INSTITUTE OF TECHNOLOGY OF CAMBODIA

CA Meeting

General and Pedagogical Documents 2022-2023

16 June 2022

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PART I: GENERAL DOCUMENT

1 Introduction

Since its establishment in 1964, the Institute of Technology of Cambodia (ITC) has received greater recognition for its successes and achievements in serving the country through human resources development, institutional capacity building and working intensely on the economic and infrastructure development of Cambodia. ITC, for more than four decades, has established a link between the French and English speaking networks in the region and in the world. With its numerous collaborators, administrators, students, faculty staffs and alumni, this institution offers a unique multilateral context for an exchange of views with ministries, local authorities, NGOs, the private sectors and partner institutions.

ITC has a mission to train students with high-quality education in the fields of engineering, sciences and technologies and to develop innovative technology transfer. Students are provided with a strong scientific base and technical know-how and skills which allow their integration and evolution in the labor market. Based on the decision of the annual board meeting, the future orientation of ITC is to expand the engineering education area and develop research platforms in order to sustain the development of the country. This requires strengthening the basic scientific knowledge, developing research programs in connection with the private sectors and national and international stakeholders, supporting communities, fostering economic development through entrepreneurship programs, and helping our graduate students integrating the global economy. Ultimately, it is important for ITC to keep its own identity of a multilingual institution maintaining and expanding a network with French and English speaking universities, to provide an education that motivates teaching staffs and students, stimulates creativities and inspires future ambitions, and to develop an internationally recognized research in adequacy with the needs of the society.

The vision of Institute has been set out based on the Rectangular Strategy Phase 4 of the Royal Government of the 6th legislative term of the National Assembly "**to improve work, equity and effectiveness, to form a basis towards achievement of Cambodia's Vision for 2050**".

2 Perspective and Strategies

2.1 Perspectives

To become a leading institution with efficiency and excellence offering the academic, research, science, technology, innovation and engineering in technology transfer to the community.

ITC has adopted the new Strategic Plan (2021-2030) based on the Rectangular Strategy (Phase IV) of the government together with the National Strategic Development Plan (2019-2023). This Strategic Plan will provide directions for effective implementation of the Action Plans and address the challenges in order to improve the engineering education quality in a competitive environment.

Two main objectives of ITC Strategic Plan (2021-2030) to be reached by 2030 are as follows:

1- To train 17200 students with high qualification towards the Cambodia Vision 2030
2- To implement 175 applied projects with technology transfer and start-up for harmonization and development towards the Cambodia Vision 2030

2.2 Strategy of ITC

ITC has developed 5 main strategies to meet the 10 year objectives as follows:

1- Establish and apply academic program responding to the market needs with national and international recognition
2- Develop human resources and modernize technology for good governance, management and financial affairs
3- Develop physical infrastructure and modernize the laboratories
4- Establish the investment projects and applied research projects targeting to start-up and technology transfer
5- Modernize the data information system for dissemination of activities and results to the communities

2.3 Result Framework

The Result Framework for 10 Years: 2021 to 2030-Institutional Level is presented in Table 1.

Table 1: Result Framework for 10 Years: 2021 to 2030-Institutional (Institute) Level

Indicators	-	Basis	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total
1. Number of students graduated from national program with minimum quality standard	Admitted postgraduate students	0	0	0	20	100	180	260	340	440	540	640	640
	Graduated postgraduate students	0	0	0	0	18	90	162	234	306	396	486	486
	Admitted engineers students	0	0	140	1180	3760	6600	8090	9690	11450	13270	15090	15090
	Graduated engineering students	0	0	0	0	126	1070	3497	6138	7524	9012	10649	10649
	Admitted technical students	0	0	150	800	1500	2200	2900	3600	4300	5000	5700	5700
	Graduated technical students	0	0	0	135	731	1395	2046	2697	3348	3999	4650	4650
2. Number of students graduated from international program	Admitted postgraduate students	0	0	0	30	80	130	220	310	400	490	580	580
	Graduated postgraduate students	0	0	0	0	27	76	124	209	295	380	466	466
	Admitted engineers students	0	0	0	25	75	230	460	690	1000	1360	1720	1720
	Graduated engineering students	0	0	0	0	0	23	70	213	435	656	950	950
3. Number of Research Studies in connection with development		62	83	93	103	108	114	121	129	137	145	153	153

4. Number of Research Studies on Technology Transfer		0	0	0	0	0	0	0	2	2	2	4	4
5. Number of Business Startup Projects		0	0	0	0	0	4	4	8	11	14	18	18
6. Number of international programs		0	0	0	1	2	7	9	9	14	15	15	15
7. Number of national programs with minimum quality standard		0	0	2	13	15	18	19	22	24	25	25	25
8. Number of students who have received middle income (at least five times of unskilled workers' salaries)		0	0	0	0	62	385	1089	1925	2487	3083	3753	3753
9. Number of Center of Excellence		0	0	0	0	1	1	2	2	3	3	4	4
10. Number of publication of international scientific articles		39	59	84	109	139	169	204	239	279	319	359	359

3 Perspectives and Action Plan for 2022-2023

3.1 Baseline and Projected Data

The number of students, PhD staff, lab for baseline 2021-2022 and projected 2022-2023 is given in Table 2.

Table 2: Number of students, PhD staff, lab for baseline 2021-2022 and projected 2022-2023

Faculty	Department/ Option	Baseline Academic year 2021-2022								
		No. Technician Student	No. Eng. Student	No. Master Student	No. PhD Student	No. Master staffs	No. PhD staffs	No. Support Staff	No. Lab (Teaching)	No. Lab (Research)
	Tronc Commun		2823			12	1	2	3	
Faculty of Civil Engineering	GCI	170	180			6	14	2	3	
	Arch		60			11	1	0	1	
	Transport		0			0	3	0		
Faculty of Electrical Engineering	GEE	64	386			12	5	6	4	4
	GTR		165			5	5	7	2	3
	GIM	32	323			20	8	4	10	4
	GIC		214			10	3	11	7	2
Faculty of Chemical & Food Engineering	Food	80	320			13	9	1	12	Use teaching lab
	Chemical		129			10	5	0	Use Food lab	Use teaching lab
Faculty of Hydrology and Water Resources Engineering	WRI		304			10	8	9	5	4
	WEE		155			6	7	9	5	4
Faculty of Geo-Resources and Geotechnical Engineering	GGG		157			10	11	2	6	1
Graduate School				122	55	1	9	1		
Total		**346**	**5216**	**122**	**55**	**126**	**89**	**54**	**58**	**22**

Faculty	Department/ Option	Planned Academic year 2022-2023								
		No. Technician Student	No. Eng. Student	No. Master Student	No. PhD Student	No. Master staffs	No. PhD staffs	No. Support Staff	No. Lab (Teaching)	No. Lab (Research)
	Tronc Commun		3000			13	1	2	3	
Faculty of Civil Engineering	GCI	170	180			6	16	2	2	
	Arch		80			11	1	0	1	
	Transport		30			2	3	0		
Faculty of Electrical Engineering	GEE	200	450			15	8	8	7	4
	GTR	60	200			6	5	7	3	3
	GIM	35	110			21	9	7	10	4
	GIC	0	240			10	4	11	7	2
Faculty of Chemical & Food Engineering	Food	100	320			14	10	1	13	0
	Chemical	0	150			11	5	0	2	0
Faculty of Hydrology and Water Resources Engineering	WRI	5	365			10	9	9		4
	WEE	5	172			7	8	9	6	4
Faculty of Geo-Resources and Geotechnical Engineering	GGG	0	180			11	13	3	6	2
Graduate School	GS	0	0	136	62	1	10	2	None	None
Total		**575**	**5477**	**136**	**62**	**138**	**102**	**61**	**60**	**23**

3.2 Improve Teaching Program

Currently, the number of PhD academic staff at ITC is 89 PhD. In spite of this significant number, it is still needed to accomplish the ITC Strategy (2021-2030) for promoting engineering education quality, research and innovation development at ITC. Three main activities will be taken into account:

- Improve the minimum standard quality for all engineering programs
- Establish International Programs
- Modernize and establish new laboratories through the implementation of Lab based education (LBE) project and higher education improvement project (HEIP)

Table 3: Action plan for achieving the minimum quality standard based on IQA system

Faculty/Department	Name of Program	Scoring (IQA Assessment 2021)		Completion Plan
		Quantitative (QN)	Qualitative (QL)	
Hydrology and Water Resources Engineering	Water and Environmental Engineering (WEE)	33	22	Jan 2022
Electrical and Energy Engineering - GEE	Electronics and Automation - EA	37	27	May 2022
Electrical and Energy Engineering - GEE	Electrical Energy	36	27	May 2022
Faculty of Geo-resources and Geotechnical Engineering	Geo-resources and Geotechnical Engineering	33	22	Jan 2023
Chemical and Food Engineering	Chemical Engineering	34	22	Jan 2023
	Food Engineering	34	22	Jan 2023
Civil Engineering	Civil Engineering	36	26	Jan 2022
	Architectural Engineering	31	27	Jan 2023
Information and Communication Engineering	Information and Communication Engineering	40	25	Jan 2023
Industrial and Mechanical Engineering	Industrial Engineering	33	24	Jan 2023
	Mechanical Engineering	33	26	Jan 2023
Telecommunication and Network (GTR)	Telecommunication and Network Engineering	35	29	Jan 2023

3.3 Curriculum Modification and Improvement

The modification and Improvement of curriculum from GGG and GIC is given in Table 4.

Table 4: Modification and Improvement of curriculum

Engineering program	Current situation		Proposed modification		Remarks
	Name of course	Duration	Name of course	Duration	
I3GGG	1. Ore Microscopy	16h (TP)	Remove this course	-	This course will be combined with the course No.2: Petrology and Mineralogy
	2. Petrology and Mineralogy	48h (Course +TP)	Petrology and Mineralogy	- Course: 16h - TP: 48h	This subject is mainly practical work. The number of is increased by combination of Ore Microscopy.
I4-GGG	1. Geophysics (Course)	48h	Geophysics (Course + Practical lab)	64h - Course: 32h - TP: 32h	There are many geophysical methods, Gravity, magnetic, seismic, electrical methods etc., thus students need to do practical work to improve their understanding. Currently, faculty has magnetic equipment and DUG Insight software for analysis and interpretation geophysical data. In late 2022, Faculty is going to have seismic, electrical resistivity, IP, NMR equipment and Petrel Software. Therefore, faculty needs to

					update this subject.
	2. Rock blasting techniques	16h	Rock blasting techniques	32h - Course: 16h TD: 16h	This course is needed for blasting design and calculation
	3. Basic geological mapping	32h	Basic geological mapping	32h - Course: 16h - TD: 16h	This course is needed the practical work for mapping
	4. Mineral exploration	48h	Mineral exploration	48h - Course: 32h - TD: 16h	Currently, faculty has enough lab facility for practical work
	5. Mineral characterization	32h	Remove this course	-	This course will be added to Mineral exploration

Engineering program	Current situation		Proposed modification		Remarks
	Name of course	Duration	Name of course	Duration	
I3GIC Semester 1	Algorithms and programming	80h	Algorithm and Programming	32h	Review (Complete in year 2)
	Combinational and sequential logics	32h	Combinational and sequential logics	48h	
	Computer architecture	16h	Computer architecture	0h	(Complete in year 2)
	Discrete mathematics	32h	Discrete mathematics	32h	
	Electronics	16h	Electronics	16h	
	Information systems analysis and design	32h	Information systems analysis and design	48h	
	Introduction to computer systems and networks	32h	Introduction to computer systems and networks	32h	
	Probability and statistics	48h	Probability and statistics	48h	
	English	32h	English	32h	
	French	64h	French	64h	
	Soft skills	0h	Soft skills	16h	New course

