utilized for the regular experiments of M.Sc. Students The existing courses need to be modernized. The content related to overvoltage and transient will be shifted to Electrical Transients in Power System which will be offered in next semester The in-depth knowledge about the generation, measurement breakdown and condition and monitoring should be included			
Rational	Since the electrical Power is transmitted in high voltage and all electrical power apparatus must withstands different overvoltage Testing and condition monitoring of insulation of apparatus will becoming challenging due to lack of testing laboratory			
Scope of eACCESS Collaboration	Utilization of Laboratory developed in Kantipur Engineering College for faculty research Laboratory works will be conducted in Kantipur Engineering College (Bachelor students will do regular experiments as well as specific experiments in Kantipur Engineering College as of partner institutions) Resource person sharing Compendium / course manual will be developed which will be common for Kantipur Engineering College and PU Web based teaching is possible between PU and Kantipur Engineering College			
Teaching staff	Dr. Basant Kumar Gautam- Visiting Associate Professor-more than 20 years of teaching and research experience			
Approval Processes	Recommendation from Subject committee and final approval from Pokhara University Academic Council			
Implementation	1.On processes / Revision team has already been formed 2.Upgraded curriculum will be implemented from 2020 intake			
Technical Support	Required suggestion and feedback from experts of Partner institute during course module development and implementation			
Capacity Building	Young Faculty of Pokhara University needs to be trained during curriculum development and training session on power system. They will gain extra			

and Tutor Training requirements	knowledge, create networking with national/international experts, motivate towards the quality education system. It is the part of the Sustainability and Capacity Building in HEI.
e-Learning and the use of the eACCESS platform	Use of Moodle Platform and zoom if required for teaching and evaluation/demonstration
Financial Aspects	Pokhara University has allocated the budget for curriculum upgrading and modernization. The allocated budget will be utilized for curriculum development workshop, meeting allowances and remuneration. Pokhara University and eACCESS Project Funding will be utilized for Curriculum Development, Training to staff and organization of seminar/conference.

Table 89

<table>
<tr><th colspan="5">eACCESS proposed module: Electrical Transients in Power System</th></tr>
<tr><td colspan="3">New Course: Yes</td><td colspan="2">Need to Modernize: No</td></tr>
<tr><td>Semester: 3rd</td><td colspan="2">Type: Elective</td><td colspan="2">Credits: 3.0.0</td></tr>
<tr><td>Course Objective</td><td colspan="4">To impart knowledge on generation and propagation of overvoltages, its modelling and impacts on terminal apparatus. To provide the knowledge on the modelling of overhead lines, underground cables, transformers. To impart the knowledge about power system transients.</td></tr>
<tr><td>Learning Outcome</td><td colspan="4">Learners will be able to model overhead lines, cables and transformers. Learners will be able to analyse power system transients and its impacts. Learner will be able to protect the power system networks form overvoltage transients</td></tr>
<tr><td>Teaching methods/learning activities</td><td colspan="4"><table>
<tr><th>Approach</th><th>Hours per week</th><th>Total credit hours</th></tr>
<tr><td>Lecture</td><td>3</td><td>45</td></tr>
<tr><td>Assignment Practices</td><td>0</td><td>0</td></tr>
<tr><td>Practical</td><td>0</td><td>0</td></tr>
<tr><td>Total</td><td></td><td>45</td></tr>
</table></td></tr>
<tr><td>Assessment methods</td><td colspan="4"><table>
<tr><th>Sl. No.</th><th>Mode of Assessment</th><th>Nos.</th><th>Marks Allocated</th></tr>
</table></td></tr>
</table>

	1	**Internal Assessment**		
	1.1	Internal assessment I	1	20
	1.2	Internal Assessment II	1	20
	1.3	Assignments	1	10
	1.4	Class Performance/Attendance/Presentation	1	10
	2	**Semester End Examination**: 3 hrs duration, closed book	1	**40**
Changes	New Course development			
Rational	Overvoltage in power system is mainly switching and lightening transients and it propagate along the line. The insulation systems and protective systems are designed to mitigate its impact to human and the terminal device			
Scope of eACCESS Collaboration:	Utilization of Laboratory developed in Kantipur Engineering College for faculty research Laboratory works will be conducted in Kantipur Engineering College (Maters students will do regular experiments as well as specific experiments in Kantipur Engineering College) Resource person sharing Compendium / course manual will be developed which will be common for Kantipur Engineering College and PU Web based teaching is possible between PU and Kantipur Engineering College			
Teaching staff	Dr. Basant Kumar Gautam- Visiting Associate Professor-more than 20 years of teaching and research experience			
Approval Processes	Recommendation from Subject committee and final approval from Pokhara University Academic Council			
Implementation	1.On processes / Revision team has already been formed 2.Upgraded curriculum will be implemented from 2020 intake			
Technical Support	Required suggestion and feedback from experts of Partner institute during course module development and implementation			
Capacity Building and Tutor Training requirements	Young Faculty of Pokhara University needs to be trained during curriculum development and training session on power system. They will gain extra knowledge, create networking with national/international experts, motivate towards the quality education system. It is the part of the Sustainability and Capacity Building in HEI.			
e-Learning and the use of the eACCESS platform	Use of Moodle Platform and zoom if required for teaching and evaluation/demonstration			

Financial Aspects	Pokhara University has allocated the budget for curriculum upgrading and modernization. The allocated budget will be utilized for curriculum development workshop, meeting allowances and remuneration. Pokhara University and eACCESS Project Funding will be utilized for Curriculum Development, Training to staff and organization of seminar/conference.

Table 90

eACCESS proposed module: Electromagnetic Field Computation and Modelling				
New Course: Yes				Need to Modernize: No
Semester: 2nd/3rd	Type: Elective			Credits: 3.0.0
Course Objective	Impart the knowledge of Electromagnetic computation and its application to design high voltage electrical apparatus To impart the knowledge of different methods, tools and techniques for the simulation of electromagnetic field distribution in electrical apparatus			
Learning Outcome	Students will learn basic theory of electromagnetic field computation Student will be able to visualize field distribution in electrical apparatus using commercially available software Student will be able to perform 3D analyse for electrical and thermal field distribution in electrical apparatus			
Teaching methods/learning activities		**Approach**	**Hours per week**	**Total credit hours**
		Lecture	3	45
		Assignment Practices	0	0
		Practical	0	0
		Total		**60**
Assessment methods				

	Sl. No.	***Mode of Assessment***	***Nos.***	***Marks Allocated***
	1	**Internal Assessment**		
	1.1	Internal assessment I	1	20
	1.2	Internal Assessment II	1	20
	1.3	Assignments	1	10
	1.4	Class Performance/Attendance/Presentation	1	10
	2	**Semester End Examination**: 3 hrs duration, closed book	1	**40**

Changes	New Course development
Rational	Useful in designing Electrical Apparatus and understand the electrical, magnetic and thermal stresses in different part of the electrical apparatus switchyard components etc
Scope of eACCESS Collaboration	Entirely New course, Pokhara University expecting technical supports like software, experts etc
Teaching staff	Dr. Bishal Silwal-Visiting Faculty/Full Time Contract, more than 10 years of teaching and research experience in University.
Approval Processes	Recommendation from Subject committee and final approval from Pokhara University Academic Council
Implementation	On processes / Revision team has already been formed Upgraded curriculum will be implemented from 2020 intake
Technical Support	Required suggestion and feedback from experts of Partner institute during course module development and implementation
Capacity Building and Tutor Training requirements	Young Faculty of Pokhara University needs to be trained during curriculum development and training session on power system. They will gain extra knowledge, create networking with national/international experts, motivate towards the quality education system. It is the part of the Sustainability and Capacity Building in HEI.
e-Learning and the use of the eACCESS platform	Use of Moodle Platform and zoom if required for teaching and evaluation/demonstration
Financial Aspects	Pokhara University has allocated the budget for curriculum upgrading and modernization. The allocated budget will be utilized for curriculum development workshop, meeting allowances and remuneration. Pokhara University and eACCESS Project Funding will be utilized for Curriculum Development, Training to staff and organization of seminar/conference.

Table 91

eACCESS proposed module: Soft Computing Techniques		
New Course Unit:Yes		Need to Modernize: No
Semester: 3rd	Type: Elective	Credits: 3.0.0

<table>
<tr><td>Course Objective</td><td colspan="5">To impart the fundamentals of ANN and fuzzy set theory. To make students capable to implement ANN and Fuzzy set theory in power system application</td></tr>
<tr><td>Learning Outcome</td><td colspan="5">The learner will be able understand ANN and fuzzy concept. The learner will be able to use ANN and Fuzzy concepts to solve electrical problems. The learner will be able to use ANN and Fuzzy as tools to make their Master thesis</td></tr>
<tr><td>Teaching methods/learning activities</td><td colspan="5"><table>
<tr><td>Approach</td><td>Hours per week</td><td>Total credit hours</td></tr>
<tr><td>Lecture</td><td>3</td><td>45</td></tr>
<tr><td>Assignment Practices</td><td>0</td><td>0</td></tr>
<tr><td>Practical</td><td>0</td><td>0</td></tr>
<tr><td>Total</td><td></td><td>45</td></tr>
</table></td></tr>
<tr><td>Assessment methods</td><td colspan="5"><table>
<tr><td>Sl. No.</td><td>Mode of Assessment</td><td>Nos.</td><td>Marks Allocated</td></tr>
<tr><td>1</td><td colspan="3">Internal Assessment</td></tr>
<tr><td>1.1</td><td>Internal assessment I</td><td>1</td><td>20</td></tr>
<tr><td>1.2</td><td>Internal Assessment II</td><td>1</td><td>20</td></tr>
<tr><td>1.3</td><td>Assignments</td><td>1</td><td>10</td></tr>
<tr><td>1.4</td><td>Class Performance/Attendance/Presentation</td><td>1</td><td>10</td></tr>
<tr><td>2</td><td>Semester End Examination: 3 hrs duration, closed book</td><td>1</td><td>40</td></tr>
</table></td></tr>
<tr><td>Changes</td><td colspan="5">New Course development</td></tr>
<tr><td>Rational</td><td colspan="5">Machine learning, ANN and Fuzzy are used to analyse electrical systems</td></tr>
<tr><td>Scope of eACCESS Collaboration:</td><td colspan="5">Entirely New course, Pokhara University expecting technical supports like software, experts etc</td></tr>
<tr><td>Teaching staff</td><td colspan="5">Ananta Adhikari-Permanent Faculty/On study leave for PhD, more than 5 years of teaching</td></tr>
<tr><td>Approval Processes</td><td colspan="5">Recommendation from Subject committee and final approval from Pokhara University Academic Council</td></tr>
<tr><td>Implementation</td><td colspan="5">On processes / Revision team has already been formed
Upgraded curriculum will be implemented from 2020 intake</td></tr>
<tr><td>Technical Support</td><td colspan="5">Required suggestion and feedback from experts of Partner institute during course module development and implementation</td></tr>
<tr><td>Capacity Building and Tutor</td><td colspan="5">Young Faculty of Pokhara University needs to be trained during curriculum development and training session on power system. They will gain extra knowledge, create networking with national/international experts, motivate</td></tr>
</table>

Training requirements	towards the quality education system. It is the part of the Sustainability and Capacity Building in HEI.
e-Learning and the use of the eACCESS platform	Use of Moodle Platform and zoom if required for teaching and evaluation/demonstration
Financial Aspects	Pokhara University has allocated the budget for curriculum upgrading and modernization. The allocated budget will be utilized for curriculum development workshop, meeting allowances and remuneration. Pokhara University and eACCESS Project Funding will be utilized for Curriculum Development, Training to staff and organization of seminar/conference.

Table 92

eACCESS proposed module: Smart Grid						
New Course: Yes					Need to Modernize: No	
Semester: 2nd/3rd	Type: Elective				Credits: 3.0.0	
Course Objective	To Study about Smart Grid technologies, different smart meters and advanced metering infrastructure. To familiarize the power quality management issues in Smart Grid. To familiarize the high-performance computing for Smart Grid applications					
Learning Outcome	Learners will be able to describe concepts of Smart Grid, its present developments and different Smart Grid technologies. Learner will be able to understand different smart meters and advanced metering infrastructure. Learner will develop more understanding on power quality management in Smart Grids and LAN, WAN and Cloud Computing for Smart Grid applications.					
Teaching methods/learning activities		**Approach**	**Hours per week**	**Total credit hours**		
		Lecture	3	45		
		Assignment Practices	0	00		
		Total		**45**		
Assessment methods	***Sl. No.***	***Mode of Assessment***		***Nos.***	***Marks Allocated***	***Marks (%)***

	1	**Internal Assessment**		
	1.1	Internal assessment I	1	20
	1.2	Internal Assessment II	1	20
	1.3	Assignments	1	10
	1.4	Class Performance/Attendance/Presentation	1	10
	2	**Semester End Examination**: 3 hrs duration, closed book	1	**40**
Changes	New Course development			
Rational	Technologies trends are toward distribution system automation, substation automation, Microgrids, RT penetration , Demand side management , hour-based tariff sensing , data transmission and online metering concepts so this course need to be introduced			
Scope of eACCESS Collaboration	Entirely new course, Pokhara University expecting technical supports like software, experts etc			
Teaching staff	Dr. Shailendra Kumar-Visiting Faculty, more than 15 years of teaching and research experience			
Approval Processes	Recommendation from Subject committee and final approval from Pokhara University Academic Council			
Implementation	1.On processes / Revision team has already been formed 2.Upgraded curriculum will be implemented from 2020 intake			
Technical Support	Required suggestion and feedback from experts of Partner institute during course module development and implementation			
Capacity Building and Tutor Training requirements	Young Faculty of Pokhara University needs to be trained during curriculum development and training session on power system. They will gain extra knowledge, create networking with national/international experts, motivate towards the quality education system. It is the part of the Sustainability and Capacity Building in HEI.			
e-Learning and the use of the eACCESS platform	Use of Moodle Platform and zoom if required for teaching and evaluation/demonstration			
Financial Aspects	Pokhara University has allocated the budget for curriculum upgrading and modernization. The allocated budget will be utilized for curriculum development workshop, meeting allowances and remuneration. Pokhara			

	University and eACCESS Project Funding will be utilized for Curriculum Development, Training to staff and organization of seminar/conference.

Table 93

<table>
<tr><th colspan="5">eACCESS proposed module: Energy Management and SCADA</th></tr>
<tr><td colspan="3">New Course: Yes</td><td colspan="2">Need to Modernize: No</td></tr>
<tr><td>Semester: 3rd</td><td colspan="2">Type: Elective</td><td colspan="2">Credits: 3.0.0</td></tr>
<tr><td>Course Objective</td><td colspan="4">• This course provides an introduction to various Energy Management Systems (EMS) and its Applications in Power Systems, which includes various techniques which are executed in the load dispatch centre.
• To impart the knowledge of e hardware and software components of SCADA (Supervisory Control and Data Acquisition), which is an interface between the Physical Power System and the EMS programs.</td></tr>
<tr><td>Learning Outcome</td><td colspan="4">• The learner will able to understand the hardware components and software components of SCADA
• The learner will be able to describe SCADA communication protocols
• The learners will able to describe different techniques for EMS</td></tr>
<tr><td>Teaching methods/learning activities</td><td colspan="4"><table>
<tr><th>Approach</th><th>Hours per week</th><th>Total credit hours</th></tr>
<tr><td>Lecture</td><td>3</td><td>45</td></tr>
<tr><td>Tutorial</td><td>0</td><td>0</td></tr>
<tr><td>Practical</td><td>0</td><td>0</td></tr>
<tr><td>Total</td><td></td><td>45</td></tr>
</table></td></tr>
<tr><td>Assessment methods</td><td colspan="4"><table>
<tr><th>Sl. No.</th><th>Mode of Assessment</th><th>Nos.</th><th>Marks Allocated</th></tr>
<tr><td>1</td><td colspan="3">Internal Assessment</td></tr>
<tr><td>1.1</td><td>Internal assessment I</td><td>1</td><td>20</td></tr>
<tr><td>1.2</td><td>Internal Assessment II</td><td>1</td><td>20</td></tr>
<tr><td>1.3</td><td>Assignments</td><td>1</td><td>10</td></tr>
<tr><td>1.4</td><td>Class Performance/Attendance/Presentation</td><td>1</td><td>10</td></tr>
<tr><td>2</td><td>Semester End Examination: 3 hrs duration, closed book</td><td>1</td><td>40</td></tr>
</table></td></tr>
<tr><td>Changes</td><td colspan="4">New Course development</td></tr>
<tr><td>Rational</td><td colspan="4">Modern load dispatch centre and Generating station communication uses SCADA protocols. Thus, important subject area in monitoring control display and energy management</td></tr>
</table>

Scope of eACCESS Collaboration:	Entirely new course, Pokhara University expecting technical supports like software, experts etc
Teaching staff	Lalit Bickrum Rana-Permanent Associate Professor, Program Coordinator of Master of Science in Electrical Engineering, more than 20 years of teaching and researching experience in University.
Approval Processes	Recommendation from Subject committee and final approval from Pokhara University Academic Council
Implementation	1.On processes / Revision team has already been formed 2.Upgraded curriculum will be implemented from 2020 intake
Technical Support	Required suggestion and feedback from experts of Partner institute during course module development and implementation
Capacity Building and Tutor Training requirements	Young Faculty of Pokhara University needs to be trained during curriculum development and training session on power system. They will gain extra knowledge, create networking with national/international experts, motivate towards the quality education system. It is the part of the Sustainability and Capacity Building in HEI.
e-Learning and the use of the eACCESS platform	Use of Moodle Platform and zoom if required for teaching and evaluation/demonstration
Financial Aspects	Pokhara University has allocated the budget for curriculum upgrading and modernization. The allocated budget will be utilized for curriculum development workshop, meeting allowances and remuneration. Pokhara University and eACCESS Project Funding will be utilized for Curriculum Development, Training to staff and organization of seminar/conference.

D. Human Resources

The Faculty of Science and Technology, Pokhara University launched Master of Science in Electrical Engineering in Power System in 2019 intake with annual enrolment capacity of 16 students. The program is running in School of Engineering, outside the capital in beautiful city Pokhara. FOST lunched the program with limited human resources and strong commitment of visiting faculties and experts from power industries. School of Engineering already announced the fulltime faculty position in national newspaper and expecting two faculties with Doctorate and two with M.Sc. as soon as possible. Beside that school has promoted few faculties for the further studies. The list of faculties that are assigned for each course module is presented here with detail information.

Experts for the curriculum modernization and development for Bachelor Program

S/N	Course Title	Experts
1	High Voltage Engineering	Dr.Basanta Kumar Gautam
2	Industrial Automation	Er. Lalit Bickram Rana
3	Renewable Energy and grid integration	Dr. Suresh Baral
4	Special Machine and Controller	Dr. Bishal Silwal
5	Simulation and Modelling	Er. Lalit Bickram Rana / Dr. Bishal Silwal

Experts for the curriculum modernization and Development for master's Program

S/N	**Course Title**	**Experts**
1	Advanced High Voltage Engineering	Dr.Basanta Kumar Gautam
2	Electrical Transients in Power System	Dr.Basanta Kumar Gautam
3	Electromagnetic Field Computation and Modelling	Dr. Bishal Silwal
4	Soft Computing Techniques	Er. Annanta Adhikari
5	Smart Power Grid	Dr.Shailendra Kumar Jha
6	Energy Management System and SCADA	Er. Lalit Bickram Rana

Basanta Kumar Gautam, PhD-Visiting Faculty, received PhD Eng. in High Volatge Engineering from the Matsuoka Laboratory, Chubu University, Kasugai, Japan (MONBUSHO scholarship) .He received Bachelor of Engineering in Electro-Automation Technology; Wuxi University of Light Industry, Wuxi, China (Chinese government scholarship) in july 1996. He worked as Research student of High Voltage Insulation in the Matsuoka Laboratory, Chubu University, Kasugai, Japan (Chubu University Scholarship) in 2004. Dr Gautam is serving as a permanent faculty in the Department of Electrical Engineering in Pashchimanchal Campus, Institute of Engineering, Tribhuvan University, Nepal from 10/1997. Currently, he is working as a capacity of Associate Professor in the Department of Electrical Engineering in Pashchimanchal Campus, Institute of Engineering, Tribhuvan University. He is working as visiting Associate professor in School of Engineering of Pokhara University since 2010. He also worked as Head of the Department of Department of Electrical Engineering, Pashchimanchal Campus, Pokhara from 07/2013 – 05/2017 and Program Coordinator of MSc in Electrical Engineering (Distributed Generation) program in Pashchimanchal Campus, Institute of Engineering, Tribhuvan University from 11/2015 – 05/2017. Dr, Gautam is Member of the Electrical Engineering Subject Committee of Institute of Engineering, Tribhuvan University and Pokhara University. Dr. Gautam as worked as Editor-in-Chief of OODHBODHAN, a Technical journal of TUTA, Pashchimanchal Campus 2012 – 2014.

Lalit Bickrum Rana- Permanent Associate Professor received B.Sc**. E**ngineering (Electrical and Electronics) from Bangladesh University of Engineering and Technology, Dhaka, Bangladesh in 1997 and master's in engineering (with specialization in Power Electronics and Drives) from Anna University, Chennai, India 2002. He also completed postgraduate courses and research in Lappeenranta University of Technology Lappeenranta, Finland and Norwegian University of Science and Technology, Norway .Mr. Rana worked as an Assistant professor in electrical and electronic department of Kathmandu University from 1998 to 2010 . He worked as a capacity of Associate professor in School of Engineering of Pokhara University since 2013. He worked as a capacity of Dean of Faculty of Engineering of Midwestern university from 11/2017 to 11/2018 . Currently he is program coordinator of M.Sc. Program of Electrical Power System Engineering of Pokhara University. His area of interest is power electronics and Variable speed drives, energy efficient drive systems .He is serving as a member of subject committee of electrical and electronics engineering of various university of Nepal. He has more than 10 publications in national and international conferences and journals.

Suresh Baral, PhD-Permanent Assistant Professor, received PhD in Mechanical Engineering, Bhusan University, South Korea in 2017, Master of Renewable Energy, School of Engineering, Kathmandu University in 2009 and Bachelor of Bachelor of Mechanical Engineering; Institute of Engineering, Pulchowk Campus, Nepal in May 2006. He is working as a capacity of Assistant professor in school of Engineering since 2010. Dr Baral also worked as Deputy Controller of Examination, Controller of Examination, Pokhara University.2017 to 2019 and Head, Internal Exam, School of Engineering, Pokhara University from 2011 to 2013 .Dr. Baral has published national and international conference and journal paper related to Renewable Energy Conversion Technologies.

Bishal Silwal, PhD-Visiting Faculty/Full Time Contract, received PhD Electrical Engineering, Aalto School of Electrical Engineering, Finland in 2017, Master of Science (Tech), Electrical Engineering, Aalto School of Electrical Engineering, Finland in 2012 and Bachelor of Electrical and Electronics Engineering; School of Engineering, Kathmandu University, Nepal in 2009. Dr. Silwal worked as Doctor Assistant Staff, Dept. of Electrical Energy, Metals, Mechanical Construction and Systems, Ghent University from 2017 to 2020.Dr. Silwal was involved in the project of Analysis, Selection and/or Re-design of electrical machine for E-bike of Ghent University Belgium, Electromagnetic design of three 6MW permanent magnet synchronous machines with efficiency over 97% for wind power applications of Alto University, Finland. Dr, Silwal published more than 10 papers in international conferences and journals. His interest is FEA, electro-mechanics and Machine modelling.

Ananta Adhikari-Permanent Faculty/On study leaves for PhD, received Master of Science in Electrical Power System Engineering, Anna University, India and Bachelor of Electrical and Electronics Engineering; School of Engineering, Kathmandu University, Nepal. Currently, he is pursuing PhD in electrical engineering in Thailand. He is serving Pokhara university as a capacity of Assistant Professor since 2016.During his stay in Pokhara university he was involved in projects Microcontroller Based Hybrid E-Rickshaw, Team Leader (February 17 2017- April 31 2018), Nepal Innovation Technology and Entrepreneurship Centre, Pokhara University and Analysis and Optimization of Power Systems Using FACTs Controller, PURC. Mr. Adhikari published 3 conference and journal papers. His area of interest is power system.

Dr. Shailendra Kumar Jha, PhD-Visiting Faculty, received PhD, Electrical and Electronics Engineering, School of Engineering, Kathmandu University, Nepal in 2018 , Master of Science

in MSc in Renewable Energy Engineering Institute of Engineering, Pulchowk Campus, Nepal in 2006 and BE, Electrical and Electronics Engineering, School of Engineering, Kathmandu University, Nepal in 2001
Dr. Jha is currently permanent Assistant professor of Kathmandu University and he is serving as a visiting faculty in school of engineering of Pokhara university since 2019. Dr. Jha severed as project member of ELNAB project, ERASMUS+, Kathmandu University, EU funded from 2017 to 2019. Dr. Jha is working as a subject committee member of electrical Engineering program of Pokhara and Prubanchal University. Currently, he is the chairperson of Subject Committee of Electrical Engineering Program of Kathmandu University. He is teaching field from last 18 years and he published more than 10 conferences and journal papers in national and internal level

E. Preliminary feasibility study

The feasibility study requirements for upgrading and modernization of new curriculum on Bachelor of Electrical and Electronics Engineering and Master of Science in Electrical Engineering in Power System include aspects of the following:

Curriculum

The curriculum of Bachelor of Electrical and Electronics Engineering and Master of Science in Electrical Engineering in Power System has already approved from Pokhara University system and the programs have already been started in Pokhara University. There is the need of the upgrading and modernization of new curriculum on Bachelor of Electrical and Electronics Engineering and Master of Science in Electrical Engineering in Power System which will cause the emergence of costs for the preparation of the system and procurement of new materials for lectures, including books and references and the provision of room facilities. Pokhara University has allocated the budget for curriculum upgrading and modernization. The allocated budget will be utilized for curriculum development workshop, meeting allowances and remuneration. Pokhara University and eACCESS Project Funding will be utilized for Curriculum Development, Training to staff and organization of seminar/conference. The budget for curriculum development required for this section is around ***EUR 9000***.

Laboratory

The laboratory aspect will bring up the costs of providing equipment and materials, a program for preparing practicum procedures, providing laboratory space. Each Fiscal Year, Pokhara University allocate the budget for new equipment purchasing, repair and maintenance of existing laboratory/machines and running cost for the laboratory. Pokhara University, Kantipur Engineering College has planned to establish the High Voltage Laboratory at Kantipur Engineering College through eACCESS Project Funding. The budget required for this section is around ***EUR 120,000***.

Teaching staff

Pokhara University has already started the programs in its constituent school and recruited the faculty required. The Regular Salary for the Permanent/Full Time/Visiting Faculty has allocated by the University. During the curriculum upgrading/modernization there is the need of extra fund for the course module development and fulfilment of work package activities. So, there is the need of ***EUR 10,000*** for those activities each year during eACCESS project implementation.

Apprenticeship Place

During the field work/field exercise student of electrical engineering/electrical engineering in power system has been sent to different industry/Government Organization (like Nepal Electricity Authority, Alternative Energy Promotion Centre). It is also required to find an appropriate internship for final year students in the field of renewable energy. Approaches to the industry are needed in order to be willing to accept internships for renewable energy. The budget required for this section is around ***EUR 4000*** for their accommodation, allowance to faculty and field staff and extra facility upgrading. There are well furnished classrooms for bachelor and master level student in School of Engineering with the following facility.

- Minimum space capacity of 48 students,
- Wi-Fi facilities,
- LCD projectors,

The development of information systems and internet-based e-learning applications require very large internet bandwidth, especially for learning new modules. But due to low bandwidth it is required to improve/upgrade the speed of the internet through purchasing of extra bandwidth internet. Due to power cut-off the class conduction and laboratory conduction may affect. So, it is required to install the solar backup for the continuous power supply to enhance green economy.

Source of risk

Pokhara University has already started the programs in its constituent school and recruited the faculty required. There is the need of continuous requirement of faculty through Pokhara University Service Commission for permanent position. Sometimes, the recruitment process takes time for the publication of the vacant position due to internal administrative delay. Due to such situation, the appropriate faculty member may not stay for long in contract basis. The power energy there is still lacking in supplying quality human resources, so it requires extra energy communication and networking to attract faculty to join at University.

Administrative risk

The appointment of high-level authority at university has been appointed by the Government of Nepal. Due to delay in appointment of high-level officials, there may be the delay in some work including decision from Academic Council, Executive Council for final approval of the curriculum and to run the program. There is the risk to coordinate with the Government offices for the collaboration during the curriculum development process.

Economic risk

The university runs the program in suitability approach which indicates that the running cost must be fulfilled from the fee collected. There is fee paying stream in the admission criteria which involve the payment of fee by the student in the semester system. If, there is the significant lowering of student in the program the running cost will not bourn by the school if there is significant dropdown of application/admission. Fortunately, the both the programs are very much popular among the students till time. It is required to develop the strategy to attract good student in the program which requires the publicity of the programs through public/social media.

IV. Royal University of Bhutan (RUB)

A. Curriculum modernization procedure at RUB

At Royal University of Bhutan (RUB), the changes in programme is of two categories: minor changes and major changes

Minor changes

Minor changes to programmes such as modifications to modules such as changes to the module title, subject matter, teaching learning approaches, and assessment approaches, can be approved within the College provided an up-to-date record of the changes and the cohorts of students affected by those changes are recorded.

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

Table 94

Changes to a programme	Restructuring the programme 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 programme. Increasing or decreasing subject matter by less than 25%.

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

Major changes

Major changes are those, which affect the title of the programme, its awards, its philosophy, its aims and objectives, its structure (including the proposed addition of new modules), its management and its regulations.

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

Table 95

Changes to a programme	Changing programme 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 & 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%.

Documentation to be submitted to seek approval for major changes should include the old version of the relevant section of the programme document together with the revised version, indicating the changes and the justifications for the proposed change. The complete programme document may be required if the changes affect other parts of the programme.

The programme 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.

CST is expected to submit for review of programme by Sept 2021. Therefore, the documents have to be ready before Sept 2021. The RUB review team may at times modify the content for which we need to be fully prepared for justification. No constraints once it is approved.

Expected timeline

August 2021

Electrical Programme committee is expected to submit the complete programme documents to College Academic Committee of College of Science and Technology

September 2021 - College Academic Committee submits to the Academic Board of the Royal University of Bhutan

March 2022

Expect Approval from Academic Board of the Royal University of Bhutan

July 2022 – Implemented to July 2022 cohort

As the proposed modules are for 3rd year and 4th year, its real implementation will be from July 2024 to June 2026. The changes may be minor as defined above and we can implement from July 2022.

B. Curriculum development and modernization of Bachelor of Electrical Engineering

As regarding the construction of the bachelor course, the following general information should be considered:

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

The Honours degree programme will consist of 480 credits and will be taken over 4 years of full-time study. The allocation of credits

Table 96

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

To pass a module a student must have registered on the module within the period of registration, have obtained an overall mark of 50% and not less than 40% in each of the prescribed assessment components. If a student fails a module, he or she may be offered a reassessment for that module.

BE in Electrical Engineering is 4-year programme. After completing every cycle, programme is reviewed to meet the changing technology and country requirements. Therefore, some of the modules identified are mention below. They are selected, as there is rapid change in modern power system whereas our course is not focusing much on it.

Table 97

<table>
<tr><th colspan="4">eACCESS proposed module: Power Generation</th></tr>
<tr><td colspan="2">Existing Course Unit: Power Generation</td><td colspan="2">Need to Modernize: Yes</td></tr>
<tr><td>Semester: 5th</td><td colspan="2">Type: Core: yes</td><td>Credits: 12</td></tr>
<tr><td>Course Objective</td><td colspan="3">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.</td></tr>
<tr><td>Learning Outcome</td><td colspan="3">Compare different methods of power generation.
Calculate the amount of hydro power generation.
Analyse power plant economics and tariffs.
Analyse short term and long-term load forecasting.
Calculate cost of unit energy generation, fixed and variable (operating) costs, tariffs, load factor, maximum demand factor and diversity factor.
Analyse the basic concepts of reliability modelling of generating units, generation capacity reserve evaluation and reliability indices.
Explain the causes and effects of low power factor.
Propose various methods of power factor improvement
Calculate the most economic power factor.
Formulate engineering problems in a conceptual form as well as in terms of mathematical and physical models.</td></tr>
<tr><td>Teaching methods/learning activities</td><td colspan="3"><table>
<tr><th>Approach</th><th>Hours per week</th><th>Total hours per semester</th></tr>
<tr><td>Lecture</td><td>4</td><td>60</td></tr>
<tr><td>Tutorial</td><td>1</td><td>15</td></tr>
<tr><td>Independent learning study/self-study</td><td>3</td><td>45</td></tr>
<tr><td>Total</td><td></td><td>120</td></tr>
</table></td></tr>
</table>

<table>
<tr><td>Assessment methods</td><td>
<table>
<tr><th>Sl. No.</th><th>Mode of Assessment</th><th>No of activity.</th><th>Marks Allocated</th><th>Marks (%)</th></tr>
<tr><td>1</td><td colspan="4">Continuous Assessment (Theory)</td></tr>
<tr><td>1.1</td><td>Term Tests (5th and 10th week); Unit I, II& III for TT-1 and Unit IV & V for TT-2; 1 hour each, closed book</td><td>2</td><td>20</td><td rowspan="3">40</td></tr>
<tr><td>1.2</td><td>Assignment: in 4th week (Determining selection and comparison of different power plants and six numerical questions) 8th week (It will consist of twelve numerical questions)</td><td>2</td><td>10</td></tr>
<tr><td>1.3</td><td>Project work and presentation 12th week: Determine power plant and its capacity for a given condition or location. (maximum 25 pages)
Criteria
• Introduction
• Calculation
• Recommendation/justification
• Conclusions
• Presentation (5-10 min)</td><td></td><td>10</td></tr>
<tr><td>2</td><td>Semester End Examination: 2 hrs duration, closed book</td><td>1</td><td>60</td><td>60</td></tr>
</table>
</td></tr>
<tr><td>Changes</td><td>Include latest technology on renewable energy</td></tr>
<tr><td>Rational</td><td>To be in line with modern technology</td></tr>
<tr><td>Scope of eACCESS Collaboration:</td><td>Modify module to suit present day requirement.</td></tr>
<tr><td>Teaching staff</td><td>Roshan Chhetri/ Namgay Tenzin/ Gom Dorji</td></tr>
<tr><td>Approval Processes</td><td>See the description of Minor Changes on page 102</td></tr>
<tr><td>Implementation</td><td>July 2022 cohort</td></tr>
<tr><td>Technical Support</td><td>Required Suggestion and feedback from Experts of Partner institute during course module development and implementation</td></tr>
<tr><td>Capacity Building and</td><td>Tutors are qualified to teach</td></tr>
</table>

Tutor Training requirements	
e-Learning and the use of the eACCESS platform	Use of virtual learning environment (VLE) and module, BigBlueButton (BBB) and zoom
Financial Aspects	Not applicable

Table 98

eACCESS proposed module: Power Transmission and Distribution		
Existing Course Unit: Power Transmission and Distribution	Need to Modernize: yes	
Semester: 6th	Type: Core: yes	Credits: 12
Course Objective	The module is to provide students to understand, analyse and design electrical power transmission and distribution systems including power system planning and voltage control. The module also introduces advanced power systems.	
Learning Outcome	Explain different terms used in power transmission and distribution systems. Identify different types of conductors used in transmission and distribution systems Calculate line parameters including the effects of earth online parameters. Find regulation and efficiency of lines and string efficiency of overhead insulators. Calculate line losses and corona loss. Calculate sag and conductor length in overhead (OH) line Determine insulation resistance, inductance, stress, capacitance and grading of different underground cables. Perform transmission and distribution system planning. Explain voltage control of transmission line, travelling waves on transmission line, excitation and governing systems. Design Electrical transmission and distribution system	
Teaching methods/learning activities	**Approach** / **Hours per week** / **Total hours per semester** Lecture / 3 / 45 Tutorial / 1 / 15	

<table>
<tr><td></td><td>
<table>
<tr><td>Independent learning study/self-study</td><td>4</td><td>60</td></tr>
<tr><td colspan="2">Total</td><td>120</td></tr>
</table>
</td></tr>
<tr><td>Assessment methods</td><td>
<table>
<tr><th>Sl. No.</th><th>Mode of Assessment</th><th>No of activities.</th><th>Marks Allocated</th><th>Marks (%)</th></tr>
<tr><td>1</td><td colspan="4">Continuous Assessment (Theory)</td></tr>
<tr><td>1.1</td><td>Term Tests (5th and 10th week); Unit I, II& III for TT-1 and Unit IV, V, VI, VII, VIII for TT-2; 1 hour each, closed book</td><td>2</td><td>20</td><td rowspan="3">50</td></tr>
<tr><td>1.2</td><td>Assignment: in 4th week and 8th week (It will consist of twelve to fifteen numerical questions each)</td><td>2</td><td>10</td></tr>
<tr><td>1.3</td><td>Project work and presentation 14th week: Design a transmission line to evacuate a given power or for a given plant/ distribution system for village or industry (maximum 30 pages)
Criteria
• Introduction
• Design and calculation
• Recommendation/justification
• Conclusions
• Presentation (5-10 min)</td><td>2
8
3
2
5</td><td>20</td></tr>
<tr><td>2</td><td>Semester End Examination: 2 hrs duration, closed book</td><td>1</td><td>50</td><td>50</td></tr>
</table>
</td></tr>
<tr><td>Changes</td><td>Include practical</td></tr>
<tr><td>Rational</td><td>To be in line with modern technology</td></tr>
<tr><td>Scope of eACCESS Collaboration:</td><td>Modify module to suit present day requirement.
Procure and install practical equipment based on modules</td></tr>
<tr><td>Teaching staff</td><td>Roshan Chhetri/ Cheku Dorji/Namgay Tenzin</td></tr>
<tr><td>Approval Processes</td><td>See the description of Minor Changes on page 102</td></tr>
<tr><td>Implementation</td><td>July 2022 cohort</td></tr>
</table>