I3GIC Semester 2	Algorithms and programming	64h	Algorithms and programming	0h	(Complete in year 2)
	Automata theory	32h	Automata theory	32h	
	Combinational and sequential logics	32h	Combinational and sequential logics	0h	Include in semester 1
	Computer architecture	48h	Computer architecture	0h	(Complete in year 2)
	Database	48h	Database	48h	
	Theoretical computer science	32h	Theoretical computer science	32h	
	Informatique (MATLAB)	32h	Informatique (MATLAB)	32h	
	English	64h	English	64h	
	French	32h	French	32h	
	Web design	0h	Web design	48h	Move from year 4 – Internet Programming
	Object-Oriented Programming (OOP)	0h	Object-Oriented Programming (OOP)	64h	Move from year 4
	Introduction to programming environment	0h	Introduction to programming environment	16h	New course
	Research methodology	0h	Research methodology	32h	Move from year 5
I4GIC semester 1	Advanced computer architecture	32h	Advanced computer architecture	32h	
	Human computer interaction	32h	Human computer interaction	32h	
	Internet programming I	48h	Internet programming I	48h	
	Networks I	32h	Networks I	32h	
	Operating systems	48h	Operating systems	64h	
	Software engineering	64h	Software engineering	64h	
	Telecommunication	48h	Telecommunication	32h	
	English	32h	English	32h	
	French	32h	French	32h	
	Compilation	0h	Compilation	32h	Move from semester 2
I4GIC semester 2	Advanced database and database management systems	48h	Advanced database and database management systems	48h	
	Compilation	48h	Compilation	0h	Move to semester 1
	Distributed Systems	48h	Distributed Systems	48h	

	Internet programming II	48h	Internet programming II	48h	
	Networks II	32h	Networks II	32h	
	Operating systems	16h	Operating systems	0h	Move to semester 1
	Software engineering	48h	Software engineering	0h	Include in semester 1
	Systems and networks administration	48h	Systems and networks administration	48h	
	English	32h	English	32h	
	French	32h	French	32h	
	DevOps	0h	DevOps	48h	New course
	Network design	0h	Network design	16h	New course
	Introduction to mobile app development	0h	Introduction to mobile app development	32h	New course
	Year 4 Internship				2 credits
I5GIC semester 1	Artificial intelligence	32h	Artificial intelligence	32h	
	Image processing	48h	Image processing	48h	
	IT project management	32h	IT project management	32h	
	Modelling and simulation	32h	Modelling and simulation	0h	Remove
	Network security	48h	Network security	48h	
	Cloud computing	48h	Cloud Computing	48h	
	Natural Language Processing (NLP)	48h	Natural Language Processing	48h	
	Research methodology	32h	Research Methodology	0h	Move to year 3
	English	32h	English	32h	
	French	32h	French	32h	
	Data mining	0h	Data mining	16h	New course
	Information security	0h	Information security	32h	New course
I5GIC semester 2	Final year internship				9 credits
GRU Water Resources Engineering and Rural Infrastructure	Construction of Rural Roads	64hr	Road Engineering and Construction	64hr	At the recent year, may student have interested in road construction for their internship and job as this sector is growing job

					market covering all kind of road construction. Seeing this skill need at faculty under the program of Water Resources Engineering and Rural Infrastructure, we would like to improve our course syllabus to cover all type of road construction.
I4-Méca	Constructions mécaniques	40h	Introduction to Robotics	40h	
I4-Indu	Systèmes asservis	48h	Control Theory 1	48h	
I3GTR Semester 1	Data Structure and Algorithm	48h	Operating System	48h	The subject Data Structure and Algorithm (48 hours) which exists in the new curriculum of year 2 is replaced by Operating System (48 hours) from semester 2
I3GTR Semester 2	Computer Architecture	48h	Microcontroller and Sensors	48h	The subject Computer Architecture (48 hours) which exists in the new curriculum of year 2 is replaced by a new subject Microcontroller and Sensors (48 hours)
	Operating System		Object Oriented Programming	48h	the subject Operating System (48 hours) which is moved to semester 1 is replaced by Object-Oriented

					Programming (48 hours)
I4GTR semester 1	Object Oriented Programming	48h	Mobile Application	32h	The subject Object-Oriented Programming (48 hours) which is moved to year 3 semester 2 is replaced by Mobile Application (32 hours)
I4GTR semester 2	Mobile Application	32h	Introduction to Cloud Computing	48h	The subject Mobile Application (32 hours) which is moved to semester 1 is replaced by a new subject Introduction to Cloud Computing (48 hours)

3.4 Establishment of Pre-Degree Foundation Program by Applied Curriculum of Curtin University

3.4.1 Background

The needs of contemporary industry necessitate a lessening of the gap between skills taught through traditional education and those actually required for effective workplaces. In particular, the demand for skilled labor has been increasing over the past several years as Cambodia gradually moves from agriculture to industrial and manufacturing sectors. To meet these demands, tremendous effort and commitment is required to strengthen the education system, which has long suffered from a lack of resources. Enhancing STEM education is therefore essential to sustain economic growth and remain internationally competitive over the coming decades. Moreover, Cambodia's higher education vision 2030 and higher education roadmap 2017-2030 indicates the importance of STEM in the human resource development strategy. Institute of Technology Cambodia is eager to play a significant role to fulfill this demand.

Institute of Technology of Cambodia (ITC) is a public higher education institution and one of the leading engineering institutes in Cambodia that offers engineering education in five engineering faculties. Currently, ITC is in the process of upgrading and improving its teaching-learning system and research to meet both regional and international standards.

To achieve this vision, ITC is planning to launch an International Pre-degree Foundation Programs of Curtin in 1year at ITC and students could continue their undergraduate study for both Engineering and Science at any Curtin campus upon this foundation program completion.

3.4.2 Establishment of Pre-degree Foundation Program

The Pre-degree Foundation Program is kind of applied curriculum of Curtin University in 1year at ITC. This one-year international foundation studies includes two semester courses in Foundation Engineering and Science

The Foundation of Engineering and Science prepares students for undergraduate study in Engineering and Science and Information Technology. In addition to several units that are common to all foundation courses, students study units in Engineering Mathematics, Physics and Chemistry and Programming in C++. The courses are aimed at developing academic diligence, critical analysis, and a raft of generic skills in students. They provide a solid foundation for the students to adapt to university education more confidently, both in terms of level and style of education.

There are two (2) streams for the Foundation of Engineering and Science program:

- Engineering stream (+3years)
- Science stream (+4years)

Students who obtain satisfactory results are eligible for admission to a range of undergraduate courses offered in the Faculty of Engineering and Science at any Curtin campus (Malaysia, Perth-Australia, Singapore, etc)

Students with satisfactory results in the Foundation Studies – Engineering Stream can enter degree programs below:

- Bachelor of Engineering (Hons.) (Chemical, Civil and Construction, Electrical and Electronic, Environment, Mechanical, Petroleum)
- Bachelor of Applied Science (Construction Management)

Students with satisfactory results in the Foundation Studies – Science Stream can enter degree programs below:

- Bachelor of Technology (Computer Systems & Networking)
- Bachelor of Applied Science (Construction Management)
- Bachelor of Science (Hons.) (Applied Geology, Software Engineering, Cyber Security)

3.4.3 Program educational objectives (PEOs)

1 year of Pre-Degree Foundation studies include two semester courses in foundation Engineering and Science. The courses are aimed at developing academic diligence, critical analysis, and a raft of generic skills in students. A solid foundation is provided for the student to adapt to high level and style of education.

Students of the Pre-degree Foundation in Engineering and Science programme are able to:

- **Knowledge:** Apply knowledge of Mathematics, Science and Information Technology to solve engineering problems.
- **Problem Solving:** Identify, analyze and solve problem using principles of Mathematics, Sciences and Information Technology
- **Use of Technology:** Select and apply appropriate techniques and resources to various Sciences and Information Technology
- **Communication:** Communicate effectively through written work and oral tasks.

- Team work: Work effectively as a member or leader in a multi-disciplinary and diverse group.
- **Continuous learning:** Engage in continuous lea
- rning and acquire essential skills to pursue higher education.

3.4.4 Graduate Attribute

- **Apply discipline knowledge:** understand its theoretical underpinnings, and ways of thinking; extend the boundaries of knowledge through research.
- **Thinking Skills:** Apply logical and rational processes to analyze the components of an issue; think creatively to generate innovative solutions.
- **Information Skills:** Decide what information is needed and where it might be found using appropriate technologies; make valid judgements and synthesize information from a range of sources.
- **Communication skills:** Communicate in ways appropriate to the discipline, audience and purpose.
- **Technology skills –** Use appropriate technologies recognizing their advantages and limitations.
- **Learning how to learn –** Use a range of learning strategies; take responsibility for one's own learning and development; sustain intellectual curiosity; know how to continue to learn as a graduate.
- **International perspective –** Think globally and consider issues from a variety of perspectives; apply international standards and practices within a discipline or professional area.
- **Cultural understanding –** Respect individual human rights; recognize the importance of cultural diversity particularly the perspective of Indigenous Australians; value diversity of language.
- **Professional skills –** Work independently and in teams; demonstrate leadership, professional behavior and ethical practices.

3.4.5 Course Structure

The course structure of 1year Pre-degree Foundation in both Engineering and Science stream is showing in **Table 5** and **Table 6**. Student who successfully completed the Pre-degree Foundation Program in 1 year at ITC are eligible to pursue undergraduate study offered in any Curtin campus.

Table 5: Course Structure of Pre-degree Foundation in Engineering Stream

Engineering Stream			
Semester 1	**Credit**	**Semester 2**	**Credit**
Effective Communication Skills		Chemistry	
Engineering Mathematics I		Engineering Mathematics II	
Physics 1		Physics II	

Programming in C++		Writing and Research Skills	
Total		**Total**	

Table 6. Course Structure of Pre-degree Foundation in Science Stream

Science Stream			
Semester 1	**Credit**	**Semester 2**	**Credit**
Effective Communication Skills		Writing and Research Skills	
Engineering Mathematics I		Engineering Mathematics II	
Physics 1		Business Information Technology	
Programming in C++		Introduction to Business Studies	
Total		**Total**	

The detailed curriculum of pre-degree foundation program is attached in **Annex-A**.

The course description of pre-degree foundation program is shown in **Annex-B.**

The admission requirement of pre-degree foundation program is shown in **Annex-C.**

The human resources of ITC for pre-degree foundation program is listed in **Annex-D**.

The laboratories and facilities for pre-degree foundation program is detailed in **Annex-E.**

3.4.6 Supporting Project and Partnership Program

The pre-degree foundation program was established by technical assistant from both Curtin Perth, Australia and Curtin Malaysia under Higher Education Partnership Program of HEIP. The Establishment of Pre-degree Foundation Program in Eng. and Science will meet the Curtin's undergraduate entry requirement at any Curtin campus.

Curtin will assist in pre-degree foundation program as following:

- To provide all relevant materials for the Foundation courses to ITC including Course structures, course unit content, syllabus, curriculum map, assessment (structure, map and design) with training and coaching
- To build up the capacity of ITC staff on some courses specific for pre-degree foundation program at ITC:
  - Foundation class/teaching observations
  - Co-plan of units and give feedback
  - Develop teaching materials, possible amendments to syllabus, assessment, rubrics
  - Moderation meetings

- Internal quality assurance
- Student results and appeals

3.5 Capacity Building of Faculty Staffs

Capacity building of staff is one of the main priorities at ITC through sending faculty staffs to abroad for enhancing/sharing experiences in teaching, scientific research and soft skill development through university partnership, exchange program etc., and vice versa. The inbound and outbound of staff capacity building is detail in the Table 7 and 8.

Table 7: Inbound staff for capacity building 2021-2022

Name	Skill/Department	Partners	Financial support	Others
Dr. Eng Chandoeun	Geophysics	Total Energies Cambodia	Total Energies Cambodia	
Dr. Kret Kakda	Geophysics			
Ms. Heng Muoy Yi	Geophysics			
Ms. Pech Sopheap	Method of Teaching	Curtin University	HEIP	
Ms. Sio Sreymean	Method of Teaching	Curtin University	HEIP	
Dr. Boeut Sophea	Method of Teaching	Curtin University	HEIP	
Dr. Bun Kim Ngun	IQA	MoEYs		
Dr. Eng Chandoeun	IQA	MoEYs		
Dr. Yos Phanny	IQA	MoEYs		
Dr. Boeut Sophea	IQA	MoEYs		
Ms. Pech Sopheap	IQA	MoEYs		
Vai Vannak	Electrical Energy	INP-Grenoble	Erusmus	
Kim Bunthern	Electronics and Automation	INP-Grenoble	Erusmus	
CHOU Koksal	Electronics and Automation	INP-Grenoble	Erusmus	
Jérémy Olivier	Wastewater	École Nationale Supérieure en Génie des Technologies Industrielles (ENSGTI)_PAU	AFD	
Pierre Le Cloirec	Distribution system	École nationale supérieure de chimie de Rennes (ensc-rennes)	AFD	
Marc Descloitres	Hydrogeophysical survey	IRD	HGP Mekong	
Sunil Herat	Waste Management and Circular Economy	Griffith University	Griffith University	

Table 8: Outbound staff for capacity building 2021-2022

Name	Skill/Department	Partners	Financial support	Others
Ms. Heng Muoy Yi	Geophysics	University of Liege	Impulse Program	
Dr. Eng Chandoeun	Geophysics	University of Liege	HEIP Project	
Dr. Kret Kakda	Remote Sensing	Kyushu University	LBE-JICA	
Dr. Eng Chandoeun	X-Ray Fluorescence	Kyushu University	LBE-JICA	
Dr. TITH Dara	Information Security / GIC	University of Namur	ARES	
HEU Rina	Water supply	PAU	AFD	
BUN Saret	Wastewater	PAU	AFD	

KET Pinnara	Water Resources	CHULA	HIEP	
Chan Rathboren	Urbanization	Université de Liège	KA2	
ANN Vannak	Education/pedagogy	University of Girona - UdG	Erasmus+ InowAsia	
EANG Khy Eam	Education/pedagogy	University of Girona - UdG	Erasmus+ InowAsia	
CHHUON Kong	Education/pedagogy	University of Girona - UdG	Erasmus+ InowAsia	
Mr. Seng Sunhor	PhD candidate in Thermal system	Kanazawa University, Japan	MEXT	
Mr. Ban Sam	PhD candidate in Industrial and Supply Management	ENSEITH Toulouse, France	BGF	

3.6 Pedagogy

- Implement Fab-lab (through HEIP project)
- Implement Lab-based education (through JICA project)
- Increase hand-on practice in the lab and field
- Introduce e-learning classes (encourage staff to develop more E-Learning courses)
- Language reform for 2022-2023

3.7 Quality Assurance

- Strengthen the internal quality assurance system
- Enhance the capacity of internal quality assurance official
- Make internal assessment mechanism to monitor and evaluate educational quality
- Provide the students to assess qualification of teaching staff by evaluation sheet (twice a year)
- Concentrate on the information, data analysis concerning to learning, teaching and academic program in order to find out strengths and weakness and to raise recommendation to make reform
- Make internal self-assessment report
- Provide the assessment in educational training application from external circle like from ACC as well as from Higher Educational Department General (MoEYS)
- Require regular staff meeting to discuss the challenges and find proper solution/improvement
- Require regular meeting to raise and solve problems in teaching and learning
- All lecturers are advised to check the performance of students regularly by having quizzes, assessments, presentations, mid-term exam and final exam.
- Join training with ACC, DGHE and HEIs relevant to develop IQA
- Join every meeting and activities related to IQA at ITC
- Improve assessment tool and assessment mechanism for good IQA

- Make action plan to develop IQA guideline including action to strengthen and develop capacity of ITC staff
- Manage Seminar/Workshop related to QA, Learning and Teaching.

3.8 Towards the Establishment of International Program in Civil Engineering

3.8.1 Goal

Civil engineering is going to be transformed itself as international programs whose curriculum is taught in English by national and international teachers, students need to do at least one semester exchange in another partner university.

3.8.2 Curriculum and infrastructure

A-Curriculum and requirements

The civil engineering department is practicing the curriculum that have been improved from time to time and applied since 1993 when the ITC obtained cooperation with French speaking universities as partners. The review regular by CA and Consortium has rendered the curriculum of Civil engineering strong in producing capable engineers to fit the current and future markets of Cambodia. Recent years, ITC projected missions for long term development in order to raise the quality of higher education and prosperity of people lives. The curriculum reform is one of the most important key tasks for achieving the cited purposes. The suggestions to be done are as follow:

i. The curriculum shall be revised and updated in English format to be easily accessed and understood by our partners
ii. 10% of courses should be taught by foreign teachers who are recruited in different fields of expertise.
iii. Student and teacher services are fast and improved with dates well defined and administered.
iv. each student shall experience at least one semester in partner university for courses or for final works.
v. The degree is the engineer degree.

B-Human Resources

In the faculty, we have 47 teachers specialized in different fileds. PhD holders are 18, Master holders are 22 and the remaining teacher and staff are holding bachelor of engineer degree. We have been informed by the survey about international program, **20 teachers** are willing to teach in English and comply with the requirements of international program. This number of teachers may be increased if we recruit more new capable teachers.

Table 9: List of human resources

	Bachelor	Master	Ph.D	Subtotal	
GCI	2	6	14	22	
GAR	3	11	1	15	
GTI	0	0	3	3	
Lab	0	5	0	5	
Sec	2	0	0	2	
Total	**7**	**22**	**18**	**47**	

C-Classes and laboratories

In total, civil engineering faculty has 3 labs for civil engineering, one workshop for architectural engineering and one small lab for transportation engineering. We have classes and labs well designed for teaching engineers for a batch of maximum 60 students. The increase target in future will require faculty to have number of labs double increased.

D-MOU with partner universities

MOU with partner universities for receiving and sending students for the purpose of international exchange should be very important and we plan to have at least 8 universities before the start of international programs as we expect to exchange with one university 4 students. We have now MOU with

①.INSA de Rennes
②.INSA de Toulouse
③.SIIT
④.KMUTT

E-Supporting offices

For the good functioning of international program, works and tasks will be increased. The immigration, accommodation, insurance, health care are all important that a host university need to assure and manage for exchange students. I found that we should at least have few offices suggested as below:

①.Foreign student office (accommodation, insurance, health care, student manual, campus map,….)
②.Exchange office (communication for find places in exchanging, trip planning,…for students and teachers,….)
③.Teaching office (national and international teacher affairs, schedule, contracts, exchange,…)

The above offices and tasks should be created and managed effectively to educate engineers in an international way.

3.8.3 Progress

Internation program planning

Civil Engineering

No	Description	Progress	Time in month																															
			year 2022											Year 2023												2024										
			2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
1	National Teachers	20																																		
2	Curriculum in English																																			
3	Partner universities (MOU)	40%																																		
4	Pilot courses	on way																																		
5	Course syllabus in English																																			
6	Pilot exchange																																			
7	Foreign Students manual	on way																																		
8	supporting office and staff																																			
9	Program advertisment																																			
10	Progrm launch																																			

3.8.4 Call for support and international co-operation

We really need support and cooperation from partner universities in providing technical advice and places for student exchange. The Campus of ITC is also open to receive your students for an exchange to provide them knowledges of technical skill and particular the diversity of culture exchange in Cambodia.

3.9 Toward the establishment of Cambodian Coastal Research Center

Recently, the coastal area of Cambodia has received rapid urban development due partly to the overall sustaining economic growth of the country. Government of Cambodia is developing and transforming Sihanoukville Province into a multi-purpose Special Economic Zone. The environmental concern on the coastal areas which researching and monitoring environmental condition to secure the sustainable development such as support the need of water sources for supplying in province. This requires more in deep understanding of environmental process and response under new level of development stage, and then looks for innovative strategies to cope with the expected challenges. Moreover, the water resource and climate change impact studies in the coastal areas of Cambodia are very limited because of the challenge in data availability, while there are a lot of studies and reports for the catchments located inside the Mekong basin because of the data availability from national and international sources. Cambodian coastal area has strong demand for flood disaster prediction, water resource monitoring and management due to the rapid industrialization and urbanization process. Thus, we need very urgent the scientific-based research to improve knowledge on coastal environmental status and process, which require routine environmental observation and monitoring.

In this regard, Ministry of Environment (MoE) has strong interest on coastal environment where there is National Committee on Management and Development of Cambodian Coastal Areas to work on coastal zone conservation and management. Looking at the same interest, Institute of Technology of Cambodia (ITC) which is the leading engineering school and scientific research institute has carried out many scientific and technological research project cooperation in Cambodia and absorbs more and more talent researchers to work for. In order to enhance our scientific research which, contribute directly to science-based action on

sustainable and climate-resilient development in the coastal area, we need the co-creation of a Cambodian Coastal Research Center (CCRC) in the Cambodian coastal zone for facilitating the coastal scientific research commitment. The co-creation will be depended on the interest of MoE to have sustainable impact to our coastal development including offshore and onshore environmental safeguarding. The vision of CCRC is to become the national center of excellence to directly assist the government in solving the environmental issue and possesses the knowledge and expertise dedicated to scientific research collaboration on coastal management. The purposes of creating CCRC are to enhance national scientific research collaboration between national institutions and international collaboration to find the solution on regional and global environmental issues focusing on coastline area. This research center also arms to be the training hub for governmental staffs, national and international researchers, and other relevant stakeholders on environmental monitoring and management to respond the future need of human resources in this field.

The CCRC will work on the following research fields: Coastal processes monitoring and modelling; Flood and Drought Forecasting for River Basins in the Coastal Area; Surface Water and Groundwater Aquifers; Coastal and Marin Biodiversity; Coastal erosion, Climate change impact and Adaptation; sea level raise; sea surface current; Infrastructure and technology. To cover all these scientific research field, CCRC will need to have land area and building which consist of laboratories room, demonstration room, and conference room.