Technical Support	Demonstration of practical
Capacity Building and Tutor Training requirements	Provide basic demonstration of practical. Tutors are qualified to teach
e-Learning and the use of the eACCESS platform	Use of virtual learning environment (VLE) and module, BBB and zoom
Financial Aspects	Not applicable

Table 99

eACCESS proposed module: Power System Analysis		
Existing Course Unit: Power System Analysis		Need to Modernize: yes
Semester: 7th	Type: Core: yes	Credits: 12
Course Objective	The module is to provide students to 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	
Learning Outcome	Classify power system busses and identify their practical and theoretical significance. Distinguish between steady state, transient and sub transient operating conditions. Implement iterative methods for different power system analysis procedures involving nonlinear equations. Analyse unbalanced faults at power system terminals. Determine the power system stability. Distinguish between the steady state and transient stability limits of a power system. Understand the factors that influence the steady state and transient stability limits of power systems. Develop model for power system analysis study using suitable software and IEEE Standard Perform load flow study for simple IEEE bus system	

<table>
<tr><td></td><td>Interpret the result of power system analysis study</td></tr>
<tr><td>Teaching methods/learning activities</td><td>
<table>
<tr><th>Approach</th><th>Hours per week</th><th>Total credit hours</th></tr>
<tr><td>Lecture</td><td>2</td><td>30</td></tr>
<tr><td>Tutorial</td><td>1</td><td>15</td></tr>
<tr><td>Practical</td><td>2</td><td>30</td></tr>
<tr><td>Independent study</td><td>3</td><td>45</td></tr>
<tr><td>Total</td><td></td><td>120</td></tr>
</table>
</td></tr>
<tr><td>Assessment methods</td><td>
<table>
<tr><th>Sl. No.</th><th>Mode of Assessment</th><th>No of activities.</th><th>Marks Allocated</th><th>Marks (%)</th></tr>
<tr><td>1</td><td colspan="4">Continuous Assessment (Theory)</td></tr>
<tr><td>1.1</td><td>Term Tests: Closed book, one-hour duration in 5th and 10th week
Two units will be covered for term I and three units for term II.</td><td>2</td><td>20</td><td rowspan="3">35</td></tr>
<tr><td>1.2</td><td>Assignment 4th week</td><td>1</td><td>5</td></tr>
<tr><td>1.3</td><td>Project work and presentation</td><td>1</td><td>10</td></tr>
<tr><td>2</td><td colspan="4">Continuous Assessment (Practical)</td></tr>
<tr><td>2.1</td><td>Regular Practical Class: 2 hrs every week</td><td>8</td><td>8</td><td rowspan="2">25</td></tr>
<tr><td>2.2</td><td>Practical Exam and Viva: 2 Hrs at 14th week</td><td>1</td><td>9</td></tr>
<tr><td>2.3</td><td>Project work (computer-based simulation) 7th week</td><td>1</td><td>8</td><td></td></tr>
<tr><td>3</td><td>Semester End Examination: 2 hrs duration, closed book</td><td>1</td><td>40</td><td>40</td></tr>
</table>
</td></tr>
<tr><td>Changes</td><td>Include practical</td></tr>
<tr><td>Rational</td><td>To be in line with modern technology</td></tr>
<tr><td>Scope of eACCESS Collaboration:</td><td>Modify module to suit present day requirement.
Procure and install practical equipment based on modules</td></tr>
</table>

Teaching staff	Roshan Chhetri/ Cheku Dorji/Namgay Tenzin
Approval Processes	See the description of **Minor Changes** on page 102
Implementation	July 2022 cohort
Technical Support	Demonstration of practical
Capacity Building and Tutor Training requirements	Provide basic demonstration of practical. Tutors are qualified to teach
e-Learning and the use of the eACCESS platform	Use of VLE and module, BBB and zoom
Financial Aspects	Not applicable

Table 100

eACCESS proposed module: Switchgear and Protection		
Existing Course Unit: Switchgear and Protection	Need to Modernize: yes	
Semester: 7th	Type: Core	Credits: 12
Course Objective	The module is to provide students to 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.	
Learning Outcome	Explain the need for protective systems Solve simple calculation of short circuit currents. Classify various relays based on the construction and working principle. Differentiate between various instrument transformers. Solve different numerical problem regarding system safety.	

<table>
<tr><td></td><td>Analyse the construction and working principle of modern static and microprocessor-based relays

Analyse various methods and schemes of generator protection

Analyse different protective schemes for the transmission lines and distribution lines.

Analyse the protection schemes against the overcurrent, overvoltage protection, distance protection and differential protection.

Explain the working of different circuit breakers.

Describe various circuit breakers used in the power system, their construction, working principle, advantages and disadvantages.</td></tr>
<tr><td>Teaching methods/learning activities</td><td>
<table>
<tr><th>Approach</th><th>Hours per week</th><th>Total hours per semester</th></tr>
<tr><td>Lecture</td><td>3</td><td>45</td></tr>
<tr><td>Tutorial</td><td>1</td><td>15</td></tr>
<tr><td>Independent learning study/self-study</td><td>4</td><td>60</td></tr>
<tr><td>Total</td><td></td><td>120</td></tr>
</table>
</td></tr>
<tr><td>Assessment methods</td><td>
<table>
<tr><th>Sl. No.</th><th>Mode of Assessment</th><th>No of activities.</th><th>Marks Allocated</th><th>Marks (%)</th></tr>
<tr><td>1</td><td colspan="4">Continuous Assessment (Theory)</td></tr>
<tr><td>1.1</td><td>Term Tests: Closed book, one-hour duration in 5th and 10th week
Three units will be covered for term I and four units for term II.</td><td>2</td><td>20</td><td rowspan="3">40</td></tr>
<tr><td>1.2</td><td>Assignment: In 4th and 8th week (It will consist of ten numerical questions each)</td><td>2</td><td>10</td></tr>
<tr><td>1.3</td><td>Case study- To identify the types of relay used in modern power system and determine the relay required for a given condition or area (Max 30 page)

Criteria
•Introduction
•Design and calculation</td><td>

1
3
3</td><td>10</td></tr>
</table>
</td></tr>
</table>

		• Recommendation/justification • Conclusions	2		
	2	**Semester End Examination**: 3 hrs duration, closed book	1	**60**	**60**
Changes	Include practical				
Rational	To be in line with modern technology				
Scope of eACCESS Collaboration:	Modify module to suit present day requirement. Procure and install practical equipment based on modules				
Teaching staff	Roshan Chhetri/ Cheku Dorji				
Approval Processes	See the description of **Minor Changes** on page 102				
Implementation	July 2022 cohort				
Technical Support	Demonstration of practical				
Capacity Building and Tutor Training requirements	Provide basic demonstration of practical. Tutors are qualified to teach				
e-Learning and the use of the eACCESS platform	Use of VLE and module, BBB and zoom				
Financial Aspects	Not applicable				

Table 101

eACCESS proposed module: Advanced Power System Protection		
Existing Course Unit: Advance Power System Protection	Need to Modernize: yes	
Semester: 8th	Type: Elective	Credits: 12
Course Objective	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 analyse and design of overcurrent, differential and distance relaying schemes and the coordination among the circuits.	

<table>
<tr><td>Learning Outcome</td><td>Describe about the various schemes of Over current protection. Determine the time-current characteristics of over current relay. Choose suitable protective devices (CT, PT, CB) for power system protection. Inculcate in-depth knowledge on the protection of generators, motors, transformer and transmission lines. Analyse the overcurrent protection and its coordination
Analyse distance and carrier protection. Design of differential protection for unit protection (transformers, generator, busbar and motor. Design of distance protection for non-unit protection (transmission lines). Analyse the concept of numerical protection and computer relaying for power system.</td></tr>
<tr><td>Teaching methods/learning activities</td><td>
<table>
<tr><th>Approach</th><th>Hours per week</th><th>Total hours per semester</th></tr>
<tr><td>Lecture</td><td>3</td><td>45</td></tr>
<tr><td>Tutorial</td><td>1</td><td>15</td></tr>
<tr><td>Independent learning study/self-study</td><td>4</td><td>60</td></tr>
<tr><td colspan="2">Total</td><td>120</td></tr>
</table>
</td></tr>
<tr><td>Assessment methods</td><td>
<table>
<tr><th>Sl. No.</th><th>Mode of Assessment</th><th>No of activities.</th><th>Marks Allocated</th><th>Marks (%)</th></tr>
<tr><td>1</td><td colspan="4">Continuous Assessment (Theory)</td></tr>
<tr><td>1.1</td><td>Term Tests: Closed book, one-hour duration in 5th and 10th week
Three units will be covered for term I and four units for term II.</td><td>2</td><td>20</td><td rowspan="4">40</td></tr>
<tr><td>1.2</td><td>Assignment: In 4th and 8th week (It will consist of ten numerical questions each)</td><td>2</td><td>10</td></tr>
<tr><td>1.3</td><td>Case study- To identify the types of relay used in modern power system and determine the relay required for a given condition or area (Max 30 page)
Criteria
• Introduction
• Design and calculation
• Recommendation/justification
• Conclusions</td><td>1
3
3
2</td><td>10</td></tr>
<tr><td>2</td><td>Semester End Examination: 3 hrs duration, closed book</td><td>1</td><td>60</td><td>60</td></tr>
</table>
</td></tr>
</table>

Changes	Include latest technology on Advance Power System Protection
Rational	To be in line with modern technology
Scope of eACCESS Collaboration:	Modify module to suit present day requirement.
Teaching staff	Roshan Chhetri/ Cheku Dorji/Manoj Sharma
Approval Processes	See the description of **Minor Changes** on page 102
Implementation	July 2022 cohort
Technical Support	Required Suggestion and feedback from Experts of Partner institute during course module development and implementation
Capacity Building and Tutor Training requirements	Tutors are qualified to teach
e-Learning and the use of the eACCESS platform	Use of VLE and module, BBB and zoom
Financial Aspects	Not applicable

Table 102

eACCESS proposed module: High Voltage Engineering		
Existing Course Unit: High Voltage Engineering	Need to Modernize: yes	
Semester: 8th	Type: Core	Credits: 12
Course Objective	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.	

<table>
<tr><td>Learning Outcome</td><td>Identify the different applications of high voltage. Analyse basic problems in dealing with high voltage and high currents. Explain theories of breakdown in gaseous, liquid, and solid. Distinguish and explain different types of insulations. Analyse the insulation design of different types of machines. Distinguish the different types of high voltage generation. Identify the different types of tests on equipment. Conduct high voltage tests. Identify different types of non-destructive testing of materials. Interpret tests results. Solve numerical problems regarding high voltage topics.</td></tr>
<tr><td>Teaching methods/learning activities</td><td>
<table>
<tr><th>Approach</th><th>Hours per week</th><th>Total hours per semester</th></tr>
<tr><td>Lecture</td><td>3</td><td>45</td></tr>
<tr><td>Practical</td><td>1</td><td>15</td></tr>
<tr><td>Independent learning study/self-study</td><td>4</td><td>60</td></tr>
<tr><td colspan="2">Total</td><td>120</td></tr>
</table>
</td></tr>
<tr><td>Assessment methods</td><td>
<table>
<tr><th>Sl. No.</th><th>Mode of Assessment</th><th>No of activities.</th><th>Marks Allocated</th></tr>
<tr><td>1</td><td colspan="3">Continuous Assessment (Theory)</td></tr>
<tr><td>1.1</td><td>Term Test: Closed book, one-hour duration in 5th (Unit I & II) & 10th week (Unit III & IV)</td><td>2</td><td>20</td></tr>
<tr><td>1.2</td><td>Assignment: One-week duration in 3th, 6th, 9th, and 12th week (descriptive report, Numerical calculation – max four question each)</td><td>4</td><td>20</td></tr>
<tr><td>1.3</td><td>Practical report and viva</td><td>2</td><td>10</td></tr>
<tr><td>2</td><td>Semester Examination: Closed book and 3 hours examination at end of semester</td><td>1</td><td>50</td></tr>
</table>
</td></tr>
<tr><td>Changes</td><td>Include latest technology on High Voltage Engineering</td></tr>
<tr><td>Rational</td><td>To be in line with modern technology</td></tr>
</table>

Scope of eACCESS Collaboration:	Modify module to suit present day requirement.
Teaching staff	Roshan Chhetri/ Namgay Tenzin
Approval Processes	See the description of **Minor Changes** on page 102
Implementation	July 2022 cohort
Technical Support	
Capacity Building and Tutor Training requirements	Tutors are qualified to teach
e-Learning and the use of the eACCESS platform	Use of VLE and module, BBB and zoom
Financial Aspects	Not applicable

C. Curriculum development and modernization of Master of Electrical Power System Engineering

At the moment the Royal University of Bhutan is not planning modernization of existing course units or development of new course units at the Master Level of studies.

D. Human Resources

The following are the teaching faculties and laboratory technician against each proposed modified module at CST. Teaching faculty has master qualification and are well equipped for teaching the modules. They have been teaching the same modules. Minor upgradation in modules will not be an issue for teaching faculties. The staff (teaching and lab technician) mentioned below, need to be given hands on training on the use of new equipment installed in the labs.

Mr. Roshan Chhetri completed his Diploma in Electrical Engineering from Royal Bhutan Polytechning, Dewathang, Bhutan, BTech in Electrical and Electronic Engineering from REC (now NIT) Warangal, Andhra Pradesh, India and MScE in Electrical Engineering and Diploma in University teaching from University of New Brunswick, Canada. He started teaching since September 1990 and presently working as Assistant Professor at College of Science and Technology (CST), Royal University of Bhutan. He served as Head of Electrical Engineering Department from May 2009 till 30 June 2013. His present research interest includes unit commitment under deregulated environment, energy efficiency, Renewable energy, Power Generation, Distribution, Transmission and Protection. He has published and presented more than 18 papers in journals and conferences. He was a coordinator for (i) Interweave project (Erasmus Mundus), (ii) University- Business Partnership programme for Analysis and Modelling of Bhutan's Hydropower Plants & Allied Activities funded by DAAD, German academic Exchange, (iii) Erasmus +KA107 with University of Valencia from 2015 till date. Roshan is a recipient of the National Award of Merit (Gold) for Long Tenure in Academic in

Dec 2013 and National Award of Merit (Gold) for Excellence in Academic in Dec 2014 from His Majesty the King. He is also a recipient of Endeavour Executive Fellowship Awards, March to July 2015, University of Wollongong, NSW, Australia. He was an invited speaker for Renewable Energy: The Main Source of Energy in Bhutan at AFORE2017, Busan, South Korea. He was President of IEEE Bhutan-Subsection in 2019. He is Chairperson for the Electrical and Electronic Technical Committee, Bhutan Standards Bureau, Thimphu (September 2011 till date) and President for Bhutan's National Electrotechnical Committee (NEC), (February 2013 till date).

Mr Roshan Chhetri will be involved in modernization of the following teaching modules: Power System Protection, Power Transmission and Distribution, Power Station, High Voltage Engineering

Dr Tshewang Lhendup is an Assistant Professor and Dean of Academic Affairs of the College of Science and Technology, Royal University of Bhutan. Dr Lhendup obtained his Master of Engineering Science and PhD in Renewable Energy from the University of Melbourne, Australia. He did his postdoctoral at Kyoto University Japan. Dr Lhendup has been teaching science and engineering courses for more than 20 years. He has developed several engineering programmes and is the coordinator of Master of Engineering in Renewable Energy at the College of Science and Technology. He has authored/co-authored more than 40 peer-reviewed scientific papers, a book on 'Development of Inter-seasonal Thermal Storage', and a chapter on Green Technology. Dr Lhendup was awarded the National Oder of Merit (Gold) by His Majesty the King of Bhutan in December 2016 for his exemplary service to the Nation Building in the field of Education. Dr Lhendup chaired two international conferences on Renewable and Sustainable Energy organised and held in Bhutan in 2015 and 2017. He also chaired several technical sessions within and outside Bhutan. Dr Lhendup also served as a President of IEEE Bhutan-Subsection 2018 and Counsellor of IEEE Bhutan Student Chapter.

Dr Tshewang Lhendup will be involved in modernization of the following teaching modules: Power Station, Power System Protection

Mr Cheku Dorji, Lecturer (since 2007), in Electrical Engineering Programme, College of Science and Technology, Royal University of Bhutan. Mr Cheku has B. Tech in Electrical and Electronics Eng.(India) and M.Tech in Power and Energy Systems (NIT, India). His research interest is mainly in Power Systems; Modelling and Simulation of Hydropower Plants and the Renewable Energy Systems (Solar PV and thermal System). He has published more than 6 papers. Mr Chuku has served Head of the Department for Electrical Engineering Department for 3 years and presently handling ERASMUS Plus project.

Mr. Cheku Dorji will be involved in modernization of the following teaching modules: Power System Protection, Engineering Computing and Analysis, High Voltage Engineering.

Mr. Manoj Sharma is currently working as the Lecturer & Head of the Department for Electrical Engineering Department under the College of Science and Technology, Royal University of Bhutan. Prior to College of Science and Technology, he worked for Kurichhu Hydro Power Plant from the year 2002-2005. He has Master of Technology in Control and Automation from VIT University, Vellore India under the Nehru Wangchuck Scholarship Program from the year 2013- 2015. He was also selected for exchange program under the

Interweave Erasmus Mundus scholarship at the Riga Technical University, Latvia. In the year 2019, he was selected by the WIPO Geneva & PRV Sweden for a training program in Intellectual Property Rights in Stockholm, Sweden. His current research interest is in the field of Engineering Education, Control & Automation, Energy Management & Policy Studies, Electromobility, renewable energy technologies and Intellectual Property Rights.

Mr. Manoj Sharma will be involved in modernization of the following teaching modules: High Voltage Engineering

Mr. Namgay Tenzin, Associate Lecturer, Electrical Engineering Department. College of Science and Technology; Royal University of Bhutan, Rinchending, Phuentsholing, Bhutan. He obtained his Bachelor of Engineering degree in Electrical Engineering from College of Science and Technology (CST), Royal University of Bhutan (RUB), Bhutan in 2015; Master of Technology Degree in Alternate Hydro Energy Systems from Department of Hydro and Renewable Energy (Formerly known as Alternate Hydro Energy Centre), Indian Institute of Technology Roorkee, Uttarakhand, India in June 2019. Presently he is working as Lecturer in Electrical Engineering Department, CST, RUB, Bhutan since September 2015. His research area includes integrated renewable energy grid, small hydropower, smart grid, solar and wind power system along with human wildlife conflict.

Mr. Namgay Tenzin will be involved in modernization of the following teaching modules: Power Station, Power System Protection, High Voltage Engineering.

Mr. Gom Dorji, working as Associate Lecturer at College of Science and Technology, Electrical Engineering Department, Royal University of Bhutan since August 2015. I have done Bachelor of Engineering in Electrical Engineering from College of Science and Technology, Royal university of Bhutan in June 2015. I completed MSc. Electrical Engineering specialized in Electrical Power System from Frederick University, Nicosia, Cyprus in 2017. I have in total nine publications in related field of my research area. Other than teaching, I also serve as IEEE member (international level) and program committee member (PCM), Program board of Examiner (PBE) member and college exam cell member.

Mr. Gom Dorji will be involved in modernization of the following teaching modules: Power Station, High Voltage Engineering

More to the academic staff, two technicians, Nidup and Yoezer Dema, will be also involved in the preparation of the new teaching program in the framework of the eACCESS project. Mr. Nidup will assist the modernization of the Power System Protection module and Mr. Yoezer Dema will help to modernize the modules Engineering Computing and Analysis

E. Preliminary feasibility study

Hydropower is one of the main sources of revenue in Bhutan. Generating and supplying reliable electric power at a cheaper cost is still the biggest challenge for any power company. One of the very popular ways that the Power utility companies are trying to improve the reliability is by distribution automation and reducing power loss by decreasing distribution length. The main function of a Bhutan Power Corporation (BPC) is to provide quality electrical energy to its

customers as economically as possible with minimal power loss. Hence BE in Electrical Engineering is attractive programme in Bhutan.

The aim of the programme 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.

The overall rating of the College by the graduates and employers is good to excellent. The graduates are well employed as there is ample of scope for employment with accelerating growth of construction industry, hydroelectric projects, medium and small-scale industries, which demands the need for qualified and competent electrical engineers.

The analysis indicated that the conceptual and analytical skills of the graduates are commendable and the undergraduate Electrical Engineering programme at CST has greatly enhanced their capability to plan better and work independently. The tracer studies also show employers prefer CST graduates compared to graduates from other universities.

The programme is thus envisaged to strengthen and support the Human Resource Development goals of the Royal Government. The programme would also help in promoting and supporting the technical education programme in the country.

Bhutan having endowed with huge potential of harnessing hydropower to the tune of about 30 GW. About 24 GW is technically and economically viable. Only about 2.3 GW stands harnessed till date. With the country's plan to generate more energy through hydropower and other alternate energy like solar and wind, the need of Electrical Engineering (EE) graduates will only increase over the years. Thus, the requirement of EE personnel is envisaged to increase in the coming years indicating the requirement of this Programme.

Curriculum

The Bachelor of Electrical Engineering curriculum is approved by Royal University of Bhutan. It is a 4-year programme. After completing every cycle, programme is reviewed to meet the changing technology and country requirements system. There is the need of the upgrading and modernization of new curriculum focusing on Power System. Every year College allocate reasonable budget to Library for procurement of books. The funding from eACCESS Project will be utilized for Curriculum Development, Training to staff and organization of seminar/conference.

Laboratory

The Electrical Engineering programme has adequate laboratory space for present intake. The college allocate funds for procurement of new equipment, repair and maintenance and consumable materials based on requirement. Power System laboratory need face uplift with modern technology to meet the present demands. College has planned to improve through eACCESS Project Funding. The budget required for this section is around ***EUR 85,000***

Teaching staff

College of Science and Technology, Royal University of Bhutan started the programs in 2001. The Royal Government of Bhutan allocate budget to the College through University using certain mechanism. The college uses this budget to meet all expenditure including salaries. During the curriculum upgrading/modernization there is the need of extra fund for the course module development and fulfilment of work package activities. The funding from college and eACCESS Project will be utilized for these activities.

Job Placement

At the end of 7th semester, student of are send to different industry/Government Organization for 6 weeks On the Job training. The office of Dean, Research and Industrial Linkages, help students get placement. College support their living expenses based on university regulation. All students will submit report on OJT training and present during seminar.

Administrative risk

The changes in programme is of two categories: minor changes and major changes. The changes in curriculum has to undergo through prescribed University review process. The review of Electrical Engineering Programme at College of Science and Technology is due towards end of 2021. Any changes have to be completed by September 2020 to meet the university review process. There is a risk if we are late to complete and submit. Major changes in any module then will take a long time to get it approved.

Economic risk

The university runs the program based on approved cohort strength. The program is very much popular among the government, university, and students till time. It is required to develop the strategy to attract good student in the program which requires the modernization of course to meet the present-day requirement.

V. Atma Jaya Catholic University of Indonesia (ATM)

A. Curriculum modernization procedure at ATM

The discussion of existing condition and the procedure that would be taken at Atma Jaya Catholic University of Indonesia are discussed below.

1. Existing Condition

As stated by IESR in "A Roadmap for Indonesia's Power Sector: How Renewable Energy Can Power Java-Bali and Sumatra", Indonesia electricity sector still be dominated by fossil fuel. This study recommends electricity sector in Indonesia to efficiently develop, manage, and integrate several type of power plants: hydro-powers, wind turbine, and others, in the future. However, with a very high demand of power, Indonesia cannot dramatically turn off the fossil fuel power plants and shift to completely renewable energy, the non-renewable and renewable energy must be operated in parallel, and that will require Smart-Grid operation. With a high complexity in implementing smart-grid to manage electricity generator, transmission and distribution, there is a need to form a skilful workforce who equipped with theoretical and practical knowledge of Smart-Grid.

Electrical Engineering Bachelor program at Atma Jaya Catholic University is one of the reputable major and university in Indonesia. However, the existing curriculum and laboratory facility has quite limitation to deliver modern power engineering materials. We only cover basic courses in power, power electronics and control such as: Basic Electric Power Engineering, PLC, SCADA, Electric Machine. With a progressive changing in power industry, our study program needs to adapt (modernize or introduce new courses and upgrade lab facility) to prepare students to enter the job market.

Equipped with upgraded curriculum, prospective graduates are expected to work in Electricity Sector, such as in vendors, suppliers, contractors, or policy makers.

2. Internal and External Approval Process

At Atma Jaya Catholic University of Indonesia, the changes related to program study are classified into two categories: Minor Changes and Major Changes

Minor changes

These changes under this category are considered as minor revision:

Table 103

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 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.

The changes that address in this category need to follow this procedure:
Minor changes must be proposed in the department meeting and approved by head of electrical engineering program. However, the proposed changed should consider the framework of the department and meet several recommendations from internal such as P2AI Department (Enhancement and Development Centre of Instructional Activities) and external such as FORTEI (Indonesian Electrical Engineering Forum).

Major changes

These changes under this category are considered as major revision:

Table 104

Category	Change
Changes to a program	Changing name of study program
Changes to mode of teaching, learning and assessment	Changing approaches to teaching learning from regular over 14 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%.

National Standard of Study Program

There are several things we cannot change such as title of award, level of award, mode of delivery and total credits. These things are standardized by national higher education ministry. These are some of requirements to open engineering study program for S1/Bachelor level:

1. Completing 144 credits (SKS - Satuan Kredit Semester) in minimum (1 credit is equivalent to 1.44 ECTS)
2. Program duration 4 – 7 years, full-time
3. Title of award: Sarjana Teknik (equivalent to Bachelor of Engineering)

Other operational requirements are not mention since not relevant to eACCESS. Since these are the standard from our ministry, it cannot be change.

Changing name of Study Program

Changing name of study program would require external approval from national ministry of high education. Proposer must fulfil these requirements:

- The new name proposal
- Recommendation from university academic senate, higher education regional official (LLDIKTI), ministerial decree.

The procedures are explained as follow:

1. University rector request recommendation from LLDIKTI and higher education director general
2. The director general initiates a task force team to evaluate and verify the changing name proposal
3. On behalf of the higher education ministry, the director general issues a permit to change the name of study program

Other Major Changes

Other changes do not need external approval and all the process will be carried out in the university level. The procedure described as follows:

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. Faculty academic senate review and verify the proposed curriculum
3. The proposed curriculum forwarded by the faculty, to rectorate
4. Rectorate disposed the proposed curriculum to Vice Rector I, to be reviewed by Enhancement and Development Centre of Instructional Activities Bureau (P2AI).
5. The P2AI Bureau check whether the curriculum draft meets university and national regulations and requirements.
6. The P2AI bureau give the review comments to Vice Rector I.
7. Vice Rector I forward the final decision to Rector.
8. Rector validates the final updated curriculum.

Please note that department officials will initiate curriculum evaluation in every 4 years.

B. Curriculum modernization procedure of Bachelor Level of Electrical and Electronics Engineering

In Indonesia, we use SKS as a credit system. 1 SKS activities per week are equal to:

- 50 minutes lecture
- 60 minutes academic structured activity (learning activity that dictated from teachers, and need to be done prior or after the lecture, e.g., read materials, topics to be discussed in class)
- 60 minutes independent study (learning activity that initiated by student themselves)

As in our university, we account 14 lectures per semester. In conclusion, per semester has 14 x (number of credits) total credit hours.

The following courses will be modernized

Table 105

<table>
<tr><th colspan="3">Electric Machinery</th></tr>
<tr><td colspan="2">Existing Course Unit: Yes</td><td>Need to Modernize</td></tr>
<tr><td>Semester: 4th</td><td>Type: Core</td><td>Credits (L, T, P): 3.0.1
Total credits: 4 SKS</td></tr>
<tr><td>Course Objective</td><td colspan="2">To familiarize the students with several types of AC and DC Machines</td></tr>
<tr><td>Learning Outcome</td><td colspan="2">Students understand the principles of electric machines and transformer
Students can explain the characteristic of several types of AC and DC machines</td></tr>
<tr><td>Teaching methods/learning activities</td><td colspan="2">Teaching activities:
<table><tr><th>Approach</th><th>hours/week</th><th>Total credit hours</th></tr><tr><td>Lecture</td><td>2.50</td><td>35 hours</td></tr><tr><td>Tutorial</td><td>0</td><td>0</td></tr><tr><td>Lab Exercise</td><td>0.83</td><td>~12 hours</td></tr></table>
Lab Exercise will have 12 hours in total. However, the lab practice activities usually summed up to approximately five meetings per semester, means these students will have around 140 minutes (2 hours 20 minutes) per meeting. The number of meeting will be depending on experiments at each lab, hence the number of meeting for each lab may varies.</td></tr>
<tr><td>Assessment methods</td><td colspan="2">Oral and written examination, oral presentation, assignments</td></tr>
</table>

Changes	Additional course material about: BLDC motor, stepper motor and SRM
Rational	Modernized of electric machinery are widely used in the industry
Scope of eACCESS Collaboration:	Course material can be shared among partner universities
Teaching staff	Budi Kartadinata, Tajuddin Nur
Approval Processes	It will be conducted on the department level because the name of the course and the credit is not changed
Implementation	The new curriculum will be implemented in February 2022
Technical Support	Existing laboratory managed by teaching staff and lab assistant
Capacity Building and Tutor Training requirements	Additional training for the teaching staff regarding the new subject
e-Learning and the use of the eACCESS platform	Moodle (elearning.atmajaya.ac.id)
Financial Aspects	Training cost for teaching staff

Table 106

<table>
<tr><td colspan="3">Programmable Logic Controller</td></tr>
<tr><td colspan="2">Existing Course Unit: Yes</td><td>Need to Modernize</td></tr>
<tr><td>Semester: 5th</td><td>Type: Core</td><td>Credits (L, T, P): 2.0.1
Total Credits: 3 SKS</td></tr>
<tr><td>Course Objective</td><td colspan="2">To give students knowledge about the programming of PLC: ladder diagram, function block and the discrete and analogue input and output</td></tr>
<tr><td>Learning Outcome</td><td colspan="2">Students able to construct PLC programs and develop applications by using ladder diagram and function block</td></tr>
<tr><td>Teaching methods/learning activities</td><td colspan="2">Teaching activities:
<table><tr><th>Approach</th><th>hours/week</th><th>Total credit hours</th></tr><tr><td>Lecture</td><td>1.67</td><td>~27 hours</td></tr><tr><td>Tutorial</td><td>0</td><td>0</td></tr><tr><td>Lab Exercise</td><td>0.83</td><td>~12 hours</td></tr></table></td></tr>
</table>

	Lab Exercise will have 12 hours in total. However, the lab practice activities usually summed up to approximately five meetings per semester, means these students will have around 140 minutes (2 hours 20 minutes) per meeting. The number of meeting will be depending on experiments at each lab, hence the number of meeting for each lab may varies.
Assessment methods	Oral and written exam, assignments
Changes	Additional learning material Function Block Diagram and pneumatic system
Rational	PLC s are extensively used in industry
Scope of eACCESS Collaboration:	Teaching staff and students exchange
Teaching staff	Budi Kartadinata, Karel Octavianus Bachri, Anisa Sarah (students assistant)
Approval Processes	It needs approval at the department level only
Implementation	August 2021
Technical Support	Modernization of PLC laboratory practice facility
Capacity Building and Tutor Training requirements	Additional training for teaching staffs
e-Learning and the use of the eACCESS platform	Moodle (elearning.atmajaya.ac.id)
Financial Aspects	Training cost for teaching staffs and lab development

Table 107

SCADA		
Existing Course Unit: Yes	Need to Modernize	
Semester: 6th	Type: Core	Credits (L, T, P): 3.0.0 Total Credits: 3 SKS
Course Objective	To give the students understanding about Scada in the industrial and the power engineering sector	
Learning Outcome	Students can explain the concept of SCADA. Students can understand about smart meter, RTU, communication protocol. Students can understand the SCADA application in industry and electric power distribution.	

<table>
<tr><td>Teaching methods/learning activities</td><td>Teaching activities:<table><tr><th>Approach</th><th>hours/week</th><th>Total credit hours</th></tr><tr><td>Lecture</td><td>2.50</td><td>35 hours</td></tr><tr><td>Tutorial</td><td>0</td><td>0</td></tr><tr><td>Lab Exercise</td><td>0</td><td>0</td></tr></table></td></tr>
<tr><td>Assessment methods</td><td>Oral and written test. Oral presentation</td></tr>
<tr><td>Changes</td><td>Introduction to new subjects such as communication protocol and cyber security</td></tr>
<tr><td>Rational</td><td>With the implementation of Industry 4.0 the implementation of Scada in industry and the power sector is inevitable</td></tr>
<tr><td>Scope of eACCESS Collaboration:</td><td>Exchange of teaching materials</td></tr>
<tr><td>Teaching staff</td><td>Budi Kartadinata, Marsul Siregar, Anisa Sarah</td></tr>
<tr><td>Approval Processes</td><td>It will be conducted at the department level because the name and credit are unchanged</td></tr>
<tr><td>Implementation</td><td>February 2022</td></tr>
<tr><td>Technical Support</td><td>Required feedback and suggestions from the industry and electric power supplier</td></tr>
<tr><td>Capacity Building and Tutor Training requirements</td><td>Additional training for teaching staff</td></tr>
<tr><td>e-Learning and the use of the eACCESS platform</td><td>Moodle (elearning.atmajaya.ac.id)</td></tr>
<tr><td>Financial Aspects</td><td>Procurement cost for new simulation lab of smart grid</td></tr>
</table>

Table 108

<table>
<tr><th colspan="3">Power Electronics</th></tr>
<tr><td colspan="2">Existing Course Unit:Yes</td><td>Need to Modernize</td></tr>
<tr><td>Semester: 6th</td><td>Type: Elective</td><td>Credits: 2.0.1
Total Credits: 3 SKS</td></tr>
<tr><td>Course Objective</td><td colspan="2">To introduce knowledge about power electronics</td></tr>
<tr><td>~~Study~~ Learning Outcome</td><td colspan="2">Students can describe the characteristic of diodes, thyristor, IGBT and GTO. Students can understand the working principles of</td></tr>
</table>

<table>
<tr><td></td><td>rectifier and inverter. Students can explain several types of rectifier and inverter.</td></tr>
<tr><td>Teaching methods/learning activities</td><td>Teaching activities:
<table><tr><td>Approach</td><td>hours/week</td><td>Total credit hours</td></tr><tr><td>Lecture</td><td>1.67</td><td>~27 hours</td></tr><tr><td>Tutorial</td><td>0</td><td>0</td></tr><tr><td>Lab Exercise</td><td>0.83</td><td>~12 hours</td></tr></table>
Lab Exercise will have 12 hours in total. However, the lab practice activities usually summed up to approximately five meetings per semester, means these students will have around 140 minutes (2 hours 20 minutes) per meeting. The number of meeting will be depending on experiments at each lab, hence the number of meeting for each lab may varies.</td></tr>
<tr><td>Assessment methods</td><td>Written and oral exams, oral presentation</td></tr>
<tr><td>Changes</td><td>Adding new course material about IGBT and GTO thyristor</td></tr>
<tr><td>Rational</td><td>Power electronics is widely used in industrial applications</td></tr>
<tr><td>Scope of eACCESS Collaboration:</td><td>Teaching materials and teaching staffs</td></tr>
<tr><td>Teaching staff</td><td>Budi Kartadinata, Tajuddin Nur</td></tr>
<tr><td>Approval Processes</td><td>It needs approval at the department level only</td></tr>
<tr><td>Implementation</td><td>February 2022</td></tr>
<tr><td>Technical Support</td><td>Technical training, guest Lecturer</td></tr>
<tr><td>Capacity Building and Tutor Training requirements</td><td>Guess Lecturer and additional training needed</td></tr>
<tr><td>e-Learning and the use of the eACCESS platform</td><td>Moodle (elearning.atmajaya.ac.id)</td></tr>
<tr><td>Financial Aspects</td><td>Training Cost and guest lecturer’s fee.</td></tr>
</table>

Table 109

Electric Drive		
Existing Course Unit: Yes	Need to Modernize	
Semester: 7th	Type: Elective	Credits (L, T, P):3.0.0