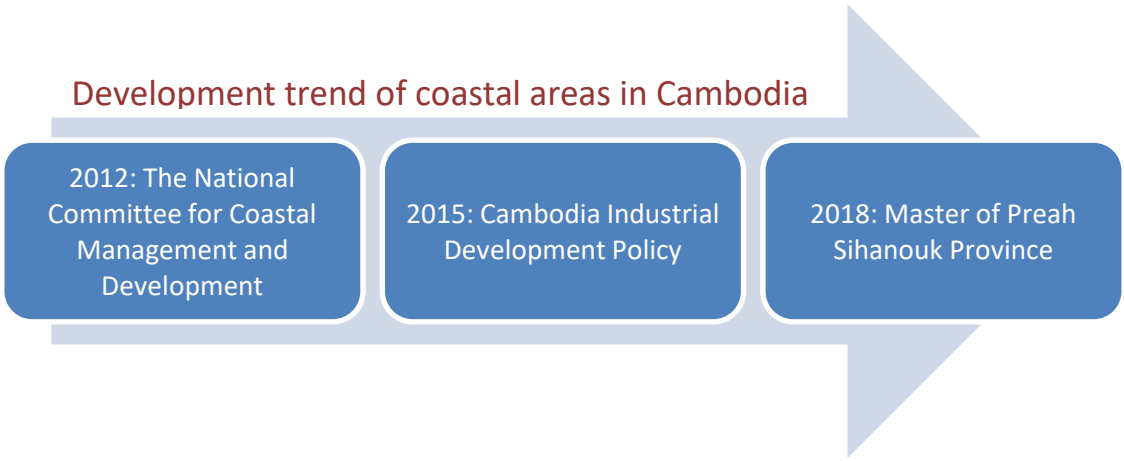


Figure 1 Development trend of coastal areas in Cambodia

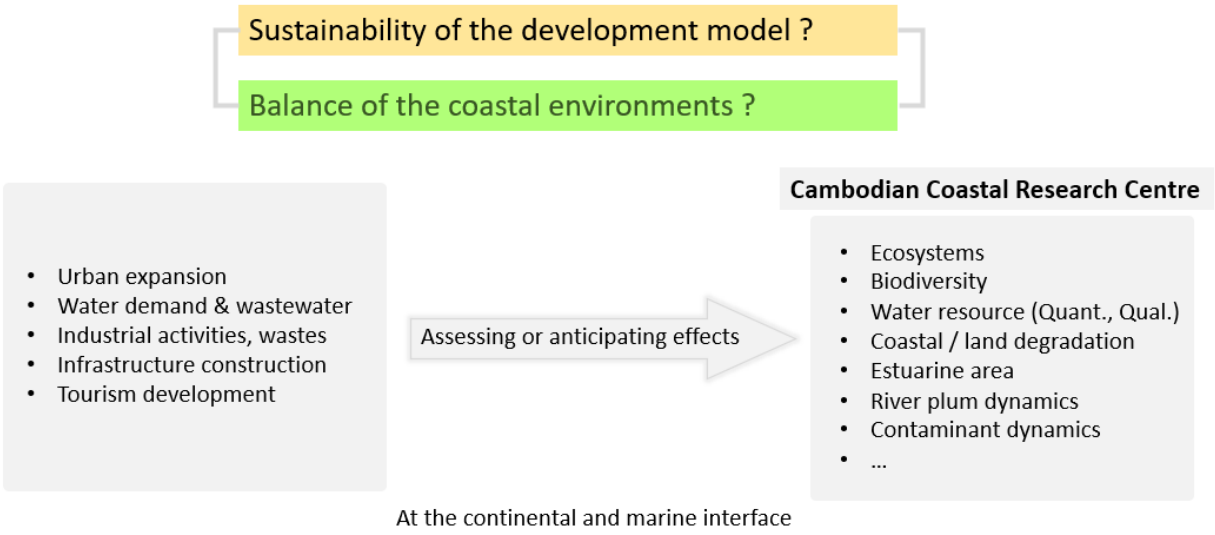


Figure 2: The need of Cambodian Coastal Research Center

Objective of Cambodia Coastal Research Center

- Coordination and collaboration
- Harmonize and link actions of the different organisms
- Linkage with the coastal communities
- Collaboration with other institutions locally and internationally (approaches, transpositions, links)
- Continuity
- Partnership with the government, regulation and decisions
- Getting visibility and funding
- Long term planning
- Formation
- Identify students and researchers, build up exchanges
- Key for building collaboration and develop expertise and continuity

Potential collaborations

National

- MLMUPC, MoE, MAFF, MoT, MOWRAM, RUA, ITC, MCC …

International

- USTH, UPD, CHU, GGGI, IRD …

3.10 Towards the Establishment of Center of Research and Technology Transfer (CRTT)

This proposal is to improve training skills for innovation and research for start-up and technology transfer. The main outcome of this project proposal is to providing high proficient graduates and skills for innovation in respond to the need of Cambodia's market.

Four outputs are expected to drive the project outcome, i.e.,

- Center of Research and Technology Transfer is built at ITC campus
- R&D lab, incubation space, training and co-working space for student entrepreneurs, school of factory are established and equipped
- Ecosystem for education to entrepreneurs is developed and implemented
- Business start-up is developed

Two components under this proposal: (1) Component 1: Improving skills for innovation of ITC's graduates; (2) Component 2: Improving research for promoting start up and technology transfer.

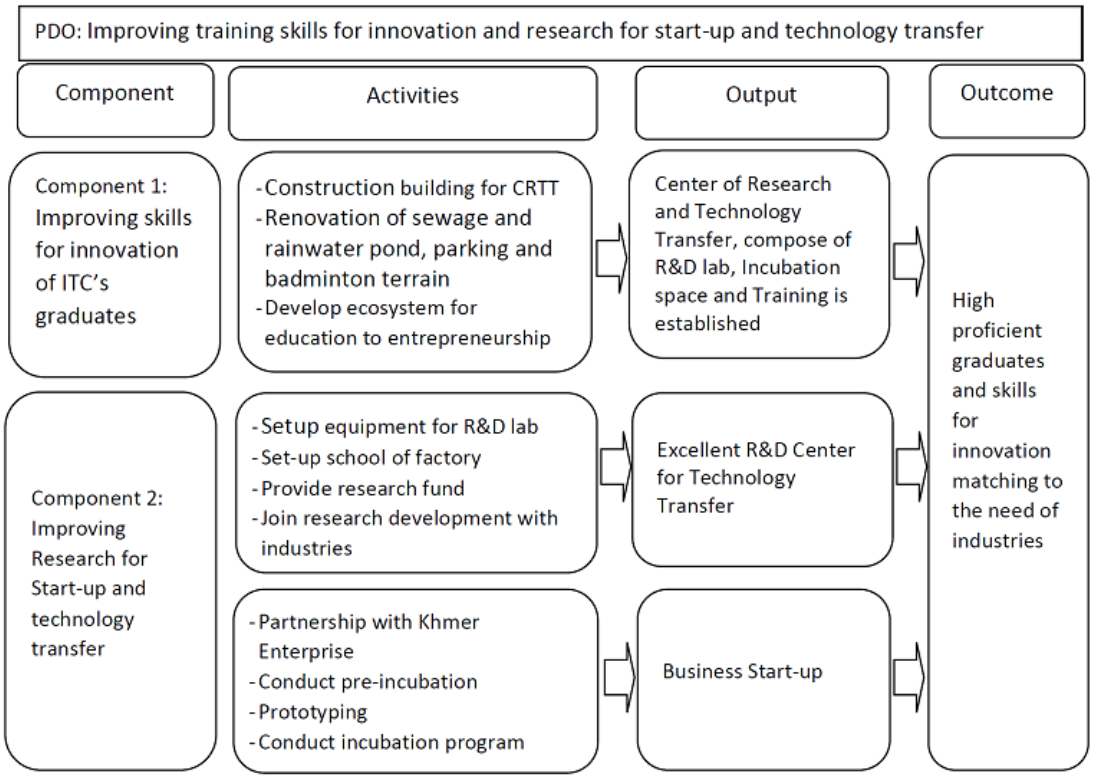


Figure 3: Framework of Center of Research and Technology Transfer (CRTT)

3.11 Project Implementation and submission

3.11.1 Establishment of Risk Management Platform for Air Pollution in Cambodia

Cambodia is a developing county which has the economic growth 7% of GDP for the last few years. Meantime, the transportation, factory, resident, and tourist are significantly increased in South-East Asia. Social infrastructure is often inadequate in these countries, environmental pollution being severe and hygiene being poor. Environmental stress, such as an increased number of traffic is evident, exceeding the allowable limit of the infrastructure, and deteriorating environmental pollution and causing sanitation problems.

Various social infrastructures as an excellent water supply system has been constructed in Cambodia. Because of the rapid growth of the urban areas as the capital city of Phnom Penh, have increase of environmental issues as noise, waste and air pollution. Air pollution is one of the global and local issue because all the urban, industrial and agricultural area have air

pollutions from various sources as traffic, construction, fuel combustion and agriculture residue burning and forest fire. Because the pollutant spreads crossing borders, it is also a global issue. The airborne infection issues as COVID-19 also suggesting the importance of indoor air quality management. However, this actual situation is not being investigated at this moment.

The proposal has been accepted on May 20, 2021 with the budget of 4.5 MUSD. The implementation period is expected to be 1 July 2022 – 31 June 2027.

Overall goal: To contribute to the creation and establishment of safe and comfortable living environment for residents and tourists from the viewpoint of air pollution, which leads to sustainable economic growth of Cambodia.

- To establish the structure/system to evaluate the present status and characteristics of air pollution in Cambodia
- To build the online network of monitoring sites with data management system
- To establish the structure/system to evaluate environmental risks
- To develop human resource, which is necessary for operation of the risk management platform for air pollution

Research Partners:

Japanese counterparts:

- Kanazawa University
- Nagasaki University
- Osaka Ohtani University
- Partical Plus Co., Ltd.

Cambodian counterparts:

- Institute of Technology of Cambodia
- University of Health and Science
- National University of Management
- Ministry of Environment
- Ministry of Education Youth and sport

Activity to implement:

The 4 working groups are:

- Group 1: Overall management
- Group 2: Data sampling and monitoring setting up
- Group 3: Environmental risk assessment
- Group 4: social implementation

Activities work plan for five years

1. The structure/system to evaluate the present status and characteristics of air pollution in Cambodia

- Understand status and characteristics of air pollution in Cambodia.
- Understand transboundary influences of air pollution.

- List emission sources up and prepare emission inventory.
- Visualize emission sources.
- Develop a low-cost and less-maintenance PM monitoring technology that can provide advanced information

2. Online network of monitoring sites with data management system

- Fundamental information for building the online network is surveyed and summarized.
- Preliminary test of the online monitoring network is conducted.
- The online monitoring network is built and started.
- Manage the monitoring and related environmental data.

3. The structure/system to evaluate environmental risks

- Extract macroscopic potential health risk factors
- Extract microscopic potential health risk factors.
- Examine scenarios for the mitigation of potential health risk.
- Prepare a risk data base for air pollution

4. Human resource, which is necessary for operation of the risk management platform for air pollution

- Determine the management policy of platform and roles of each participating organization.
- Propose action plans of the risk management platform of air pollution.
- Propose measures to mitigate potential health risks caused by air pollutants.
- Conduct advanced researches under the international collaboration and expand the human network between researchers over the world.

For 2022-2023, there are 80 projects which are accepted and ongoing implemented through funding from HEIP World Bank, LBE-JICA, AFD/EU, IRD, CCCA3, Erasmus+KA2, USAID, JASTIP and SATREPS/Japan. The projects to be implemented in 2022-2023 are presented in Table 10 and the projects that were proposed are indicated in Table 11.

3.11.2 Projects to be implemented in 2022-2023

The ETM, FTN, MIT, MSS and WAE research unit has 10, 19, 14, 17 and 19 projects, respectively. In addition, MTE has one LBE project. Therefore, there are in total 80 projects to be implemented in 2022-2023.

Table 10: Projects to be implemented in 2022-2023

No	Title of Project	Objectives of the project	Speciality (WAE, MSS, etc…..)	Partner	Funding agency (Erasmus KA1, Erasmus KA1, AUN-SEED/Net,	Funding Amount (USD)

					AUF, AFD, ADB, WB etc.,)	
1	Applied Geophysics for Investigating Hydrocarbon Potential and Depositional Environment of Sediments at Onshore Prospect of Tonle Sap Lake, Cambodia	1. To Investigate subsurface geological structures and stratigraphy 2. To characterize the petroleum system including source, reservoir, migration pathway and seal. 3. To characterize the shallow hydrocarbon reservoir and its related geological condition. 4. To evaluate the quality of source rocks 5. To Study sedimentology and depositional environment of the sediments 6. To correlate the depositional environment from sedimentary facies and geochemical analysis	ETM	EnerCam Co., Ltd	HEIP	800,000
2	Geological and geophysical studies of hydrocarbon potential in Tonle Sap Basin, Onshore Cambodia	To investigate the characteristics of reservoir outcrop, onshore, Cambodia	ETM	N/A	LBE/JICA	29,971
3	Design and Installation of Off-Grid PV System for Clean Water and Electricity Supply in Ta Mat Primary School, Cambodia	1. To design and simulate off-grid PV systems 2. To install the selected off-grid PV system in a rural village 3. To analyze the quality of life based on the PV system utilization.	ETM	N/A	JASTIP	1,300

4	Development of a Virtual Cambodian Power System-Towards an Innovation Micro-Grid in Cambodia	1. To develop algorithms for planning tool of MV distribution grid architectures 2. To develop algorithms for planning tools of LV distribution topologies and hybrid micro-grid system architectures 3. To set up an educational virtual power distribution grid laboratory	ETM	ORBIT P.A Co., Ltd, Electricité du Cambodge (EDC)	HEIP	390,800
5	Integration of Landsat-8, ASTER, and Sentinel-2 for mapping of mineral prospective, hydrothermal alteration and geological structures for porphyry copper and epithermal gold deposits in the north Cambodia.	To define surface hydrothermal alterations of ore deposits by applying band ratios analysis for ASTER and Landsat-8	ETM	1. IMECS (Cambodia), 2. Angkor Resource Corp., 3. Ministry of Mine and Energy, Cambodia, 4. Samnang Angkor Development Co Ltd	LBE/JICA	30,000
6	Investigation the production potential of the Cambodian offshore reservoir considering effects of phase behaviour and rock-fluid interaction	To attain the reservoir characteristics, include phase behavior and quality of crude oil, reservoir rock-fluids interaction for the production potentials of the Cambodian offshore reservoir	ETM	KrisEnergy Co., Ltd	HEIP	277,529
7	Planning and Operation of Active Distribution Systems	1. To improve the algorithms of optimal LV system, reconfiguration, and restoration 2. To develop algorithms for improving the	ETM	N/A	LBE/JICA	30,000

		unbalanced distribution systems 3. To develop algorithms for fault location and isolation 4. To develop a GUI and a prototype				
8	Pushing Energy Efficiency in Cambodia	1. The creation of a self-sustaining, multi-year building Energy Efficiency contest to help EE adaptation in Cambodia, 2. Development of awareness and capacity on climate change mitigation and adaptation amongst the youth and 3. A policy advocacy work.	ETM	Sevea, EnergyLab, IFPEB, ATS	CCCA3	186,912
9	Quality Assurance of Concrete Pile Integrity and Soil Properties Investigation using Seismic and Electrical Resistivity Tomography Approaches	integrate seismic and electrical resistivity methods to qualify concrete pile integrity Progress/ status	ETM	Matlab Co., Ltd, Liege University	HEIP	240,000
10	Study on Impact of Heat Stress to Human Productivity and Economic in Cambodia	1. To build human resources in the heat stress field 2. To investigate the impacts of heat on productivity 3. To build evidence on the impacts of heat stress on productivity in three selected sectors including the construction, garment, and education sectors. 4. To develop an economic model and investigate a work/study rest schedule to be presented to the	ETM	NUS, PolyU	CCCA3	200,000

		ministries for policy planning				
11	Biotechnology for Integrated Pest Management towards Pesticide Reduction in Cambodia	To rescue all Cambodian crops from pest and diseases by integrating biotechnology into IPM approach	FTN	- Ministry of Agriculture, Forestry and Fisheries (MAFF) - Research Institute for Development (IRD), France - The Agricultural Research for Development (CIRAD), France - ORKIN Cambodia	HEIP	106,600
12	Valorization of High-value Dry Food Products (Agricultural Products including Herbal and Spices) and Other By-products in Cambodia	To set up the drying excellence center (the pilot scale of drying processing center) of agricultural products, by-products, to develop the capacity building of human resource on drying technology (including technology transfer and industrial collaboration) for agricultural products in Cambodia	FTN	- SupAgro Monpelier, France - AgroSup Dijon, France - University Libre Brussel, Belgium - Kasesart University, Thailand - Rosemoric Company - Ly Ly Food industry	HEIP	658,324
13	Improvement and Development of Rice-based Products toward the Growth of	To set up a rice-based product development platform, improving the quality of rice-based products locally produced and available in markets and to diversify rice-	FTN	- University of Liege, Belgium - Kasesart University, Thailand	HEIP	800,527

	SMEs/Industries in Cambodia	based products, human resource development, and enhancing collaborative research between university and SMEs		- Indochina Rice Mill Limited		
14	Development of Fermentation Process for Cambodian Soy Sauce	To produce Cambodian soy sauce by fermentation method with good quality and transfer the developed technology of soy sauce to the private sector	FTN	- Kasetsart University, Thailand - Tokyo Institute of Technology, Japan - AgroSup Dijion, France - Eche Ngov Heng Food Production of Kampot Co., Ltd	HEIP	90,000
15	Development of Cooking Oil Processes for Commercialization	To develop cooking oil processes in order to produce cooking oils with good quality, to transfer the technology to private sectors for commercialization, to develop cooking oil research platform and to develop human resource in cooking oil processing	FTN	- UPM, Malaysia - Dara Khmer Sacha Inchi	HEIP	200,000
16	Improvement and Development of Fish and Meat Products for Better Preservation using Innovative Technology	To improve the quality, and add-value to the existing fish and meat products which are available on Cambodian market by applying different preservation technique	FTN	- Nantes-Atlantic National College of Veterinary Medicine, Food Science and Engineering, France - KC Food	HEIP	210,660
17	Valorization of Agricultural By-products in Cambodia through Extractions and	To identify and screen essential oils/bioactive compounds in extracts obtained from varieties of Cambodia	FTN	- Tokyo Institute of Technology (TIT), Japan	HEIP	199,960

	Formulations of Essential Oils and Bioactive Compounds	agricultural food products and wastes; then evaluate its applicability to be used as aromatherapy, food preservatives and active ingredients and to promote institutional Chemical Engineering Field, through university-SME technology transfers and strengthen university-university research collaborations		- VIE International Co., Ltd		
18	HEALTHYRICE	To identify diversified agricultural rice systems allowing an increase in soil and plant health, and a decrease in pesticide use and their occurrence as residues in consumption products	FTN	IRD, CIRAD, RUA, UBB	IRD	55,293.51
19	FOODI (MSc course in Food Processing and Innovation)	To educate aspiring food entrepreneurs, healthcare professionals, government officials, and food industry professionals in the end-to-end value chain of food processing: from understanding the elements of food, to starting a new venture for disrupting and enriching the food processing industry in Asia	FTN	University of the Aegean, University College Dublin, University of Salerno, Research Innovation and Development Lab PC, Metropolitan college SA, AIT, PSU, Universit Kuala Kampur, University of Malaya, Universiti Teknologi Mara, UTM, UBB, Svay Rieng University	Erasmus+ KA2	54,055 EUR

				, University of Heng Samrin Thbongkhmum, MoEYS		
20	Training a new generation of entrepreneurs in sustainable agriculture and food engineering (FoodSTEM)	To build the partnership between Cambodian and European universities, and to create a favourable condition in the 4 partners universities for the emergence of student entrepreneurship and micro or small enterprises	FTN	NPT-ENSAT, Institut Agro/Sup Agro Montpellier,Liege University, UBB, RUA, and RULE	Erasmus+	330,307 EUR
21	Agroecology and Safe Food System Transitions (ASSET)	To make food and agricultural systems in Southeast Asia more sustainable, safer and inclusive, through harnessing the potential of agroecology to transform them	FTN	APPARI, ILRI, CIRAD, SEI, GDA/MAFF, VAAS, GRET, Swisscontact, University of Florence, University of Hohenheim, Mediaseeds, NUOL, DALAM, NAFRI	EU/AFD and GRET	231,000 EUR
22	Reducing Foodborne Pathogen Contamination of Vegetables in Cambodia: Innovative Research, Targeted Interventions, and Impactful, Cambodian-Led Engagement	To reduce the prevalence and incidence of foodborne pathogen contamination of vegetables produced and sold in Cambodia	FTN	Royal University of Agriculture; Institut Pasteur du Cambodge; World Vegetable Center; Purdue University; Penn State University; Kansas	USAID	130,000

				State University		
23	Development of Cambodian Fermented Cucumbers by using Freeze-Dried Lactic Acid Bacteria with their Potential Use as Aromatic and Bacteriocin-producing Starters	To develop fermented cucumbers by using freeze-dried LAB that are useful for taste and preservation	FTN	Tokyo Institute of Technology, AgroSup Dijon	JICA/JICA	30,000
24	ASEAN Network for Green Entrepreneurship and Leadership/ ANGEL	To build the capacity necessary in eleven ASEAN Universities for balancing the high potential economic growth and innovation in the partner countries with their lack of capacities in green entrepreneurship as well as resolving entrenched issues and challenges of poverty, low quality jobs in the informal sector, digital divide and leadership gaps	FTN	- Universiti Teknologi Malaysia (UTM) - Universiti Malaysia Kelantan (UMK) - Universiti Tun Hussein Onn (UTHM) - Universitas Gadjah Mada (UGM) - Universitas Islam Indonesia (UII) - University of South-East Asia (USEA) - Royal University of Phnom Penh (RUPP) - Savannakhet University (SKU) -	Eramus +	60,000

				Champasack University (CU) - Can Tho University (CTU) - Hanoi University of Mining and Geology (HUMG) - Research Innovation and Development Lab (ReadLab) - Hellenic Open University (HOU) - European University of Cyprus (EUC) - Centre for Social Innovation (CSI)		
25	Impact of Initial Composition and Processing Techniques on Aromatic Quality of Mango	To identify the biochemical composition (volatile compounds and aroma precursors) of three contrasted cultivars at three ripening stages before and after each processing (drying, puree, and vacuum frying)	FTN	UMR-Qualisud, CIRAD	BGF & MoEYS	20,000
26	Assessment on Nutritional Profiles, Storage Stability and Sensory Evaluation of Dried Fish Powder Made by Low-Value Small Fish Species	To assess the nutritional profile of low-value small fish species and develop low-cost nutrient fish powder by following the sensory and nutritional profile along storage.	FTN	Institut Agro (Montpellier), National University of Battambang, Vissot Enterprise	LBE/JICA	15,175
27	Removal of Diclofenac and Caffeine from	To remove the diclofenac and caffeine as	FTN	National Institute of Applied	AFD/EU	13,000