<table>
<tr><td></td><td></td><td>Total Credits: 3 SKS</td></tr>
<tr><td>Course Objective</td><td colspan="2">To give the students understanding of control aspects of electric</td></tr>
<tr><td>Learning Outcome</td><td colspan="2">Students will understand about starting, speed control, braking and reversing of induction motor and DC brushed motor. Students understand about PMSM, BLDC motor and SRM</td></tr>
<tr><td>Teaching methods/learning activities</td><td colspan="2">Teaching activities:
<table>
<tr><th>Approach</th><th>hours/week</th><th>Total credit hours</th></tr>
<tr><td>Lecture</td><td>2.50</td><td>35 hours</td></tr>
<tr><td>Tutorial</td><td>0</td><td>0</td></tr>
<tr><td>Lab Exercise</td><td>0</td><td>0</td></tr>
</table></td></tr>
<tr><td>Assessment methods</td><td colspan="2">Oral and written exams, oral presentation</td></tr>
<tr><td>Changes</td><td colspan="2">Additional topic concerning BLDC motor and SRM</td></tr>
<tr><td>Rational</td><td colspan="2">The students must understand several applications of electric motor s in the industry</td></tr>
<tr><td>Scope of eACCESS Collaboration:</td><td colspan="2">Exchange of teaching staffs and learning materials</td></tr>
<tr><td>Teaching staff</td><td colspan="2">Budi Kartadinata, Tajuddin Nur</td></tr>
<tr><td>Approval Processes</td><td colspan="2">It will be conducted at the department level</td></tr>
<tr><td>Implementation</td><td colspan="2">August 2021</td></tr>
<tr><td>Technical Support</td><td colspan="2">Feedback from the industry</td></tr>
<tr><td>Capacity Building and Tutor Training requirements</td><td colspan="2">Additional training for teachers, inviting visiting Professors</td></tr>
<tr><td>e-Learning and the use of the eACCESS platform</td><td colspan="2">Moodle (elearning.atmajaya.ac.id)</td></tr>
<tr><td>Financial Aspects</td><td colspan="2">Cost for training of teachers and inviting guest lecturers</td></tr>
</table>

Table 110

<table>
<tr><th colspan="3">Renewable Energy</th></tr>
<tr><td colspan="2">Existing Course Unit: Yes</td><td>Need to Modernize</td></tr>
<tr><td>Semester: 7th</td><td>Type Elective</td><td>Credits (L, T, P):3.0.0
Total Credits: 3 SKS</td></tr>
<tr><td>Course Objective</td><td colspan="2">To introduce knowledge of several type of renewable energy</td></tr>
</table>

<table>
<tr><td>Study Learning Outcome</td><td>Students will be able explain the principles of conventional power plants. Students can explain the non-conventional power plants. Students understand about photovoltaic system.</td></tr>
<tr><td>Teaching methods/learning activities</td><td>Teaching activities:
<table>
<tr><th>Approach</th><th>minutes/week</th><th>Total credit hours</th></tr>
<tr><td>Lecture</td><td>2.50</td><td>35 hours</td></tr>
<tr><td>Tutorial</td><td>0</td><td>0</td></tr>
<tr><td>Lab Exercise</td><td>0</td><td>0</td></tr>
</table></td></tr>
<tr><td>Assessment methods</td><td>Written and oral tests, oral presentation</td></tr>
<tr><td>Changes</td><td>Updated material concerning biomass</td></tr>
<tr><td>Rational</td><td>With the depletion of fossil fuel, the primary energy will shift to the non-conventional source</td></tr>
<tr><td>Scope of eACCESS Collaboration:</td><td>Exchange of teaching staffs</td></tr>
<tr><td>Faculty Available Teaching staff</td><td>Budi Kartadinata, Tajuddin Nur, Marsul Siregar</td></tr>
<tr><td>Approval Processes</td><td>Only at the department level only</td></tr>
<tr><td>Implementation</td><td>August 2021</td></tr>
<tr><td>Technical Support</td><td>Modernization of laboratory</td></tr>
<tr><td>Capacity Building and Tutor Training requirements</td><td>Additional training for teaching and lab practice activities</td></tr>
<tr><td>e-Learning and the use of the eACCESS platform</td><td>Moodle (elearning.atmajaya.ac.id)</td></tr>
<tr><td>Financial Aspects</td><td>Cost for training of teachers for teaching and lab activities</td></tr>
</table>

The following courses will be developed from scratch

Table 111

<table>
<tr><th colspan="3">Introduction to Electric Power Distribution</th></tr>
<tr><td colspan="2">New Course: Yes</td><td>Developed from scratch</td></tr>
<tr><td>Semester: 5th</td><td>Type: Core</td><td>Credit (L, T, P): 3.0.0
Total Credits: 3 SKS</td></tr>
</table>

Course Objective	To give the basic concepts of fault conditions, and the coordination of protective devices
Learning Outcome	Students can understand types of fault in electrical distribution system. Students can use software in calculating the short circuit capacity of each branch of network. Students can understand the principles of protection coordination in power system. Students understands the function of substations.
Teaching methods/learning activities	Teaching activities:

Approach	hours/week	Total credit hours
Lecture	2.50	35 hours
Tutorial	0	0
Lab Exercise	0	0

Assessment methods	Oral and written test, oral and written presentation, assignments
Changes	New course
Rational	It is important for the students to understand the basic important operation in electrical distribution
Scope of eACCESS Collaboration:	Exchange of teaching staffs and students
Teaching staff	Budi Kartadinata, Tajuddin Nur
Approval Processes	New subject, must be approved by the Dean, the P2AI and the rectorate
Implementation	August 2021
Technical Support	Required feedback and suggestions from the electric power supplier
Capacity Building and Tutor Training requirements	Training for the new software such as ETAP Ecodial and MATLAB
e-Learning and the use of the eACCESS platform	Moodle (elearning.atmajaya.ac.id)
Financial Aspects	Training cost for teaching staffs

Table 112

Management of Electric Power Distribution	
New Course	

Semester: 7th	Type: Elective	Credits (L, T, P): 3.0.0 Total Credits: 3 SKS
Course Objective	To give students understanding about coordination in power system distribution	
Learning Outcome	Students understand the concept of load sharing and load shedding. Students understand coordination of protective devices. Students understand fault recovery system. Students understand about economic aspects in power engineering. Students understand the traction electricity system.	
Teaching methods/learning activities	Teaching activities:	
Assessment methods	Oral presentation, oral exam	
Changes	New course	
Rational	This topic is the fundamental of smart grid	
Scope of eACCESS Collaboration:	Teaching staff exchange	
Teaching staff	Budi Kartadinata, Ronald Sukwadi, Marsul Siregar	
Approval Processes	It must be approved by the: department, the P2AI and the Rector	
Implementation	August 2022	
Technical Support	Feedback from the power company and partner universities	
Capacity Building and Tutor Training requirements	Additional training for teaching staffs	
e-Learning and the use of the eACCESS platform	Microsoft Teams and Moodle	
Financial Aspects	Training cost for teaching staffs	

Approach	hours/week	Total credit hours
Lecture	2.50	35 hours
Tutorial	0	0
Lab Exercise	0	0

The following course will be terminated

Table 113

Basic Electric Power Engineering

<table>
<tr><td colspan="2">Existing Course Unit: Yes</td><td colspan="2">Will be terminated</td></tr>
<tr><td>Semester:4th</td><td colspan="2">Type: Core</td><td>Credits (L, T, P): 2.1.0</td></tr>
<tr><td>Course Objective</td><td colspan="3">Impart a basic knowledge of electrical power engineering such as: Electric machineries, transformers, Induction motors, synchronize motors, Synchronize Generators, DC Generators and Motors, Single-phase machine, and introduction to power electronics systems.</td></tr>
<tr><td>Learning Outcome</td><td colspan="3">Identify, predict, and formulate behaviour in electrical power engineering systems from: generator, transmissions and distribution.</td></tr>
<tr><td>Teaching methods/learning activities</td><td colspan="3"><table><tr><th>Approach</th><th>Hours/week</th><th>Total credit hours</th></tr><tr><td>Lecture</td><td>1.67</td><td>~ 23 hours</td></tr><tr><td>Tutorial</td><td>0</td><td>0</td></tr><tr><td>Assignments</td><td>0.83</td><td>12 hours</td></tr><tr><td>Lab Exercise</td><td>0</td><td>0</td></tr></table></td></tr>
<tr><td>Assessment methods</td><td colspan="3">Written exam, assignments</td></tr>
<tr><td>Changes</td><td colspan="3">The course will be terminated</td></tr>
<tr><td>Rational</td><td colspan="3">The materials are overlapped to the course Introduction to Electric Power Distribution</td></tr>
</table>

C. Human Resources

The available permanent and temporary teaching staff are discussed below.

1. Available permanent teaching staff

There are six lecturers that will be allocated to deliver the eACCESS related course.

Dr. Marsul Siregar

Dr. Marsul Siregar joined Atma Jaya as a full-time lecturer since 2019. Prior to the tenure, he is a professional (1996-2018), and start to work in the university as a part-time lecturer (2015-2018). He has several working experiences in the field of EPC Power Plant, Project Management, and Automation of industrial Process. As for the academic background, he received his master's (1993) and doctoral degree (1996) from the Tokushima University, Japan, with his dissertation focusing in Control of Power System and Electromagnetic Effect on Human Being due to AC and DC Voltage. In 2019, he was also a guest lecturer in the Master Program of Tokushima University, Japan. His current works are within the areas of Energy management system, Renewable Energy, Photovoltaic and SCADA system.

Dr. Marsul will be involved in modernization of the following teaching modules: SCADA, Management of Electric Power Distribution, Renewable Energy

Dr. Karel Octavianus Bachri

Dr. Karel is an assistant professor at the Electrical Engineering Undergraduate program at the Atma Jaya Catholic University of Indonesia. He is also responsible as a Head of Instrumentation laboratory and an editor member of the national peer-review journal, Journal Elektro. Dr. Karel completed his undergraduate study in Electrical Engineering Program in Atma Jaya Catholic University of Indonesia (2002), received his master's degree in Electrical Engineering from Bandung Institute of Technology, Indonesia (2007), and a doctorate in Electrical Engineering from the same university as his master's (2019). His dissertation contributes to developing an Artificial Intelligence method for interpreting disturbance in the transformer. Dr. Karel has published 13 research papers, including proceedings and journals, in which the most topics are within the area of Intelligent instrumentation and VLSI design.

Dr. Karel will be involved in modernization of the following teaching modules: PLC

Tajuddin Nur, PhD

Tajuddin Nur, Ph.D., is a lecturer/researcher at the Electrical Engineering department at Atma Jaya Catholic University of Indonesia Jakarta since 1994. He completed his master's degree in Electrical Power from the University of Indonesia (2002), with the thesis topics related to Electric Vehicle of Maglev Train. From 1996 – 1998, he worked a part-time job at PT. Graha Fortuna Purnama as an Electrical - Mechanical Engineer. Tajuddin received his Ph.D. from the Department of Electrical Engineering, Graduate School of Engineering, Southern Taiwan University of Science and Technology (STUST) in 2017 and was working in Design of Low Cogging Torque of Permanent Magnet Generator for Wind Power. He also has professional experience in the industry, such as at Tatung Company (Taiwan), PT. Kanowa Energi Nusantara), PT. Meysis as an electrical machine designer and system optimization for Renewable Energy Application. Since 2014, Tajuddin has been invited to be a guest lecturer in several program studies such as the Electrical engineering program at Bandung Institute of Technology, Indonesia (2014), Master Program of Electrical Engineering in Hasanuddin University Makassar, Indonesia (2015), and also at a Ph.D. Program at the Department of Electrical Engineering, STUST Taiwan (2019). Most of the topics are related to the field of Electrical Machine Design and Optimization, and Finite Element Method for Electrical Machine Design. Tajuddin is familiar with Finite Element Analysis, LUA Programming, Optimization, Electrical Machine Design, and Optimization. His research interests are electric machine design, renewable energy, Finite Element Analysis, and Smart Grid.

Tajuddin will be involved in modernization of the following teaching modules: Electric Machinery, Introduction to Electric Power Distribution, Electric Drive, Power Electronics, Renewable Energy

Ir. Budi Kartadinata, SE, MT, IPM

Budi Kartadinata is an associate professor at Atma Jaya Catholic University of Indonesia and has been teaching in the university since 1987. He received his bachelor's degree in Power Engineering from Trisakti University, Indonesia (1986), and a bachelor's degree in economics from the University of Indonesia (1996). Budi completed his master's study in Industrial Control from the University of Indonesia in 1998. Currently, he works as a Head of Electrical Energy Conversion Laboratory and teaches automation control, and power engineering courses such as PLC, Renewable Energy System, Basic Electrical Power Engineering, Basic Control System and SCADA Besides academics' experience, Budi was designing several control systems for the process industry and generating plants. Budi's research interests are in the area of industrial control and renewable energy.

Budi will be involved in modernization of the following teaching modules: Electric Machinery, Introduction to Electric Power Distribution, SCADA, Electric Drive, Management of Electric Power Distribution, Power Electronics, PLC, Renewable Energy

Annisa Sarah, ST, MSc

She is an assistant professor in the Electrical Engineering Undergraduate program at the Atma Jaya Catholic University of Indonesia. She joined the Atma Jaya Catholic University of Indonesia since 2018 and now responsible as a Head of Telecommunications & IoT laboratory, as well as the editor-in-chief of a national peer-reviewed journal called Jurnal Elektro. Annisa completed her undergraduate study in Telecommunication Engineering from Telkom University, Indonesia (2014), and received an M.Sc. degree in Electrical Engineering from KTH Royal Institute of Technology, Sweden (2017). Her master's study was in Wireless Systems Master Program and fully funded by the Indonesia Endowment Fund for Education (LPDP) organized by the Indonesians Ministry of Finance. She started participating in the International academic conference since 2014 and has eight publications, including proceedings and journals. Annisa's works are mainly in rural telecommunication, wireless systems, and wireless network. She also interests in Internet-of-Things development for rural communities.

Annisa will be involved in modernization of the following teaching modules: PLC and SCADA

Technical Staff and Student Laboratory Assistants

There is one available technical staff, Rizki Surya Permana, S.Pd who manage the administrative task for all laboratories under the Department of Electrical Engineering. Rizki has a bachelor's degree in Mechatronics Engineering Education from Yogyakarta State University (2017).

Student laboratory assistants are recruited per semester basis. The number of Laboratory assistant in each lab depends on the number of students taking the practice. A calculation for number of student laboratory assistants is:

Number of Student Lab Assistants = (A/B × C/D × E/F) ×125%
where:
A: number of students taking the practice
B: number of students per team
C: number of practice course
D: number of teams per assistant
E: duration of each course
F: maximum workload hours per semester.
125% is tolerance factor.

Hence, the number of laboratory assistants are varying each year, as the number of students who take the lab practice also vary.

Technical staff and student laboratory assistants will support all laboratory activities modernization and implementation, which are the labs for: Electric Machinery, PLC and Power Electronics.

D. Human Resource Gap Analysis

To meet our objective of this project, our department needs to improve by hiring new part-time teaching staff and provide trainings to develop existing faculty members' skills. The analysis of this situation is explained as follows:

Challenge: Limited capable resource.
Solution: Hire new part-time teaching staff
Currently we only have 3 teachers who focus in the area of power engineering. Thus, it is required to hire a new teaching staff who experienced in the field of power generation, power distribution and smart grid system development. However, because of the low number of new student intake of electrical engineering study program, we are not allowed to hire new permanent teaching staffs, as stated on the policy of our university. Yet, it is permittable to hire new part time teaching staffs. To cope with this situation, we plan to hire part-time teaching staff when we carried out the new and modernized eACCESS course. For now, we still going to administer and design all the eACCESS course using the existing teaching staffs with some reference from external partners (colleague, industry).

Challenge: New laboratory tools
Solution: Develop taskforce and Training for trainers
With the modernization of courses and lab activities, existing teaching staff might not be familiar to the new tools. We need to develop specific taskforce and sent them to a training program. This taskforce could make a lab manual and train other teaching staffs in the department.

E. Preliminary feasibility study

To ensure a successful project delivery, Atma Jaya catholic university has been identify several key aspects: teaching facility adaptations, external constraints of implementing the eACCESS courses and lab practice activities and major risks discussions. There is also a discussion of preliminary timeline which account all the result of our feasibility study.

1. Teaching Facilities

Atma Jaya Catholic University equipped with modern facilities; every classroom has a whiteboard, projector, PC, and sound system. To facilitate online learning, ATM also supported by Moodle Learning System for a regular online course, which can be accessed on https://elearning.atmajaya.ac.id, and edX platform for Massive Open Online Course which can be accessed on https://atmazeds.atmajaya.ac.id. There is no need to upgrade any physical or online-platform teaching facility to deliver eACCESS related course.

However, the existing laboratory facility might not capable of facilitating the expected learning outcomes from the eACCESS course (new and modernized). There are currently three laboratories that facilitate electric power specialization lab activities: Electrical Energy Conversion lab, Instrumentation lab, and Automation and Control lab. These labs only cover the basics of electric power knowledge and might obsolete if we compare to a massive improvement in the power industry nowadays. There is a need to upgrade existing laboratory facilities to a more advanced one.

As we plan to focus on smart-grid management, we plan to build a Smart-Grid Simulation Station, which consists of:

1. Four PCs
2. MATLAB and Simulink University Software License (with the required toolbox)
3. ETAP Software license

The upgraded laboratory facilities will cover experiments related to power flow and protection system

2. External constraints

Due to Covid-19 pandemic, we expect high limitation of people movements or mobility. This limitation affects work process in every aspect, such as slow working progress (because of meeting limitation) and slow procurement process. New teamwork and internal communication method must be developed to overcome this issue. We also need to expect delay in the new laboratory facility procurement.

During the implementation phase (mid 2021 to the end of this project), we expect a low interest of students in taking eACCESS related elective courses, because the number of students who took power engineering specialization in the previous years is low. To overcome this situation, we need to promote this project as earliest as possible to the prospective students. Moreover, the ministry of energy and mineral resources in Indonesia has stated that Indonesia will need additional 34,000 employees in the electricity sector in Indonesia during 2020-2024. This is an opportunity to introduce students that choosing power engineering specialization has a good career prospect.

3. Preliminary Timeline

The preliminary timeline to implement the eACCESS project in Atma Jaya Catholic University is discussed as follows.

September 2020:
The draft of the new curriculum must be ready at the department level. The draft will be sent to Faculty Senate to be discussed. After preliminary approval by the Faculty Senate, the draft will be submitted by the Dean to The Central for Enhancement and Development of Teaching Activities (P2AI) for correction and approval.

September 2020 – December 2020

During this period the new curriculum will be evaluated, corrected and improved. This process can take about six months to one year to be finalized.

January 2021 – March 2021:

The final draft of curriculum is legalized by the Rector and ready for implementation

March 2021- July 2021:

Promotions of the new curriculum to the prospective students. This is to promote odd semester courses (5^{th} and 7^{th} semester students), then the prospective students are those who joined the program in 2019 and 2018. The number of 5^{th} semester students will be around 40s (core course), and the number of 7^{th} semester students will be around 10 – 20s since the offered course for 7^{th} semester are elective courses.

July 2021:

The new curriculum will be ready to be implemented. All the preparations are finalized.

August 2021:

Start the eACCESS courses and lab activities that offered in Odd Semester.

February 2022:

Start the eACCESS courses and lab activities that offered in Even Semester.

4. Financial Feasibility Study

The eACCESS project will financially affect three aspects: curriculum development, human resource, and procurement to upgrade laboratory equipment

Curriculum:

With the new curriculum, we need to update textbooks and e-books which must be accessible by students. Moreover, we should enrich teaching staffs with relevant journal who discuss cutting-edge research. Thus, a journal subscription fee might occur. This will cost around 5.000 Euro per year.