	Different Water Sources using Activated Carbons made from Different Wastes	micropollutants from different water sources using activated carbons made from different wastes.		Sciences (INSA), Toulouse		
28	Development of Alternative Salt Process to Manufacture Refined Table Salt from Coarse Salt	To develop an alternative coarse salt refining process with affordable cost of production and acceptable quality on physical and chemical criteria in term of maintaining the original characteristics of salt for GI application	FTN	GRET ARTE-FACT CIRAD IRAM CERTIPAQ REDD	AFD	45,000
29	Development of High Nutritional Value Farmed Fish and Safe Processed Products (Smoked and Fermented Fish) in Cambodia (CAMBOFISH)	The global objective of CAMBOFISH is to stimulate sustainable fish farming in Cambodia in order to 1) to create jobs and reduce poverty, and 2) to improve the safety of fish-derived products and their nutritional quality	FTN	ULIège, UCLouvain, RUA	ARES	500,000 EUR
30	Toward Production Innovation via Fablab-ITC	1. Install Measurement lab, workshop lab, PCB fabrication and assembly lab. 2. Develop management, control, and data collection system for smart agriculture	MIT	MAUSO, INP-Toulouse	HEIP	409,313
31	Initiative towards electrical and electronic products testing and certification by EMC Laboratory	1. To set up an anechoic chamber at ITC. This chamber will be used for conducting research and development (R&D) on related EMC issues. 2. To analyze and design electromagnetic wave absorber using time domain techniques. 3) To study a new topology of	MIT	INP-Toulouse	HEIP	793,450

		reverberation chamber by using meta-material to improve spectral richness, reduce size and control direction of arrival.				
32	Flight Controller and Structural Design for Small Unmanned Aerial Vehicle.	1. Design of aircraft body and autopilot simulation. 2. Design and implement autonomous flight controller and equip surveillance sensors.	MIT	Tokyo Tech	AOARD, US Air Force	69,800
33	Development of Nanosatellite	1. To conduct background research and formulate mission objective 2. To create concept design of the satellite and create a report 3. To submit the CubeSat mission application form to KiboCube program	MIT	U-Tokyo	MoEYS	62,500
34	Indoor mobile robot localization using multisensor data fusion	1. Implement and evaluate robot's localization and planned trajectory 2. Focus on multiple sensor scenarios 3. Established methods relying on sensor fusion	MIT	N/A	Takahashi	5,000
35	Investigation of configuration issues related to SDN/NFV deployments (New topic)	1. Design NFV testbed with cluster of Raspberry Pi. 2. Benchmarking the testbed. 3. Investigate the various deployment issues.	MIT	U-Namure	ARES-CCD	80,000
36	Building trustable and privacy aware IoT systems using blockchain and smart contracts	To focus on security, privacy and inter-operability of the IoT network, which could take into account the architecture model, authentication, authorization, access	MIT	U-Namure	ARES-CCD	90,000

		control, policy and data protection.				
37	Building Blood bank eco-system using blockchain technology	To apply blockchain technology for decentralized system to store those data and proposed using existing secure technique.	MIT	Tokyo Tech	Tokyo Tech	20,000
38	Ancient Manuscript Digitization and Indexation	1. Standardized manuscript digitization and dataset construction 2. Improvement of existing content analysis approaches 3. Design of an interactive search engine - Knowledge transfer to potential institutions and users	MIT	National Museum	HEIP	61,535
39	Applied Control and Automation for Agriculture in Cambodia	1. Simulation study of electric drive using BLDC/PMSM motor. 2. Study of new technique of sensorless vector control for BLDC/PMSM motor.	MIT	INP-Toulouse	HEIP	37,6500
40	ASEAN Factori 4.0	1. To improve capacity building for PLC 2. To set-up PLC excellence center at ITC	ETM & MIT	Universitu y of Claude Bernard Lyon1, University of Ruse (UR), Grenoble Alpes University (UGA)	Erasmus +	70,733 EURO
41	Design and Implementation of Health Data Collection Communication Protocol using Physical-Layer Network Coding	To implement a healthcare platform that allows users can monitor the patient's condition and to propose a data collection communication protocol.	MIT	N/A	LBE/JICA	14,980
42	Plagiarism Detection	To develop a plagiarism detection	MIT		LBE/JICA	14,380

	System for Khmer Language	framework to find duplicated texts and similarities of an input text in a document (document to be analyzed) compared to existing referenced documents.		National University of Battambang (NUBB)		
43	Smart Farming for Qualified Vegetable using Mechatronics Techniques	1.To do comprehensive literature review as well as to perform site surveys in order to collect necessary information and data related to Cambodia vegetable farming style and behavior and the necessity for technological adoption. 2.To conceptualize and perform the detailed analysis of an appropriate automation system integrated with a smart system. 3.To develop and design a prototyping system which will be later installed for testing and validation.	MIT	Chitose Institute of Science and Technology, Tokyo Polytechnic University, Oita University, Kagawa University, University of Fukui, Tokyo Institute of Technology	LBE/JICA	14,990
44	Green BIM - Analysis of BIM approach for designing a bioclimatic building	1. Find bioclimatic design to achieve thermal comfort in building specific in tropical region by using BIM as instrument 2. BIM to facilitate at the early stage of this design process to avoid certain conflicts between architect and engineer 3. Perspective of application of BIM and Bioclimatic design in AEC sector in Cambodia	MSS	University of Liege	ARES	94,568
45	The managing collaboration between	1. To identify the effective strategies for	MSS	University of Liege	ARES	94,568

	architecture, structure, and MEP in service of construction 4.0: workshop at ITC case	interdisciplinary collaboration in BIM 2. To integrate the interdisciplinary collaboration in BIM for construction in Cambodia context 3. To integrate the interdisciplinary collaboration in BIM for the architectural engineer, which is aligned with construction in Cambodia context				
46	Development and optimization of ceramic tile using Cambodian clays incorporating with industrial wastes	To characterize the physical, chemical, mineralogical properties of the raw materials – clays and rock dusts	MSS	N/A	HEIP	256,520
47	Cambodian natural rubber/different minerals composites for floor mat shock absorbing application	- To optimize mechanical and physical properties of Cambodian natural rubber composites by varying common clay mineral and limestone fillers content for shock absorbing applications such as floor tile	MSS	CRRI, USM	HEIP	416,669
48	Initiative on the development of wind load for design of building structures in Cambodia	1. To evaluate the wind load 2. To develop wind load calculation for design of buildings in Cambodia 3. To collaborate with construction industries and professionals 4. To promote research activities in civil engineering at ITC for both undergraduate and graduate levels	MSS	KMUTT	HEIP	50,200

49	Managing the Interdisciplinary Collaboration in Construction 4.0: ITC's Workshop Case	1.To integrate the evolution of technology into the field of CSCW and construction 4.0 in the international context 2.To introduce a BIM-AR collaborative method in the construction phase	MSS	Liege University , Belgium	ARES-Cambodia	94,567
50	Steel Ring Damper for Seismic Application - Collaboration with King Mongkut's University of Technology Thonburi	1. To develop a novel steel ring damper 2. To apply to a system called 'knee-brace frame' for seismic resistance	MSS	King Mongkut's University of Technology Thonburi	KMUTT	16,000
51	Durability of Concrete Beam Strengthening with GFRP	To study the durability of concrete beam strengthening with GFRP and GFRP laminate under different conditions and durations.	MSS	Fyfe Asia Pte Ltd	Fyfe Asia Pte Ltd	3,500
52	Effectiveness of Tyfo® Fibr Anchors with the Tyfo Fibrwrap Systems	To evaluate the performance of Tyfo® Fibr Anchors embedded using chemical epoxy in low compressive strength concrete cylinder specimens and the effectiveness of Tyfo® Fibr Anchors inserting to concrete cylinder confined by glass fiber reinforcing polymer	MSS	Fyfe Asia Pte Ltd	Fyfe Asia Pte Ltd	8,000
53	Air Pollution Monitoring in Phnom Penh	Monitor air quality in Phnom Penh	MSS	Kanazawa University	N/A	In-kind
54	Polyethylene (PE) Waste Recycling for Asphalt Concrete Pavement Application	Polyethylene (PE) will be added into asphalt concrete with varying PE percentage for pavement application	MSS	MoE	MoE	50,000
55	Chemical strengthening of large-scale glass	To study on a glass strengthening process, which is chemical	MSS	N/A	HEIP	329,140

	pieces for construction and engineering	tempering and its applications				
56	Sustainable building design integrated life-cycle assessment (LCA), for best strategies to design the green residential building in Phnom Penh, Cambodia	1. To analyze LCA toward the green building design 2. To propose design strategies and guidelines to reduce the overall environmental footprint of buildings 3. To study on the green building life cycle and be aware of standards, methods, tools on LCA 4. To study and investigate the situation of residential building design in Phnom Penh	MSS	Liege University, Belgium	ARES-Cambodia	181,360
57	Subsurface Mapping of Soil Bearing Capacity in Phnom Penh Area, Cambodia	To create 3D modeling of subsurface soil bearing capacity in Phnom Penh Area up to the depth of 50 meters underground based on secondary and new date logs.	MSS	Hokkaido University, Research and Development Enterprise, Ministry of Land Management, Urban Planning and Construction	LBE/JICA	14996.08
58	Evaluation of Mechanical Behavior of Post-Installed Bundled Reinforcement Used for Concrete Connections	To evaluate the mechanical behavior of post-installed bundled reinforcement	MSS	Tokyo Institute of Technology, King Mongkut's University of Technology Thonburi	LBE/JICA	14,900
59	Physical Properties and Mineralogy of Ancient Brick from Temples at Sambor Prei Kuk area, Kampong	To characterize and determine the physical and chemical properties of ancient brick, sandstone,	MSS	National Authority of Sambor Prei Kuk	LBE/JICA	14,970

	Thom, Cambodia	laterite rocks from the Sambo Prei Kuk area.				
60	Geological, Geochemical Characteristics and Genesis of Gold Mineralization, Gemstone and Rare Earth Element in Ratanakiri, Kampot, and Pailin province, Cambodia	To focus on geological conditions and geochemical characteristics to provide guideline for further gold, copper, and rare earth element exploration in those areas.	MSS	Ministry of Mines and Energy, Yangon University of Mine and Energy	LBE/JICA	14,998.08
61	Understanding and Managing the Cambodian Floodplains, The Preks of Kandal Province	To understand and manage the floodplains in Kandal province	WAE	Institut de recherche pour le développement	IRD	100,000
62	Water Evolution and Vulnerability Under Global Changes in Coastal Catchments of Cambodia	To assess surface water resource and groundwater resource in the coastal area; Groundwater salinity monitoring and mapping	WAE	Institut de recherche pour le développement	IRD	50,000
63	Development of Climate Data Information System for Cambodia	1. To construct gridded climate data from the historical point observation data over Cambodia. 2. To provide reliable climate data and downscaling climate data in Cambodia to users by using bias-correction method and climate downscaling method, respectively. 3. To share climate data and software developed in the sub-project with relevant governmental agencies and partner institutions by launching training workshops and supporting on utilizing the output herein for policy	WAE	Kyoto University Institute of Technology of Bandung	HEIP	12,250

64	Improving Sustainable Water Supply and Sanitation in Cambodia: Case of Tonle Sap Lake's Floating Villages	The objective of this research to provide a sustainable water supply and sanitation that are adapted to the socio-economic and environmental contexts of TSL by using pilot scale of advanced water treatment technologies.	WAE	Tokyo Institute of Technology	HEIP	200,000
65	Strengthening Flood and Drought Risk Management and Early Warning System in Lower Mekong Basin of Cambodia.	The main goal of the project is to improve flood risk management through integration of technical and institutional linkage into policy, and reducing vulnerability of local community livelihoods.	WAE	N/A	HEIP	200,000
66	Development of a Biofilter System Model to Control of Air Pollution toward Industrial Application	1. Characterization of air pollutant 2. Development of biofiltration system 3. Efficiency testing 4. Technology transferring to industries/SMEs	WAE	Kanazawa University	HEIP	212,710
67	Aquaculture Cambodia: Sustainability and Risk Prevention	To contribute to Cambodia's public policies for the development of sustainable aquaculture, through adapted methodological tools shared between main stakeholders of the sector.	WAE	Institut de recherche pour le développement	IRD/French Embassy	30,000
68	Water and Health Risk in Cambodia (WatHealth)	To determine how changes in river flood regimes affect the distribution of pollutants and lead to change in the biodiversity of water related pathogens and disease vectors, with ultimate effects on health, agricultural	WAE &FTN	Institut de recherche pour le développement	IRD	10,000

		production and the environment.				
69	Improving Capacity on Integrated Coastal Management with Low Impact Development Considering Environmental Sustainability and Climate Change in Coastal Area of Cambodia (CLID)	To support the integration of best practices in LID with urban planning process through scenario evaluation platforms, workshops, and instruction materials that involve the participation of city planners, policymakers, practitioners, and citizens.	WAE	Institut de recherche pour le développement Kyoto University	CCCA3	149,990
70	Integrated Approach of Precise Irrigation and Sustainable Laboratory Development: the Focus on Rice Farming	Develop advanced technology on irrigation system for rice farming	WAE	University of Liège	HEIP	200,000
71	Termite Bioturbation in Cambodia-From Characterization to Application (PhD project)	1. To identify the abundance of termite mounds 2. To analysis soil physico-chemical properties of termite mound soil 3. To study the impact of Termite mound soil on vegetable growth	WAE	N/A	ITC, BGF, and IRD	N/A
72	Prototype of Low-cost and Smart In-vessel Composter for converting Spent Mushroom Substrates to Bio-Organic Fertilizer	1. To calibrate and validate mathematic modelling of compost process of spent mushroom substrates (SMS); To prototype an automatic composter for rapid fermentation of SMS; 2. To implement the prototype composter at mushroom production farm to evaluate the quality of the SMC produced	WAE	Center of Excellence on Sustainable Agriculture and Nutrition, Royal Unvisersity of Agriculture (RUA)	LBE/JICA	30,000 USD
73	SATREPS: Establishment of Risk	1. To understand the overall picture and status of air pollution	WAE	Cambodian side: ITC, UHS,	JST and JICA	5 million

	Management Platform for Air Pollution in Cambodia	and their health risk for tourists and residents in Cambodia (provincial areas) by examining the characteristics of aerosols based on three different aspects and their inter-correlations: 1) Management of air quality monitoring, 2) IoT and data management, and 3) Environmental risk assessment. 2. To develop a better understanding of the air quality standard for aerosols using indices reasonably describing health risks, which are evaluated by using state of the art technology and knowledge based on the molecular microbial ecology. 3. To identify factors that cause health risks for tourists based on analyses of the activity of various sectors by mapping the sources of aerosol pollution in Cambodia, by obtaining the		NUM, MOE Japanese side: Kanazawa university, Osaka Otani university, Nagasaki university		
74	Kinetic and Influence of Iron Co-Presence on Arsenic Removal from Groundwater	To study a relative effect of ferrous iron co-presence on arsenic removal in batch experiment and continuous mode system.	WAE	Chulalongkorn University, Tokyo Institute of Technology, B2G Engineering Co., Ltd	LBE/JICA	15,000
75	Influence of Locally Made Effective Microorganisms (EM) on the Treatment of Domestic Wastewater	To devise a method for producing effective microorganisms in Cambodia utilizing raw materials or organic waste.	WAE	B2G Engineering Co., Ltd	LBE/JICA	15,000

	using Conventional Septic Tank					
76	Investigating the Effects of Algae Bloom in Tonle Sap Lake Source Water on Water Supply Treatment Efficiency	To investigate the characteristics of algae for enhancing algae removal in water treatment	WAE	Kompong Kou water supply (KKWS)	AFD/EU	13,000
77	Occurrence and distribution analysis of Microplastics in different environment mediums of Cambodia.	To study the assessment of MP particles in three different conditions including freshwater, marine, and salt (made by sea water) in order to understand its occurrence and distribution in both rainy and dry seasons	WAE	Chulalongkorn Universit , B2G Engineering Co., Ltd	AFD/EU	13,000
78	Water Use Behavior in peri-urban communities of Southeast Aisan Countries: case study in Phnom Penh City, Cambodia	1. To assess and evaluate water usage and sanitation practices of households in Dangkao district, Phnom Penh city 2. To analyze the quality of water, particularly drinking water, in this selected community 3. To compare these results with other communities of other countries (i.e. Vietnam, Thailand, Indonesia)	WAE	Kyoto University	Grant-in-Aid for Scientific Research (A) No. 14301 & GSGES, Kyoto University, Japan	15,000
79	Antimicrobial Resistance Circulation along the Mekong and its Delta (ARCIMED)	To enumerate and identify the antibiotic-resistant bacteria	WAE	N/A	French Government	25,000
80	How the Poor Commute in Cambodian Cities and Their Intention	1. Examine how low-income people commute in urban areas (identify opportunities/challenges for commuters	N/A	Svay Rieng University	LBE/JICA	14,350

	towards Public Transport	and public transport systems) 2. Develop an accessibility index to/from urban public transport system. 3. Feasible solutions to maximize the use of urban public transport systems via low-income citizens (policy discussion and formulation)				

3.11.3 Projects/Proposals submitted in 2021-2022

There were in total 8 projects that were submitted in 2021-2022 as indicated in Table 11 below.

Table 11: Project Proposal submitted in 2021-2022

No	Title of Project	Objectives of the project	Speciality (WAE, MSS, etc…..)	Partner	Funding agency (Erasmus KA1, Erasmus KA1, AUN-SEED/Net, AUF, AFD, ADB, WB etc.,)	Funding Amount (USD)
1	Sustainable Utilization of Residual Sources for Energy Supply (SURSES)	1. Establishing a solid information basis about the availability of residuals for sustainable utili-zation in Cambodia and the Philippines 2. Strengthening of research methods and promoting young researchers 3. Deriving applicable research results to enhance the sustainable utilization of residues for energy supply in Southeast Asia 4. Strengthening of institutional capacities of Southeast Asian partners for sustainable energy research and decision support to policy	ETM & FTN	Reiner Lemoine Institut gGmbH (RLI), Off-Grid Research Group, TU Berlin (TUB), FG Bioverfahrenstechnik, University of the Diliman (UP), Research Group Sustainable Production and Responsible Consumption	Federal Ministry of Education and Research (BMBF)	199,613.7 EUR

		makers and private sectors				
2	Decrypting Recruitment and Biocontrol Activities Against Plant-parasitic Nematodes from Suppressive Soil Microbiota	The project aims at decrypting the diversity, ecology and functions of the Root-Knot Nematode suppressive soil microbiota towards reduced *Meloidogyne graminicola* parasitism with specific objectives: 1. Determining the suppressive capacity of natural microbiota assemblages, 2. Identification of sub-microbiota and kinetics of the establishment of the gallobiome, 3. Understanding the function of bacterial communities isolated from suppressive soil.	FTN	IRD, CIRAD, MAFF	European Union	556,000 EUR
3	Monitoring and Combating Root Knot Nematodes for European and Global Rice Farmers	The projects' objectives: 1. Develop the first dynamic range modelling tool for plant pathogens and use it to assess the current and future scale of the threat caused to EU crop production by the recent arrival of the root-knot nematode Meloidogyne graminicola in Italy, 2. Integrate EU research on M. graminicola with that in Asia to produce common solutions, 3. Develop resistant rice varieties and novel products (seed, leaf or soil treatment) that will mitigate the problem in currently affected areas as well as those at risk from spread of the disease, 4. Disseminate policy advice and integrated	FTN	Cambodia (ITC), Vietnam (NLU), Banglades (BRRI), China (CAAS, SAAS, HAU), France (IRD, CFR), UK (UNIABDN, JHI), Belgium (UGent, FYTO), Spain (Kimitec), Italy (UPO, CREA, RETIONE PIEMONTE, SA.PI.SE), Portugal (INIAV).	European Commission	180, 000 EUR

		pest management tools for threat mitigation at the farm, regional and global level.				
4	Electrochemical Aptasensor for Point-of-Care Detection of Tropical Schistosoma-REDEEM	The project aims on the development of electrochemical aptamer-based biosensor device for sensitive, rapid and cost-effective screening of tropical schistosoma, neglected parasitic tropical disease causing high morbidity and mortality in humans worldwide	FTN	Fraunhofer IKTS (Germany) Riphah International University Islamabad (Pakistan)	Federal Ministry of Education and Research (BMBF)	200,000 EUR
5	Impacts of Climate Change on Animal and Plant Pathogens in Relation to Food Security and Human Health	The overall ambition of the project, hence, is to characterize the relationships between and/or impact of climate change (temperature, humidity, rainfall) on the distribution of animal and plant pathogens, with their ultimate effects on health, agricultural production and the environment.	FTN	CDRI	IDRC	547,400
6	Efficiency of Disinfectant on the Model Strains of Bacteria and Virus using Different Spraying Equipment on Surfaces	To evaluate the efficiency of disinfectant on the model strains of bacteria and virus	WAE	N/A	Takahashi Foundation	TBC
7	Assessment of Water Availability in Natural Reservoirs for Piped-water Supply in Cambodia based on Satellite Images Analysis	To assess the water availability in natural reservoirs for piped-water supply	WAE	N/A	AFD/EU	13,000

8	Optimization of Rapid Molecular Detection Method for Waterborne Pathogens: Case Study in Mekong River	To optimize the rapid molecular detection method for waterborne pathogens	WAE	N/A	AFD/EU	13,000

3.12 Promotion of Graduate School

- Maintain and extend partnerships with partner institutions (universities, NGOs, Government Agencies, private sectors, etc.).
- Continue improving and reviewing curricula of thematic programs (inter-departments)
- Seek for funds/scholarships to support students.
- Increase promotional activities to prospective students.
- Conduct graduate employment survey of master and doctoral graduates.
- Internationalize the programs through our regional and international partnerships.
- Increase communication among campus community, faculty staff and prospective students.
- Fully implement Partnership programs of the Higher Education Improvement Project (HEIP).
- Increase the visibilities of research topics response to the societies needed through supporting from research fund institutions such as ministries, LBE project, WB project.

Table 12: Perspective for 2022-2023 of Graduate School

No.	Objective	Baseline 2021-2022	Target 2022-2023	Strategies/Actions	Challenges
1	Increase number of enrolments of Master students	122 (on-going students)	136 (on-going students)	Seek for more funds/scholarships to support students	- Covid-19 - Availability of staff - Limited sources of funding support
				Increase promotional activities to prospective students	
				Improve communication materials and website contents of Graduate School	
				Promote research-based programs	
				Promote LBE and Research in HEIP projects	
				Partner and collaborate with local/regional universities, public institutions and industries, NGOs	

2	Increase number of Master graduates	277	340	Orientate research/internship activities and inform timeline and requirement Conduct regular meetings between students and supervisors Follow-up research/internship progress weekly and monthly	- Covid-19 - Late arrival of experiment equipment
3	Toward International Master Programs by 2023	0 (program)	1 (program)	Collaborate with partner universities Fully implement Partnership programs of the Higher Education Improvement Project (HEIP) Promote English as a language of communication, teaching and learning Invite professors/experts from partner institutions to provide lectures/short courses	- Covid-19 - Availability of staff
4	Toward program accreditation by 2023	0 (program)	2 (program)	Send faculty staff for training on requirement and preparation for accreditation Conduct self-evaluation on the training programs Consult with accreditation experts Prepare necessary documents and tools to meet the standard and/or requirements of the accreditation body	- Covid-19 - Availability of staff
5	Launch revised curriculum of Master programs	1	5	Propose revised curriculum developed by team members to Consortium for comments and discussions	
6	Launch new Master Program	0	1	Launch Master of Data Science under support of HEIP and French partners	
7	Increase number of enrolments of PhD students	55 (on-going students)	62 (on-going students)	Seek for more funds/scholarships to support students Increase promotional activities to prospective students Improve communication materials and website contents of Graduate School Promote research-based programs	- Covid-19 - Availability of staff - Limited funding support

				Promote LBE and Research in HEIP projects	
				Partner and collaborate with local/regional universities, public institutions and industries, NGOs	
				Develop more double-degree/cotutelle/sandwiches Programs with partner universities	
8	Increase number of PhD graduates	4	15	Orientate research activities and inform timeline and requirement	- Covid-19 - Late arrival of experiment equipment - Funding supports - Young supervision experience of some supervisor
				Conduct regular meetings between students and supervisors	
				Follow-up research/internship progress weekly, monthly and semi-annually	
9	Improve management of Graduate School			Capacity building on leadership/management/M&E skills for Graduate School's staff	- Availability of faculty staff can be constrained - Difficulty in collecting inputs due to Covid-19
				Capacity building on "Effective supervision for doctoral student"	
				Develop guidelines for students, faculty and administrative staffs	
10	Enhance quality assurance			Develop and conduct graduate employment surveys of master and doctoral graduates	Participation in questionnaire can be low
				Conduct student's evaluation on the training program	
				Conduct student's evaluation on learning and teaching	
				Conduct market survey for skill needs' assessment	
				Analyse survey data and report for program/curriculum revision or development	

3.12.1 Master Programs

A. <u>Master Program of Computer Science</u>.

Curriculum of the Master Program of Computer Science was revised last year and has been implemented successfully. The revised curriculum aims at providing skills and advanced knowledge to fit the current and future job market trends (skills related to Big Data) and embrace research and development in order to support the research study

projects in the fields of Computer Science, Machine Learning and Deep Learning at ITC or elsewhere. With the practice of the new curriculum proposed last year, some practical issue is found and there is need to be slightly updated to the curriculum. To keep students involved in their research project earlier, for year-one students, an internship project is a must, and it is proposed to be added at the end of second semester. The duration of internship will be two months with the number of credits of 3. For the perspective of academic year 2022-2023, we propose to run this program in collaboration with local partners, aiming at recruiting 10 new M2 students.