Teaching staffs:

We must deliver the relevant topics and teaching material to students. With the limitation of existing faculty member capabilities, relevant guest lecturers must be invited to give lectures. This required additional cost for around 12.000 Euro per year

Laboratory equipment:

Cost for modernization of laboratory equipment is 50.000 Euro for a 3 year-period. This include procuring 4 computers that will be used for implementing software regarding power engineering, and purchase software licenses.

5. Risk Analysis

The identified sources of risk for the successful implementation of this projects are discussed below:

Political Risks:
The Indonesian higher education ministry proposed a new regulation which called "*Merdeka Belajar*" which translated as "Independent Learning". The proposed offer students to independently choose how they will be study: they will be able to study outside from their own program for 3 semesters. By having this freedom, there is a probability that we will have a low number of students who interest in taking our elective courses.
However, by having this Independent-Learning regulation, there is also an opportunity to attract more students from outside our study program, and outside our university. Thus, we should promote the eACCESS course not only to our own students, but also from outside.

Economic Risks:
High rate of unemployment after post Covid-19 era might affect student employability after study. Moreover, non-renewable energy electricity sector in Indonesia is currently controlled by the one and only state-owned company called PT. PLN. However, the Ministry of Energy and Mineral Resources is expecting Indonesia to slowly changing the non-renewable energy to a renewable energy to generates electricity, and the ministry start to open the market to private companies. This might be a good opportunity to provide the nation with relevant skilful workforces.

Managerial Risks:

Atma Jaya Catholic University will manage eight eACCESS related course: six exist course will be modernized, and two others are the new proposed course that need to develop from scratch. As described on the Section B, half of these courses are the core course, and rests considered as an elective course. Moreover, there will be three modernized laboratory practice.

To maintain a realistic delivery, we need to map the workload of each teaching staffs and make it rational. There will be one dedicated project manager that need to ensure the smoothness of this delivery.

The distribution of eACCESS related courses in Atma Jaya Catholic University of Indonesia:

Table 114

Courses for Odd Semester	Courses for Even Semester
Programmable Logic Controller + Lab	Electric Machinery + Lab
Introduction to Electric Power Distribution	SCADA
Electric Drive	Power Electronics + Lab
Management of Electric Power Distribution	
Renewable Energy	

The existing five permanent faculty members responsibility will be mapped as follows:

Table 115

Name	Courses Responsibility during Odd Semester	Course Responsibility during Even Semester
Dr. Marsul Siregar	2 Courses	1 Course
Dr. Karel Octavianus Bachri	1 Course	-
Tajuddin Nur Ph.D	3 Courses	2 Courses
Budi Kartadinata	5 Courses	3 Courses
Annisa Sarah	1 Courses	1 Course

Based on the responsibility distribution, the scheduling of teaching staff who has high number of course offered must be maintain carefully. There is also an urge to provide more part-time lecturers to deliver eACCESS related courses during the Odd Semester since we have five modernized and new courses to offer, compared to the even semester that offered only three courses.

VI. Soegijapranata Catholic University (SCU)

A. Curriculum modernization procedure at SCU

At Soegijapranata catholic university the changes program is of two categories: Minor Changes and Major Changes.

Minor changes

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

Table 116

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.

The changes are proposed by the program committee and approved by the meeting of the electrical engineering department. This evaluation will be done every semester and it doesn't take more than a week. Programs have to meet with FORTEI (Indonesian Electrical Engineering Forum) guidance for curriculum.

Major changes

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

Table 117

Category	Change
Changes to a program	Changing program duration, title of award, level of award, mode of delivery (regular/part-time), total credits.
Changes to mode of teaching, learning and assessment	Changing approaches to teaching learning from regular over 14 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%.

When new subjects are included in the department curriculum, it is necessary for the committee formed by the department to review and evaluate them, then the new curriculum will be approved by Dean of the Engineering Faculty. New curriculum reviews and changes will be conducted every 5 years. Evaluation and review by the Ministry of Education is conducted regularly (5 years). As for cases where the content of a course is changed, it is only discussed at the level of the meeting in the department. International accreditation is optional choice.

The program committee proposes to head of department and approved by the meeting of the electrical engineering department. This evaluation will be done every five years and normally this takes about 6 months. Programs must meet with FORTEI (Indonesian Electrical Engineering Forum) guidance for curriculum. FORTEI is a consortium of Indonesian Higher Education that have Electrical Engineering program. Accreditation body is BAN-PT (Badan Akreditasi Nasional Perguruan Tinggi; National Accreditation Bureau for Higher Education) BAN-PT always refer curriculum contents from appropriate major consortium for justify learning outcomes.

The procedure for the implementation of new courses and course units is summarized in the following steps:

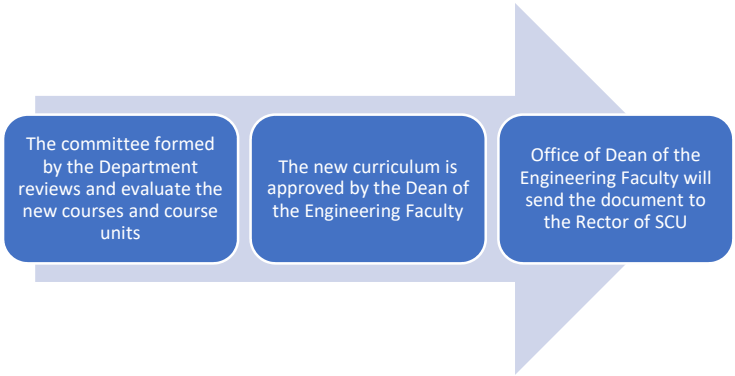

Figure 2 Procedure of implementation new program

The preparation for the launch of Renewable Energy program started in 2017. For one-year, electrical engineering department arranged program by using any reference curriculum from other university, industry, professional association and the government. During the preparation stage an evaluation process is carried out on the old program and the possibility to form a new program. The next step is to inventory all the needs for new programs, including dialogue with the government and industry. Requirements determined by FORTEI (Indonesian Electrical Engineering Forum) must also be obeyed. After everything is obtained, then the curriculum is compiled for a new program. The curriculum covers everything including lectures and practical work in laboratories and internships.

In 2018 the new curriculum compiled by the curriculum work unit was submitted to the head of the study program for review and approval. After being reviewed and approved by the head of the study program, the curriculum is requested by the Dean to be submitted to the University via Academic Administration Bureau (BAA: Biro Administrasi Akademik) for encoding courses.

The new program, Renewable Energy has been officially started in the academic year 2019/2020 with several students enrolled. However, during first semesters the students will share the same program Industrial Electronics and the difference in the curriculum will be mostly visible from the fifth semester. The new subjects, which have been selected and designed for this new program will be developed and modernize under the umbrella of the eACCESS project and they will include at least the following course units:

Lecture:

a. Electric Energy Conversion
b. Electric Drive
c. Electric Power Supply
d. Hydro and Wind Energy
e. Electric Power System
f. Applied Photovoltaic

Laboratory:

a. Electric Energy Conversion Lab
b. Electric Drive Lab
c. Electric Power Supply Lab
d. Renewable Energy Lab I
e. Renewable Energy Lab II

B. Curriculum development and modernization of Bachelor of Electrical and Electronics Engineering

The following courses are planned to be modernized in the framework of the eACCESS project:

Table 118

Course Title: Electric Energy Conversion			
Existing Course Unit		Need to Modernize	
Semester: 2nd and 3rd	Type: Core	Credits: Theory 4 Credit (in 2nd semester) Practicum 1 Credit (in 3rd semester)	
Course Objective	Understanding how the electric energy conversion related to the motor and generator		
Learning Outcome	Students will be able to describe the basic operation of motor and generator		
Teaching methods/learning activities	Approach	Hours/week	Total credit hours
	Lecture	4	56
	Tutorial	1	14
	Assignments	1	14
	Lab Exercise	3	42
Assessment methods	Oral examination, written examination, oral presentation, test, paper/essay, portfolio, report about an internship, report on fieldwork, continuous assessment.		
Changes	Parts of subjects and laboratory modules will be upgraded. The contents, teaching methods and knowledge and skills verification methods will be reviewed and improved regarding the following topics: Basic DC Machine, Basic AC Machine, Basic Power Electronics, Basic Renewable Energy, Relay Contactor, Timer, Push Button Switch. The new topics will be added to the syllabus of this course unit: Synchronous AC Generator in Parallel Operation, Photovoltaic Operation, Stand-alone PV system, PV-Grid Connected System		
Rational	The students must know the basic of microgrid components		

Scope of eACCESS Collaboration:	eACCESS will facilitate the number of the instruments, devices and capacity building, these are: • training for staff and technicians on assigned module course • sharing of staff resources • training for students on assigned module course • upgrade teaching methods
Teaching staff	Dr. Leonardus Heru Pratomo
Approval Processes	It will be conducted in the level of department meeting because the name the existing subjects is not changed
Implementation	The end of 2021
Technical Support	Laboratory supported by SCU and eACCESS, Technician and staff
Capacity Building and Tutor Training requirements	Technician and staff must be trained before teaching the subject

Table 119

Course Title: Electric Drive		
Existing Course Unit	Need to Modernize	
Semester: 6th	Type: Elective	Credits: Theory 4 Credit Practicum 1 Credit
Course Objective	Understanding how to operate and control some types of electric motors	
Learning Outcome	Students should able to describe and design some types of electric drives	
Teaching methods/learning activities	Approach / Hours/week / Total credit hours Lecture: 4 / 56 Tutorial: 1 / 14 Assignments: 1 / 14 Lab Exercise: 3 / 42	

Assessment methods	Oral examination, written examination, oral presentation, test, paper/essay, portfolio, report about an internship, report on fieldwork, continuous assessment
Changes	Parts of the syllabus and laboratory modules will be upgraded including the following topics: DC Drive, AC Drive Volt/Hz, Space Vector Modulation, AC Drive Vector Control, Stepper for micro stepping New topics will be inserted to modernize the contents of course (BLDC Motor Drive, SRM Motor Drive) Teaching and assessment methods will be upgraded
Rational	The students must know the basic of microgrid components
Scope of eACCESS Collaboration:	eACCESS will facilitate the number of the instruments, devices and capacity building, these are: • training for staff and technicians on assigned module course • sharing of staff resources • training for students on assigned module course • upgrade teaching methods
Teaching staff	Prof. Slamet Riyadi
Approval Processes	It will be conducted in the level of department meeting because the name the existing subjects is not changed
Implementation	The end of 2021
Technical Support	Laboratory supported by SCU and eACCESS, Technician and staff
Capacity Building and Tutor Training requirements	Technician and staff must be trained before teaching the subject

Table 120

Course Title: Electric Power Supply		
Existing Course Unit	Need to Modernize	
Semester: 6th and 7th	Type: Elective	Credits: Theory 4 Credit (in 6th semester) Practicum 1 Credit (in 7th semester)

Course Objective	Understanding and observing some types of switching power supplies
Learning Outcome	Students should be able to understand and design some types of switching power supplies
Teaching methods/learning activities	Approach / Hours/week / Total credit hours Lecture: 4 / 56 Tutorial: 1 / 14 Assignments: 1 / 14 Lab Exercise: 3 / 42
Assessment methods	Oral examination, written examination, oral presentation, test, paper/essay, portfolio, report about an internship, report on fieldwork, continuous assessment,
Changes	Parts of the syllabus and laboratory program will be upgraded (Linear power supply, Basic Switching Power Supply, Forward Converter, Flyback Converter, Push-Pull Converter, Half-Bridge Converter, Full-Bridge Converter New topics will be inserted to modernize the contents of course (Battery Charger) Teaching and assessment methods will be reviewed and upgraded
Rational	The students must know the basic of microgrid components
Scope of eACCESS Collaboration:	eACCESS will facilitate the number of the instruments, devices and capacity building, these are: • training for staff and technicians on assigned module course • sharing of staff resources • training for students on assigned module course • upgrade teaching methods
Teaching staff	Prof. Slamet Riyadi, Felix Yustian Setiono, M.Sc. Eng.
Approval Processes	It will be conducted in the level of department meeting because the name the existing subjects is not changed
Implementation	The end of 2022
Technical Support	Laboratory supported by SCU and eACCESS, Technician and staff

Capacity Building and Tutor Training requirements	Technician and staff must be trained before teaching this subject

Table 121

Course Title: Hydro and Wind Energy			
Existing Course Unit		Need to Modernize	
Semester: 6th	Type: Elective	Credits: Theory 4 Credit (in 6th semester)	
Course Objective	Understanding the generation of electric energy from hydro power plant and wind power plant		
Learning Outcome	Students will be able to understand the generation of electric energy from hydro power plant and wind power plant include system, components and operation		
Teaching methods/learning activities	Approach	Hours/week	Total credit hours
	Lecture	4	56
	Tutorial	1	14
	Assignments	1	14
Assessment methods	oral examination, written examination, oral presentation, test, paper/essay, portfolio, report about an internship, report on fieldwork, continuous assessment,		
Changes	Parts of subjects will be upgraded, including: Hydro Power Plant System, Generator for Hydro Power Plant System, Wind Power Plant System, Generator for Wind Power Plant System, Power Electronics in Hydro and Wind Energy, New topics will be added to the curriculum (Microgrid system), Teaching methods will be upgraded		
Rational	The students must know the basic of microgrid system		
Scope of eACCESS Collaboration:	eACCESS will facilitate the number of the instruments, devices and capacity building, these are: • training for staff and technicians on assigned module course • sharing of staff resources • training for students on assigned module course • upgrade teaching methods		

Teaching staff	Dr. Leonardus Heru Pratomo, Arifin Wibisono, B.Eng.
Approval Processes	It will be conducted in the level of department meeting because the name the existing subjects is not changed
Implementation	The end of 2022
Technical Support	Laboratory supported by SCU and eACCESS, Technician and staff
Capacity Building and Tutor Training requirements	Staff must be trained before teaching this subject

Table 122

Course Title: Electric Power System		
Existing Course Unit	Need to Modernize	
Semester: 6th	Type: Elective	Credits: Theory 4 Credit (in 6th semester)
Course Objective	Understanding the generation, transmission and distribution of electric energy.	
Learning Outcome	Students should be able to understand the generation, transmission and distribution of electric energy, include centralized and distributed generation system	
Teaching methods/learning activities	Approach / Hours/week / Total credit hours Lecture / 4 / 56 Tutorial / 1 / 14 Assignments / 1 / 14	
Assessment methods	Oral examination, written examination, oral presentation, test, paper/essay, portfolio, report about an internship, report on fieldwork, continuous assessment,	
Changes	Parts of subjects and laboratory modules will be upgraded, including the following topics: Power generation, Transmission system, Distribution system, Power Transformers, Protection Systems New topics will be added to the curriculum (Microgrid system), Teaching and assessment methods will be reviewed and upgraded	

Rational	The students must know the basic of microgrid system
Scope of eACCESS Collaboration:	eACCESS will facilitate the number of the instruments, devices and capacity building, these are: • training for staff and technicians on assigned module course • sharing of staff resources • training for students on assigned module course • upgrade teaching methods
Teaching staff	Prof. Slamet Riyadi, Arifin Wibisono, B.Eng.
Approval Processes	It will be conducted in the level of department meeting because the name the existing subjects is not changed
Implementation	The end of 2022
Technical Support	Laboratory supported by SCU and eACCESS, Technician and staff
Capacity Building and Tutor Training requirements	Staff must be trained before teaching this subject

Table 123

Course Title: Applied PV		
Existing Course Unit	Need to Modernize	
Semester: 7th	Type: Elective	Credits: Theory 4 Credit (in 6th semester)
Course Objective	Understanding the applications of Photovoltaic	
Learning Outcome	Students should be able to understand the applications of Photovoltaic include stand alone, grid connected and MPPT	
Teaching methods/learning activities	Approach / Hours/week / Total credit hours Lecture / 4 / 56 Tutorial / 1 / 14 Assignments / 1 / 14	
Assessment methods	Oral examination, written examination, oral presentation, test, paper/essay, portfolio, report about an internship, report on fieldwork, continuous assessment,	

Changes	Parts of subjects and laboratory modules will be upgraded (PV Cell, Module and Array, PV Characteristic, MPPT), New topics will be added to the syllabus (Photovoltaic Operation, Stand Alone PV system, PV Grid Connected System) Teaching methods will be upgraded
Rational	The students must know the basic of microgrid system and operation of PV in such a system
Scope of eACCESS Collaboration:	eACCESS will facilitate the number of the instruments, devices and capacity building, these are: • training for staff and technicians on assigned module course • sharing of staff resources • training for students on assigned module course • upgrade teaching methods
Teaching staff	Prof. Slamet Riyadi, Yulianto Tejo Putranto, M.Eng
Approval Processes	It will be conducted in the level of department meeting because the name the existing subjects is not changed
Implementation	First semester of 2022
Technical Support	Laboratory supported by SCU and eACCESS, Technician and staff
Capacity Building and Tutor Training requirements	Staff must be trained before teaching this subject

Table 124

Course Title: Renewable Energy Lab		
Existing Course Unit	Need to Modernize	
Semester: 6th and 7th	Type: Elective	Credits: 1 Credit/semester
Course Objective	Observing the electric energy conversion related to Renewable Energy Observing the electric energy conversion related to Renewable Energy in Microgrid System	
Learning Outcome	Students should be able to understand and observe the electric energy conversion related to Renewable Energy. Students should	

	be able to understand and observe the electric energy conversion related to Renewable Energy in Microgrid System
Teaching methods/learning activities	Approach / Hours/week / Total credit hours Lab Exercise-1 (Semester 6th) / 3 / 42 Lab Exercise-2 (Semester 7th) / 3 / 42
Assessment methods	portfolio, report on fieldwork, continuous assessment,
Changes	Parts of subjects and laboratory modules will be upgraded (Basic Photovoltaic, Synchronous AC Generator, Small Wind Turbine Power Plant, Basic Fuel Cell Operation, Battery Charger). New topics will be added to the laboratory program (Photovoltaic Operation, Stand Alone PV system, PV Grid Connected System, Synchronous AC generator in Parallel Operation, transferring battery energy into grid, Parameter detection for control and monitoring the system, Operation of system control and monitor, Microgrid in island mode, Microgrid in Grid connected mode).
Rational	The students must know the basic of microgrid components
Scope of eACCESS Collaboration:	eACCESS will facilitate the number of the instruments, devices and capacity building, these are: • training for staff and technicians on assigned module course • sharing of staff resources • training for students on assigned module course • upgrade teaching methods
Teaching staff	Prof. Slamet Riyadi, Dr. Leonardus Heru Pratomo, Yulianto Tedjo Putranto, M. Eng.
Approval Processes	It will be conducted in the level of department meeting because the name the existing subjects is not changed
Implementation	The end of 2021
Technical Support	Laboratory supported by SCU and eACCESS, Technician and staff
Capacity Building and Tutor Training requirements	Technician and staff must be trained before teaching the subject

C. Curriculum modernization procedure of Master of Electrical Power System Engineering

Soegijapranata Catholic University has not yet opened a master's Program in Electric Power Engineering and the SCU is not considering the implementation of a second level study course in Electric Power Engineering in the framework of the eACCESS project. The Master's Program is planned to be held in 2024 and so it is out of the scope of eACCESS project.

D. Human Resources

The teaching staff currently available at the faculty of Electrical Engineering Faculty includes:

Prof. Slamet Riyadi was born in Semarang-Indonesia in 1967. He has been a lecturer and researcher at the Electrical Engineering Department, Soegijapranata Catholic University Indonesia since 1992. He received the B. Eng. degree from Diponegoro University, Semarang-Indonesia in 1991. M. Eng. degree and Dr. Eng. degree from Bandung Institute of Technology, (ITB)-Bandung, Indonesia in 1997 and 2006. His research interest is mainly in Energy System, Power Electronic, Electric Motor Control, Active power filter and grid tie inverter. He has published more than 50 papers. Prof. Slamet Riyadi has served Dean of the faculty of engineering and head of laboratory of Electrical Engineering Department. The responsibility in the modernization process is curriculum development.

Assoc Prof. Florentinus Budi Setiawan was born in Semarang-Indonesia, in 1970 has been a lecturer and researcher at the Electrical Engineering Department, Soegijapranata Catholic University Indonesia since 1994. He received the B. Eng. degree from Diponegoro University, Semarang- Indonesia in 1994. M. Eng. degree and Dr. Eng. degree from Bandung Institute of Technology, (ITB)-Bandung, Indonesia in 2000 and 2010. His research interest is mainly in signal processing, control and telecommunication. He has published more than 10 papers. Assoc Prof. Florentinus Budi Setiawan has served secretary of Electrical Engineering Department. The responsibility in the modernization process are management, promotion and dissemination.

Assoc Prof. Leonardus Heru Pratomo was born in Ambarawa-Indonesia, in 1976. He has been a lecturer and researcher at the Electrical Engineering Department, Soegijapranata Catholic University Indonesia since 2000. He received the B. Eng. degree from Catholic University, Semarang, Indonesia in 1994 and M. Eng. degree from Bandung Institute of Technology, (ITB)-Bandung, Indonesia in 2004. He received the Dr. Eng. degree from Gadjah Mada University, Yogyakarta, Indonesia, in 2016. His current research is focused on multilevel inverter topology, power energy conversion and PV-Grid Systems. He has published more than 15 papers. Assoc Prof. Leonardus Heru Pratomo has served head of Electrical Engineering Department. The responsibility in the modernization process is laboratory development.

Mr. Felix Yustian Setiono, was born in Semarang-Indonesia, in 1985. He has been a lecturer and researcher at the Electrical Engineering Department, Soegijapranata Catholic University Indonesia since 2015. He received the B. Eng. degree from Soegijapranata University, Semarang, Indonesia, in 2010 and M. Eng. degree from Bandung Institute of Technology, (ITB)-Bandung, Indonesia in 2014. Now, He is a PhD Cand at Japanese Advance Institute of

Technology (JAIST) Japan. His current research is focused on discrete control, Quad Copter control. He has published more than 10 papers. The responsibility in the modernization process is laboratory development.

Mr. Yulianto Tedjo Putranto, was born in Surakarta-Indonesia, in 1968. He has been a lecturer and researcher at the Electrical Engineering Department, Soegijapranata Catholic University Indonesia since 1994. He received the B. Eng. degree and M. Eng. degree from Gadjah Mada University, Yogyakarta, Indonesia, in 1993 and 1998. Now, He is a PhD Cand at Surabaya Institute of Technology. His current research is focused on digital signal processing. He has published more than 10 papers. The responsibility in the modernization process is curriculum development.

Mr. Arifin Wibisono, was born in Semarang-Indonesia, in 1987. He has been a lecturer and researcher at the Electrical Engineering Department, Soegijapranata Catholic University Indonesia since 2000. He received the B. Eng. degree from Soegijapranata University, Semarang, Indonesia, in 2015 and M. Eng. degree from Diponegoro University, Yogyakarta, Indonesia, in 2019. His current research is focused on discrete control, renewable energy, controlled power converter. He has published more than 5 papers. The responsibility in the modernization process is laboratory development.

Description of the relevant technical staff

Laboratory assistants available in electrical engineering are an electronic engineering discipline so training and introduction are needed to relate to power engineering. This training has been started by introducing the module for practicum in electric energy conversion, power electronics practicum and electric drive practicum. Theoretical training will be carried out together in the implementation of learning conducted during lectures taking place in each semester by Prof. Slamet Riyadi.

Students supporting permanent staff in their teaching activities

Students who are active in the electrical engineering study program average 30 students per year, so the number of students who will be involved in the eACCES program is gradually start from 30 into 80 students for three years.

	Academic year									
Year of student enter	2018		2019		2020		2021		2022	
2018	semester 1	semester 2	semester 3	semester 4	semester 5	semester 6	semester 7	semester 8		
Renewable energy	1 student	1 student	1 student	1 student	1 student	1 student	1 student	1 student		
Industrial Engineering	25 students	25 students	25 students	25 students	25 students	25 students	25 students	25 students		
2019			semester 1	semester 2	semester 3	semester 4	semester 5	semester 6	semester 7	semester 8
Renewable energy			5 students	5 students	5 students	5 students	5 students	5 students	5 students	5 students
Industrial Engineering			25 students	25 students	25 students	25 students	25 students	25 students	25 students	25 students
2020					semester 1	semester 2	semester 3	semester 4	semester 5	semester 6
Renewable energy					10 students	10 students	10 students	10 students	10 students	10 students
Industrial Engineering					25 students	25 students	25 students	25 students	25 students	25 students
2021							semester 1	semester 2	semester 3	semester 4
Renewable energy							15 students	15 students	15 students	15 students
Industrial Engineering							25 students	25 students	25 students	25 students
2022									semester 1	semester 2
Renewable energy									20 students	20 students
Industrial Engineering									25 students	25 students
eACCESS					30 students	61 students	61 students	70 students	70 students	80 students

semester with subject and lab corresponding eACCESS program

student with eACCESS program

Figure 3 Existing and projected number of students

Staff training requirements

Teachers' needs are done by involving everyone by developing their respective scientific disciplines to support this eACCES program. Training of teaching staff and laboratory assistants is given training to provide insight into their knowledge, namely in the field of microgrids, control and monitoring systems, coordination of protection and power flow. Some lecturers who are studying doctoral will go home in 2021 so they can immediately join to take advantage of this program to improve their capabilities with their application of knowledge related to power engineering.

E. Preliminary feasibility study

Indonesia has a target of using new and renewable energy in the national energy mix of 23% in 2025 and 31% in 2050. Development target of such energy are geothermal (7.241 MW), hydropower (20.960 MW), Bioenergy (5.532 MW), Photovoltaic (6.379 MW), wind energy (1.807 MW) and other renewable energy (3.128 MW). Combining the existing electric energy with these renewable energies require expertise in power engineering, power electronics, control and other skills. Electrical Engineering (EE) Department of SCU has opportunity to prepare bachelors in EE to fill the vacancies. SCU has EE department that focused on Industrial Electronics (IE) since 2003 and Renewable Energy (RE) since 2018. Every 5 years, the curriculum will be evaluated regarding to the needs of the market by the committee formed by Dean of Engineering Faculty.

Electrical Engineering Soegijapranata catholic university is affiliated with universities that have an electrical engineering program called the Indonesian Electrical Engineering Forum (FORTEI), both Central Java (23 universities) and National (129 universities). FORTEI is a consortium of Indonesian Higher Education that have Electrical Engineering program. Accreditation body is BAN-PT (Badan Akreditasi Nasional Perguruan Tinggi; National

Accreditation Bureau for Higher Education) BAN-PT always refer curriculum contents from appropriate major consortium for justify learning outcomes.

This eACCESS program will provide many benefits for those who have a power engineering program, where they can develop education and practice in the field of microgrids. FORTEI Central Java and DIY regions (23 universities) usually held in bi-monthly meetings, so we can use these meetings to improve the quality of learning related to power engineering that has been implemented in a scheduled and continuous manner.

In the current curriculum in both the Industrial Electronics and Renewable Energy programs, the focus of power electronics lies in industrial applications related to power supplies, electric drives (conventional motors). Applications in the field of renewable energy not only lies in standalone photovoltaics, but also wind energy, and other system.

With the existence of PEL (Power Electronics Laboratory) proposed by SCU (Soegijapranata Catholic University), students will get further knowledge about the application of power electronics in wider applications, including microgrid, scattered generation and monitor systems related to the system.

With these benefits, students will have superior abilities and competencies so that SCU graduate students are able to compete with more abilities which are becoming a trend nowadays

Interest in potential students

Based on the data of the recruitment profile of the Electrical Engineering Study Program Students in 2018 and 2019, it can be seen that the number of interested study programs tends to increase, but it is still quite small. In 2018 there will be 1 student interest, in 2019 there will be 5 students and in 2020 there will be 5 students applying for this program until May 2020 (registration will close in September 2020). Increasing the number of students in Renewable Energy Program per year is predicted by 5 students.

By using Renewable Energy Material Promotion, by using Renewable Energy Promotion Materials, student recruitment is carried out by the University through the Communication and Student Recruitment Bureau (BKRM). To help smooth the implementation of this recruitment system, BKRM has a team whose members consist of lecturers and students from each study program. In addition, BKRM has a network of a number of secondary schools / vocational high schools in the regions of Java, Sumatra and Kalimantan as a special place to market new study programs, such as renewable energy in capturing the interest of prospective students.

Student recruitment system is carried out through three channels, as follows:

a. Achievement path.

Achievement path is a pathway to the process of registering as a student by attaching sports academic achievement during high school, evidenced by certificates or other awards.

b. cooperation pathway.

cooperation pathway is a pathway for the registration process to become a student with a cooperation agreement between the school and SCU with certain academic requirements,

c. Test Path

The test track is a pathway for the registration process to become a student by passing tests to prospective students. if the candidate exceeds a certain grade, then he / she can pass to become a student

Financial requirements for new programs that modernized include aspects of:

Curriculum
Aspects of the curriculum will cause the emergence of costs for the preparation of the system and procurement of new materials for lectures, including books and references and the provision of room facilities. The budget required for this section is around EUR 6400. These expenses will be partially funded from the eACCESS budget allocated to the equipment and subcontracting.

Laboratory
The laboratory aspect will bring up the costs of providing equipment and materials, a program for preparing practicum procedures, providing laboratory space. The budget required for this section is around EUR 45,000. These expenses will be partially funded from the eACCESS budget allocated to the equipment.

Teachers
One teacher will be hire for new program. The teaching aspect will cause the cost to recruit new teachers in the renewable energy sector. Recruitment of new lecturers will add budget of EUR 10,080 for three years.

Table 125

No	item	unit	volume	subtotal
1	Salary	EUR 205	36 months	EUR 7,380
2	Facility	EUR 900	3 year	EUR 2,700
total				EUR 10,080

It should be stressed that the above indicated expenses will be fully covered from the regular annual budget of the university, and the funds transferred as part of the eACCESS project will be able to be used only for purposes related to the preparation of new academic staff (training, domestic and foreign mobility).

The following 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.

This Procedure is determined by SCU Educational quality assurance institution.

1. The head of Electrical Engineering Program review 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's 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.

The following 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 there are several people applying 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.

Apprenticeship Place

Need to find an appropriate internship for final year students in the field of renewable energy. Approaches to the industry are needed in order to be willing to accept internships for renewable energy. The budget required for this section is around EUR 800

With the eACCES 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 teaching room construction has standards as follows:

- Minimum space capacity of 50 students,
- Wi-Fi 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.

The microgrid laboratory to be implemented has a good place; can be seen clearly by many people, easily accessed and possible to install PV modules that get sunlight well. The electrical system in the laboratory also has a large capacity so it is possible to implement a microgrid laboratory in this place.

Source of risk

The renewable energy field's population is still lacking, so it requires extra energy to develop the program. another risk is the availability of materials and tools to support renewable energy

programs. On the other hand, the lecturers need to divert some of their thinking to support this program. At the time of going to work apprenticeship needed the process of finding a longer internship, because it was still not too popular.

Political risk

The Indonesian government still lacks stimulus to the alternative energy sector, especially the renewable energy sector, so that it will hamper the development of renewable energy systems. The use of energy still focuses on using fossil sources to generate electricity. The government's willingness to lead to the use of renewable energy is lacking.

Economic risk

Procurement of renewable energy sources still requires high costs at the beginning of investment. Indonesian people still consider that renewable energy is still expensive, because it only calculates the initial investment, without calculating the monthly or annual expenditure after procuring renewable energy. This also reduces the interest of prospective students who will enter the new program.

Managerial risk

A new system is needed that is more suitable for new programs. a leader is needed for this program and its support staff. Procurement managers will incur additional costs for the university. As a result, the costs will be borne by prospective students. New programs with high costs tend not to be desirable, unless the program has a high attractiveness and popularity. In the early year management costs will certainly arise greater than if the program were running well. The development of information systems and internet-based e-learning applications require very large internet bandwidth, especially for learning new modules.

VII. Conclusion and final remarks

In the deliverable D1.2 the needs for the modernization of development of academic curriculum at partner universities in the context of teaching modern power engineering teaching have been collected and analysed by the European and Asian partners together. In the case of four partners (PU, RUB, ATM and SCU), where courses fully or partially targeting the area of the power industry are already available, it was the case of the modernization of the contents of existing courses and few additions to the current curriculum (limited number of new subjects). In the case of KEC both bachelor level and master level courses in Electrical Engineering had to be designed from nil and they will be fully implemented and validated in the course of the eACCESS project implementation.

The Asian partners working together with TUL and AUTH reviewed their existing curricula, available resources and selected subjects for future work in the next stages of the eACCESS project. The summary of the conducted analysis, drawn conclusions and produced recommendations are presented in this section.

Until now KEC does not offer undergraduate courses in Electrical Engineering. However, some subjects dealing with electrical engineering, automation and power engineering are already available from other faculties and program studies at KEC. To meet the requirements and expectations articulated by the power industry in Nepal, a new bachelor's degree will be soon available from KEC and eACCESS project is going to support the process of the implementation of this new course.
KEC entirely new bachelor program has been designed for 4 years and divided into 8 semesters. Altogether 58 subjects have been selected for the curriculum resulting in 243 credits in total for this course including 49 core (compulsory) subjects and 9 elective course units scheduled for late semesters (7-8). The elective subject makes for approximately 9% of the total credits.
The curriculum has been very much based on the Tribhuvan University (http://www.tribhuvan-university.edu.np) undergraduate program in electrical engineering, as this university will authorise officially the new course at KEC, which does not have sufficient academic credential to start new courses themselves.

Majority of the course units included in the bachelor program, particularly for the first two academic years, are based on subjects already available at KEC and these are basic engineering subjects, sciences, basic practical technical skills. This means that both the contents and academic resources are already available for these subjects.
Instead, specialisation subjects, including subjects directly dealing with power engineering knowledge and skills have to be developed from scratch. KEC requested eACCESS support for six new course units: Power System Analysis I, Power System Analysis II, Switchgear and Protection, Hydropower, Power Electronics, High Voltage Engineering.

The summary table for KEC bachelor Electrical Engineering study program is presented in the table below.

Table 126

Semester	Subject Name	Lecture	Tutorial	Project	Seminars	Laboratory Practice	Industrial Placement	Core/Elective	Credits	Status	eACCESS Support
1	Engineering Mathematics I	Y	Y	N	N	N	N	Core	4	Available	N
1	Computer Programming	Y	Y	Y	N	Y	N	Core	6	Available	N
1	Engineering Drawing, I	Y	Y	N	N	N	N	Core	4	Available	N
1	Engineering Physics	Y	Y	N	N	Y	N	Core	6	Available	N
1	Basic Electrical Engineering	Y	Y	N	N	Y	N	Core	5	Available	N
1	Applied Mechanics	Y	Y	N	N	N	N	Core	4	Available	N
									29		
2	Engineering Mathematics II	Y	Y	N	N	N	N	Core	4	Available	N
2	Engineering Drawing II	Y	Y	N	N	N	N	Core	4	Available	N
2	Basic Electronics Engineering	Y	Y	N	N	Y	N	Core	5	Available	N
2	Engineering Chemistry	Y	Y	N	N	Y	N	Core	6	Available	N
2	Fundamental of Thermodynamics and Heat Transfer	Y	Y	N	N	Y	N	Core	5	Available	N
2	Workshop Technology	Y	N	Y	N	Y	N	Core	2	Available	N
									26		
3	Engineering Mathematics III	Y	Y	N	N	N	N	Core	4	Available	N
3	Object Oriented Programming	Y	Y	Y	N	Y	N	Core	6	Available	N
3	Electric Circuit Theory	Y	Y	N	N	Y	N	Core	5	Available	N
3	Electrical Engineering Material	Y	Y	N	N	N	N	Core	4	Available	N
3	Electronic Devices and Circuits	Y	Y	N	N	Y	N	Core	5	Available	N
3	Digital Logic	Y	Y	Y	N	Y	N	Core	6	Available	N
3	Electromagnetics	Y	Y	N	N	Y	N	Core	5	Available	N
									35		
4	Electric Machine-I	Y	Y	N	N	Y	N	Core	5	Available	N
4	Numerical Methods	Y	Y	N	N	Y	N	Core	6	Available	N
4	Applied Mathematics	Y	Y	N	N	N	N	Core	4	Available	N
4	Instrumentation I	Y	Y	N	N	Y	N	Core	5	Available	N
4	Power System Analysis I	Y	Y	N	N	N	N	Core	4	Develop	Y
4	Microprocessors	Y	Y	N	N	Y	N	Core	6	Available	N
									30		
5	Communication English	Y	Y	N	N	Y	N	Core	5	Available	N
5	Probability and Statistics	Y	Y	N	N	N	N	Core	4	Available	N
5	Control System	Y	Y	N	N	Y	N	Core	5	Available	N
5	Instrumentation II	Y	Y	N	N	Y	N	Core	5	Available	N
5	Power System Analysis II	Y	Y	N	N	N	N	Core	4	Develop	Y
5	Electric Machine Design	Y	Y	Y	N	Y	N	Core	6	Available	N

Semester	Subject Name	Lecture	Tutorial	Project	Seminars	Laboratory Practice	Industrial Placement	Core/Elective	Credits	Status	eACCESS Support
									29		
6	Engineering Economics	Y	Y	N	N	N	N	Core	4	Available	N
6	Digital Control System	Y	Y	N	N	Y	N	Core	5	Available	N
6	Signal Analysis	Y	Y	N	N	Y	N	Core	5	Available	N
6	Switchgear and Protection	Y	Y	N	N	Y	N	Core	5	Develop	Y
6	Industrial Power distribution and Illumination	Y	Y	Y	N	Y	N	Core	6	Available	N
6	Hydropower	Y	Y	N	N	Y	N	Core	5	Develop	N
									30		
7	Project Engineering	Y	Y	N	N	N	N	Core	4	Available	N
7	Organization and Management	Y	Y	N	N	N	N	Core	4	Available	N
7	Technology Environment and Society	Y	Y	N	N	N	N	Core	2	Available	N
7	Power Electronics	Y	Y	N	N	Y	N	Core	5	Develop	Y
7	Utilization of Electrical Energy	Y	Y	N	N	Y	N	Core	5	Available	N
7	Power Plant Equipment	Y	Y	N	N	Y	N	Core	5	Available	N
7	Project I	N	N	Y	N	N	N	Core	2	Available	N
7	Electrical Energy System Management	Y	Y	N	N	Y	N	Elective (I)	5	Available	N
7	Reliability Engineering	Y	Y	N	N	Y	N	Elective (I)	5	Available	N
7	Rural Electrification	Y	Y	Y	N	Y	N	Elective (I)	5	Available	N
									32		
8	Engineering Professional Practice	Y	Y	N	N	N	N	Core	2	Available	N
8	High Voltage Engineering	Y	Y	N	N	N	N	Core	4	Develop	Y
8	Power Plant Design	Y	Y	Y	N	Y	N	Core	6	Available	N
8	Transmission and Distribution Design	Y	Y	Y	N	Y	N	Core	6	Available	N
8	Project II	N	N	Y	N	N	N	Core	4	Available	N
8	Advance Power System Analysis	Y	Y	N	N	Y	N	Elective (II)	5	Available	N
8	Biomedical Instrumentation	Y	Y	N	N	Y	N	Elective (II)	5	Available	N
8	Applied Photovoltaic Engineering	Y	Y	N	N	Y	N	Elective (II)	5	Available	N
8	Micro Hydro	Y	Y	N	N	Y	N	Elective (III)	5	Available	N
8	Artificial Neural Network	Y	Y	N	N	Y	N	Elective (III)	5	Available	N
8	Wind Energy Conversion System	Y	Y	N	N	Y	N	Elective (III)	5	Available	N
									32		

The master's degree program in Electrical Engineering at KEC has been designed for two years and four semesters. There are 23 subjects selected for this course resulting in a total of 60 credits. Approximately 50% of all credits are linked to core (obligatory) subjects and more than 25% of credits are to be collected by students with elective subjects starting from the second semester (the missing 25% of the 60 credits are allocated to the final project).

For this new master course, all subjects have to be developed from scratch and KEC requested assistance from eACCESS partners regarding four core power engineering subjects: High Voltage Generation and Measurement, Computer-Aided Power System Analysis, Insulation System Design Diagnostic and Testing, Power System Planning and Reliability. These subjects represent approximately 27% of the total credits for the designed master course in Electrical Engineering.

The summary table for KEC master Electrical Engineering study program is presented in the table below.

Table 127

Semester	Subject Name	Lecture	Tutorial	Project	Seminars	Laboratory Practice	Industrial Placement	Core/Elective	Credits	Status	eACCESS Support
1	High Voltage Generation and Measurement	Y	Y	N	N	Y	N	Core	4	Develop	Y
1	Optimization Technique	Y	Y	N	N	N	N	Core	4	Develop	N
1	Computer Aided Power System Analysis	Y	Y	N	N	N	N	Core	4	Develop	Y
1	Electromagnetic Field Computation and Modelling	Y	Y	N	N	Y	N	Core	4	Develop	N
									16		
2	Insulation System Design Diagnostic and Testing	Y	Y	N	N	Y	N	Core	4	Develop	Y
2	Extra HVAC Transmission	Y	Y	N	N	N	N	Core	4	Develop	N
2	HVDC Power Transmission	Y	Y	N	N	N	N	Elective I	4	Develop	N
2	Flexible AC Transmission System	Y	Y	N	N	N	N	Elective I	4	Develop	N
									12		
3	Project	N	N	Y	N	N	N	Core	4	Develop	N
3	Power System Planning and Reliability	Y	Y	N	N	N	N	Elective II	4	Develop	Y
3	Power Systems Dynamic and Stability	Y	Y	N	N	N	N	Elective II	4	Develop	N
3	Power System Operation and Control	Y	Y	N	N	N	N	Elective II	4	Develop	N
3	Power Electronics and Electric Drives	Y	Y	N	N	N	N	Elective III	4	Develop	N
3	Artificial Intelligence	Y	Y	N	N	N	N	Elective III	4	Develop	N
3	Design of Substations	Y	Y	N	N	N	N	Elective IV	4	Develop	N
3	Micro Grids	Y	Y	N	N	N	N	Elective IV	4	Develop	N
3	Industrial Automation	Y	Y	N	N	N	N	Elective IV	4	Develop	N
									16		
4	Thesis								16		
									16		

The preliminary viability study concerning availability and customization of academic resources (teaching staff), technical infrastructures and other teaching facilitates, conducted both for bachelor level and master level, do not show likely risk for the modernization, implementation and validation process in the next stages of the eACCESS project. However, in the case of the master course, there is evident risk linked to the approval process. The conditionally accepted solution involving foreign university outside EU might be a fast track to reach the objectives and meet the CBHE program requirements, but the role of the third party (Polotsk University, Belarus) need to be further formalized with official agreements (e.g. MoU), which will define the responsibilities, expectations of all involved parties, will precise the timeline and will precisely outline requirements of the authorization process. This aspect needs to be closely monitored by the relevant task leaders and the management board of the eACCESS project in the future.
Another problematic issue in the case of KEC new bachelor and master level courses is the economic feasibility which is directly linked to the number of recruited students for these new courses. The KEC is a private education school fully dependent on the income generated from tuition fees. The partners have presented viable calculations assuming 40 students for bachelor's degree and 27 students for master's degree and taking into consideration additional expenses linked to new necessary teaching staff appointment. However, the number of students for both levels seems to be high factor risk, at least for new courses offered on already busy education market of commercial schools in Nepal. Therefore, it is important to start the advertisement of new courses in advance and relevant task leaders of the work package WP2 and WP3 should consider this aspect in the planning of the second stage of the eACCESS Pillar One implementation.

For PU partner both bachelor and master existing courses have been analysed and upgraded recommendations have been worked out.

For the undergraduate level the eACCESS support in the modernization process of the following courses has been requested by PU:

Table 128

Semester	Subject Name	Lecture	Tutorial	Project	Seminars	Laboratory Practice	Industrial Placement	Core/Elective	Credits	Status	eACCESS Support
7	Industrial Automation	Y	Y	N	N	Y		Elective	3	Develop	Y
									17		
8	High Voltage Engineering	Y	Y	N	N	Y		Core	3	Modernize	Y
8	Renewable Energy and Grid Integration	Y	Y	N	N	Y		Core	3	Develop	Y
8	Simulation and Modelling	Y	Y	N	N	Y		Elective	3	Develop	Y
									18		

The selected course units represent approximately 9% of total credits to be collected by students for the bachelor's degree (137 in total).

In the case of master level course, the following specialisation subjects dealing with the power engineering domain have been submitted by PU partner for the integrated modernization within the eACCESS project:

Table 129

Semester	Subject Name	Lecture	Tutorial	Project	Seminars	Laboratory Practice	Industrial Placement	Core/Elective	Credits	Status	eACCESS Support
2	Advanced High Voltage Engineering	Y	Y	N	N	Y	N	Core	4	Modernize	Y
2	Electromagnetic Field Computation and Modelling	Y	N	Y	N	N	N	Elective	3	Develop	Y
									15		
3	Electrical Transients in Power System	Y	N	Y	N	N	N	Elective	3	Develop	Y
3	Soft Computing Techniques	Y	N	Y	N	N	N	Elective	3	Develop	Y
3	Smart Grid	Y	N	Y	N	N	N	Elective	3	Develop	Y
3	Energy Management and SCADA	Y	Y	N	N	N	N	Elective	3	Develop	Y
									14		

The selected course units represent approximately 32% of total credits to be collected by students for the master's degree (60 in total).

PU is an independent state higher education institution with a steady number of recruited students for Electrical Engineering courses both at the master and undergraduate level. Both courses are up and running every year, teaching facilities and academic staff are already secured. It minimizes the financial and managerial risk for the realization of the curriculum upgrade for PU partner, both at the undergraduate and master level.

RUB partner is currently offering only a bachelor level course in Electrical Engineering. The university selected six specialization course units, already included in the curriculum, for the further review and modernization in the framework of the eACCESS project:

Table 130

Semester	Subject Name	Lecture	Tutorial	Project	Seminars	Laboratory Practice	Industrial Placement	Core/Elective	Credits	Status	eACCESS Support
5	Power Generation	Y	Y	N	N	N	N	Core	12	Modernize	Y
									60		
6	Power Transmission and Distribution	Y	Y	N	N	N	N	Core	12	Modernize	Y
									60		
7	Power System Analysis	Y	Y	N	N	Y	N	Core	12	Modernize	Y

7	Switchgear and Protection	Y	Y	N	N	Y	N	Core	12	Modernize	Y
									60		
8	Advanced Power System Protection	Y	Y	N	N	N	N	Elective	12	Modernize	Y
8	High Voltage Engineering	Y	Y	N	N	N	N	Core	12	Modernize	Y
									72		

The selected subjects cover more than 15% of the total local credits for the undergraduate degree (504 credits in total)

Like in the previous case, RUB is the state-supported university with regular recruitment of more than 40 students at the Electrical Engineering faculty (College of Science and Technology, Phuentsholing). The college is well prepared for teaching the selected subjects, but some improvements in the laboratory infrastructure are necessary, particularly regarding power system protection devices and high voltage laboratory. The project will support the first one with the modernization of the equipment of this laboratory and the development of a new teaching program. At the moment there are no apparent risks for the implementation and validation of the curriculum modernization in the context of modern power engineering teaching for RUB partner. All the modifications in the curriculum are considered minor changes (no alternation to the list of subjects in the study program and they no need external authorisation.

ATM is a small private university, with the budget fully based on the income collected from tuition fees. ATM partner university is offering only a bachelor's degree in Electrical Engineering. After the review of the current study program conducted in the deliverable D1.1, it has been discovered that ATM curriculum is rather short in typical power engineering subjects. More to that, the number of students choosing these elective course units is small. The reason for the limited interest from students in power engineering subjects is the competition from large state universities located in Jakarta area, where graduates are more likely to get a job in state own power sector in Indonesia. For these reasons, ATM is currently more oriented in their teaching activities on industrial control and telecommunication. However, since these two areas are somehow linked with the technologies, technical solution and maintenance methods adopted in the power sector, it was possible to identify subjects of common interest which will be addressed in the eACCESS project. These are subjects concerning application of ICT technologies to the power sector, application of power electronics and genera, basic subjects dealing with electricity generation and distribution including renewable energy systems. The list of the pre-selected subjects is included below.

Table 131

Semester	Subject Name	Lecture	Tutorial	Project	Seminars	Laboratory Practice	Industrial	Core/Elective	Credits	Status	eACCESS Support
5	Introduction to Electric Power Distribution	Y	N	Y	N	N	N	Core	3	Develop	Y
5	Programmable Logic Controller	Y	N	Y	N	Y	N	Core	3	Modernize	Y
									20		
6	SCADA	Y	N	N	N	N	N	Core	3	Modernize	Y

6	Power Electronics	Y	N	N	N	Y	N	Elective	3	Modernize	Y
									20		
7	Management of Electric Power Distribution	Y	N	Y	Y	N	N	Elective	3	Develop	Y
7	Renewable Energy	Y	N	N	N	N	N	Elective	3	Modernize	Y
									20		

The selected subjects result in approximately 13% of the total credits that are to be collected for the bachelor's degree (144 credits all together).
Like in the case of other commercial university partners, the main source of risk is linked to the number of students which will select the elective subjects included in the eACCESS modernization process. At the moment there are 29 and 44 students attending the second and the fourth semester respectively. Thus, it is expected that approximately 20 students will reach in 2 and 3 years of study, semesters 5-8, where the selected subjects are scheduled. The list of eACCESS subjects includes also some new subjects, but the new program has been already internally approved by the university and external authorisation is not necessary.

The second Indonesian university, SCU partner is also a private higher education institution and very much shares the same risk and opportunities like ATM. However, it is more oriented on electrical power teaching and sees more interest from students in core subjects of this area. The list of the selected subjects is presented below.

Table 132

Semester	Subject Name	Lecture	Tutorial	Project	Seminars	Laboratory Practice	Industrial	Core/Elective	Credits	Status	eACCESS Support
2	Electric Energy Conversion	Y	Y	Y	N	N	N	Core	4	Modernize	Yes
									20		
3	Electric Energy Conversion	N	N	N	N	Y	N	Core	1	Modernize	Yes
									21		
6	Hydro and Wind Energy	Y	Y	Y	N	N	N	Elective	4	Modernize	Yes
6	Electric Power System	Y	Y	Y	N	N	N	Elective	4	Modernize	Yes
6	Electric Power Supply	Y	Y	Y	N	N	N	Elective	4	Modernize	Yes
6	Renewable Energy I	N	N	N	N	Y	N	Elective	1	Modernize	Yes
									17		
7	Electric Power Supply	N	N	N	N	Y	N	Elective	1	Modernize	Yes
7	Applied Photovoltaic	Y	Y	Y	N	N	N	Elective	4	Modernize	Yes
7	Renewable Energy II	N	N	N	N	Y	N	Elective	1	Modernize	Yes
									15		

The subjects recommended for modernization constitute almost 17% of the total credits (144) that need to be collected to graduate.
Likewise, in the case of ATM, the subject content upgrade is considered a minor modification to the curriculum and it will not require external authorisation. The current program and new subjects have been already introduced a couple of years ago to the curriculum (2018) and the eACCESS support will be used to develop the contents before the teaching activities start at semesters 5-7.
In the preliminary feasibility study, SCU presented a credible assessment of the financial viability of the implementation and validation of the eACCESS modernized course units. It is based on a typical number of students choosing Electrical Engineering courses (30) of which minimum 20-25 students should reach late semesters where the targeted course units are scheduled in the study program. In in the light of the presented analysis, the risk concerning the validation of the modernized course units should be considered low.
As regarding human resources (teaching staff) and teaching facilities, SCU partner declared that the university is ready to implement the changes and new teaching program, but some minor additional appointment of new teacher will be necessary (the related expenses linked to the new position will be borne by the university (out of eACCESS budget).

After all requests for modernization or development of the curriculum received from partner universities have been collected, working together with TUL and AUTH the submitted subjects have been reviewed and clustered in knowledge domain groups.
The European partners assessed consistency within the clusters, expertise and resources available within the consortium, time framework of the project and came up with the final list of subjects which will be supported by eACCESS project. They are predominately core power engineering subjects, which largely determine the value of the graduate in the labour market.
An only very small number of subjects which are outside the electrical engineering area (mainly mechanical engineering or electronics) have been excluded from the final list.
The final selection of subject include in the eACCESS curriculum modernization and development process is presented below.

Table 133

Semester	Subject Name	Credits	Status	Partner	Level
COURSES INCLUDED IN eACCESS CURRICULUM MODERNIZATION AND DEVELOPMENT					
	1. RENEWABLE & DISTRIBUTED ENERGY SYSTEMS				
7	Renewable Energy	3	Modernize	ATM	BSc
6	Hydro and Wind Energy	4	Modernize	SCU	BSc
7	Applied Photovoltaic	4	Modernize	SCU	BSc
7	Renewable Energy II	1	Modernize	SCU	BSc
8	Renewable Energy and grid Integration	3	Develop	PU	BSc
6	Renewable Energy I	1	Modernize	SCU	BSc
	2. POWER SYSTEM PROTECTION				
6	Switchgear and Protection	5	Develop	KEC	BSc
7	Switchgear and Protection	12	Modernize	RUB	BE
8	Advanced Power System Protection	12	Modernize	RUB	BE

Semester	Subject Name	Credits	Status	Partner	Level
	3. POWER STATIONS				
5	Power Generation	12	Modernize	RUB	BE
	4. ENERGY TRANSMISSION & DISTRIBUTION				
6	Power Transmission and Distribution	12	Modernize	RUB	BE
6	Electric Power System	4	Modernize	SCU	BSc
7	Management of Electric Power Distribution	3	Develop	ATM	BSc
5	Introduction to Electric Power Distribution	3	Develop	ATM	BSc
	5. HIGH VOLTAGE ENGINEERING				
8	High Voltage Engineering	3	Modernize	PU	BSc
8	High Voltage Engineering	4	Develop	KEC	BSc
8	High Voltage Engineering	12	Modernize	RUB	BE
	6. POWER ELECTRONICS				
6	Power Electronics	3	Modernize	ATM	BSc
7	Power Electronics	5	Develop	KEC	BSc
6	Electric Power Supply	4	Modernize	SCU	BSc
7	Electric Power Supply	1	Modernize	SCU	BSc
	7. ELECTRIC POWER SYSTEM AUTOMATION				
6	SCADA	3	Modernize	ATM	BSc
5	Programmable Logic Controller	3	Modernize	ATM	BSc
7	Industrial Automation	3	Develop	PU	BSc
	8. ENGINEERING COMPUTING & ANALYSIS				
8	Simulation and Modelling	3	Develop	PU	BSc
7	Power System Analysis	12	Modernize	RUB	BE
4	Power System Analysis I	4	Develop	KEC	BSc
5	Power System Analysis II	4	Develop	KEC	BSc
	9. ELECTRIC POWER ENGINEERING				
3	Energy Management and SCADA	3	Develop	PU	MSc
	10. ADVANCED COMPUTER TOOLS FOR POWER SYSTEMS				
1	Computer Aided Power System Analysis	4	Develop	KEC	MSc
3	Soft Computing Techniques	3	Develop	PU	MSc
	11. ADVANCED ELECTRIC POWER SYSTEMS				
3	Power System Planning and Reliability	4	Develop	KEC	MSc
3	Smart Grids	3	Develop	PU	MSc
3	Electrical Transients in Power System	3	Develop	PU	MSc
	12. HIGH VOLTAGE ENGINEERING & ELECTROMAGNETIC COMPATIBILITY				
COURSES EXCLUDED from eACCESS CURRICULUM MODERNIZATION AND DEVELOPMENT					
1	Electric Drive	5	Modernize	SCU	BSc

Semester	Subject Name	Credits	Status	Partner	Level
2	Electric Drive	3	Modernize	ATM	BSc
3	Electric Machinery	4	Modernize	ATM	BSc
4	Special Machine and Controller	3	Develop	PU	BSc
5	Hydropower	5	Develop	KEC	BSc
6	Electric Drive	5	Modernize	SCU	BSc
7	Electric Drive	3	Modernize	ATM	BSc
8	Electric Machinery	4	Modernize	ATM	BSc
9	Special Machine and Controller	3	Develop	PU	BSc
6	Hydropower	5	Develop	KEC	BSc