B. Master Program of Materials and Structural Engineering

- For the academic year 2020-2024, we push the collaboration with Chulalongkorn University (CU) in Thailand through HEIP project. The collaboration will focus on exchanges of students, professors and developing curriculum in Materials Science and Engineering part with the Faculty of Engineering of CU. Meanwhile, we work with our partner, Université Sorbonne Paris Nord (13), to establish an Erasmus+ project the support staff's and students' mobilities.

C. Master Program of Water and Environmental Engineering

- Following our SWOT analysis, feedbacks from stakeholders and our survey, for the academic year 2021-2022, we propose to revise our current curriculum to address the current development, market needs and skill gaps, by adding two new courses, namely, (1) Guest lecture Seminar (2 credits) and (2) M1 Internship for a period of 2 to 3 months. The detail of this proposal is put in the Annex [Perspective-M-WEE-2022-2023].

Table 13: Revision of current curriculum

Master program	Current situation		Proposed modification/add		Remarks
	Name of course	Duration	Name of course	Duration	
M-WEE	None	None	Guest lecture Seminar	48h	
	None	None	M1 Internship	2 to 3 months	Exempted for ITC students who enroll in M2 directly

- For the academic years 2020-2024, we push the collaboration with Chulalongkorn University (CU) in Thailand through HEIP project. The collaboration will focus on exchanges of students and professors and with Department of Environmental Engineering, Faculty of Engineering of CU. To prepare the master program to gain AUN-QA accreditation with collaboration with CU.

- To have 10 more exchange professor from France to give lecture in partnership with ITC professor for UWE program. To have exchange experts from NGOs such as GRET and Water Supply Authority to provide short courses to the Master students so that the students can know more on the real-world problems of work. This exchange is supported by EU-AFD project.

- To send master students to do internship abroad with EU-AFD projects. To have students doing research internships in the ministries and industries.

D. Master Program of Energy Technology and Management Engineering

- Following our SWOT analysis, feedbacks from stakeholders and our survey, for the academic year 2021-2022, we propose to substantially revise our current curriculum to address the current development, market needs and skill gaps. The detail of this proposal is put in the Annex Perspective-[M-ETM-2022-2023].

- For the academic years 2020-2024, we push the collaboration with Institut Teknologi Bandung (ITB) in Indonesia through the HEIP project. The collaboration will focus on exchanges of students and professors.

- We also work with ECAM-Lyon to establish the link between M-ETM and ECAM international double-degree program.

E. Master Program of Agro-industrial Engineering

- Following our SWOT analysis, feedbacks from stakeholders and survey data, for the academic year 2021-2022, we propose to substantially revise our current curriculum to address the current development, market needs and skill gaps. The detail of this proposal is put in the Annex [Perspective-M-AIE-2022-2023].

- To develop and strengthen the training and research programs in the field of Agro-industry to account for regional context, collaborating with prestigious universities in the region is essential. For the academic years 2020-2024, we push the collaboration with Kasetsart University (KU) in Thailand through the HEIP project. The collaboration will focus on exchanges of students and professors and establishing dual degree program.

F. Master Program of Mechatronics, Information and Communication Engineering

- Following our SWOT analysis, feedbacks from stakeholders and our survey, for the academic year 2021-2022, we propose to substantially revise our current curriculum to

address the current development, market needs and skill gaps. The detail of this proposal is put in the Annex [Perspective-M-MIC-2022-2023].

- For the academic years 2020-2024, we push the collaboration with, through the HIEP project, with Institut Mines Télécom (IMT) and IMT Mines Alès in France. The collaboration will focus on exchanges of students and professors and improving curriculum.

- We also work with ECAM-Lyon to study the possibility of having international double-degree program.

G. Master Program of Data Science

- For the academic years 2020-2024, we propose to launch Master's Degree in Data Science, by collaborating with our French partners IMT-TSP and ENSIIE, under the Partnership Program established under the HIEP project. The collaboration will focus on human resource development, exchanges of students and professors and improving curriculum.

Overall, in the coming academic year 2022-2023 we propose to run the following master programs:

1. Agro-industrial Engineering
2. Energy Technology and Management Engineering
3. Materials and Structural Engineering,
4. Transport Engineering
5. Computer Science
6. Water and Environmental Engineering
7. Mechatronics, Information and Communication Engineering
8. Data Science

Agenda:

- Program Promotion to I5 Engineering students: July
- Official Announcement of the new intake: July—August
- Selection and result: September
- Start of academic year: October
- Proposed Tuition Fee: 1,200$ per year and 2400$ for the double-degree international program

3.12.2 Doctoral Program

The Doctoral Program has been launched since the academic year 2017-2018. For this academic year, there are 55 doctoral students. In the coming academic year 2022-2023, ITC plans to recruit 2 PhD students each for the five fields:

1. Water and Environment
2. Materials Science and Structures
3. Energy Technology and Management
4. Food Technology and Nutrition
5. Mechatronics and Information Technology.

The PhD students will engage actively in the research projects defined under the HEIP project. We prioritize ITC faculty staffs who are potential (lecturer-researchers or pure researchers) but have difficulty to mobilize far from home (especially, female staff with children). Co-supervision and cotutelle programs with partner universities are highly considered.

Agenda:

- Announcement of the new intake: April—July
- Selection and result: August—September
- Start of academic year: October
- Proposed Tuition Fee: 1,900$ per year.

3.13 Promotion of Research and Innovation

a) Promoting research activities

- Encourage researchers to propose and to conduct research project with national and international partners
- Exchange research outputs with local and international researchers through conferences, proceeding, and workshop -etc.

b) Continuous improvement for highly-qualified researchers

- Encourage faculty staff for doctoral study or post-doctoral study
- Send researchers to have experiences in laboratory of national and international partners
- Develop capacity of researchers for research proposal writing and grant proposal writing
- Develop skill of researchers on planning, project management, and report writing

c) Upgrade laboratory facilities

With the support from the government French government, Belgium government, Japanese government, AUF, AUN-Seed-Net and other development partners ITC has equipped with some good equipment. However, there is still has limitation in terms of research facility. Therefore, ITC continues to strengthen and upgrade the laboratory facilities through expansion of collaboration with partners. The following strategies are to be implemented to achieve the above objective:

- Develop laboratory with specific field to response to development of scientific knowledge and economic improvement
- Equip modern facilities for research and development through support from government and internal partners
- Continue to strengthen and expand the collaboration with development partner such as French, Belgium, Japan, Korean and other development partners

d) Strengthening and expanding of researcher network

In the sector ITC has researcher network at local and international level such as MOEYS, RUPP, RUFA, Ministry of industry and handicraft, and Ministry of water resources and Meteorology, etc together with French embassy, AUF, Ares-CCD, AUN/Seed-Net, World Bank. These local and internal agencies provide technical and financial support to ITC. To achieve this objective ITC will do the following:

- Continue to propose research project proposal with existing partners
- Join scientific conferences and events to exchange research outputs
- Invite scientific keynote speaker for events organized by ITC

e) Strengthening and expanding of collaboration with private sector

- Continue to propose research project for development of manufacturing technologies
- Continue to organize scientific events to share experiences by involving from academic and private sectors
- Continue to provide services to private sectors such as training, raw material and final product analysis, and consultation -etc.

3.14 Promotion of Industrial Linkage

In 2022-2023, the University Industry Linkage Office of ITC aims to achieve following:

- Strengthen internal linkage between UIL and each faculty/office at ITC
- Continuous improve collaboration with private/public sectors
- Setup working flow and document/administration/regulation/data management at UIL office
- Promote business services (testing, training, consulting services)
- Conduct market research
- Develop website, an online platform for advertising

Table 14: Perspectives of UIL for 2022-2023

No.	Objective	Baseline 2021-2022	Expected 2022-2023	Strategy	Challenges
1	Increased number of companies to visit ITC labs	6	10	- Broaden marketing/advertising to companies - Encourage and invite related companies to visit labs	- Covid situation may affect the labs visit - Difficult to arrange schedule
2	Increased number of companies visited by ITC	5	7	- Contact potential companies for visiting opportunity - Involve students in the visit - Use HEIP project to support the expense	- Covid situation may affect the number of visits - insufficient budget to support the travelling to company
3	Maintain number of lectures on soft and hard skills provided by company to ITC	5	5	- Facilitating the lecture room preparation - Inviting alumina for sharing experiences	- Lack of budget - Time availability of company

				- Invite expert for the lecture under HEIP project - Provide appreciation certificate signed by ITC top management	
4	Maintain number of training service	4	4	- Advertising/Marketing - Setup a standard training room and facility under HEIP project - Create attractive training program	- Less/No budget to improve training materials
5	Maintain number of consulting service	2	2	- Build trust to company - Offer reasonable fee charge - Improve quick service - Improve technical consulting service	- Lab's facility is not enough to implement it - Limited capacity of human resource for some faculty
6	Increased number of testing/facilities renting service	4 (Excluded GCI service)	4 for each related faculty excluded GCI	- Broaden advertisement of the services using HEIP project - Make manual of testing parameters - Setup a clear administration - Give discounts - Improve services (faster service, provide consultation on data)	- Insufficient facility to offer many testing parameters - No ISO lab for the testing and marketing, then limit the expansion of marketing - Not enough budget to maintain equipment - Lack of support from faculty
7	Maintain number of applied research/project collaboration with company in kind/cash	4	4	- Encourage company to maintain the existing in-kind-collaboration if it's impossible to get cash contribution - Learning failure/ success from successful UIL department of various international universities under HEIP project - Build trust to company - ITC UIL will start collaboration with kind collaboration for new company	- Lack of commitment from researchers to join the kind collaboration project - Not enough facility
8	Maintain number of joining seminar/event related to UIL topic	5	5	- Keep seeking for communication, connection, and	- Time constraint of UIL staffs and UIL representative

	(all UIL related staff will be invited)			continuous searching for free event - Use budget in HEIP project to join important event	
9	Increased members of industry consortium	25	30	- Organize attractive consortium meeting under HEIP/LBE projects - Keep good and closely communication with the company - Work with projects (LBE/ADB) to engage more companies - Build trust for company	- Some fields have less potential company to be interested as member of consortium
10	Increased number of career fair	0	1	- Invite company to join career fair - Improve career fair agenda for the benefits of all parties (students, ITC, company) under HEP project	- Covid situation may affect the job fair event - Lack of human resources to support the event preparation

3.15 Promotion of Incubation and Start-Up

The fields covered by the Business Incubation Centre (BIC) are connected to the 5 Research Units of the Research and Innovation Centre, namely: Water and Environment (WAE), Food Technology and Nutrition (FTN), Materials Science and Structure (MSS), Mechatronics and Information Technology (MIT), and Energy Technology and Management (ETM).

However, 2 fields of innovations have been prioritized:

- **Innovations with High Technologies** including the use of Robotics, AI (Artificial Intelligence), Mechatronics, Big Data, Cloud Computing, IoTs, Cybersecurity, Automation.
  High Technologies can be applied to agriculture (smart farming), energy (smart energy production and use), environment (weather forecast, climate change predictions), and of course Industry 4.0 (prototyping, product design, quality control in manufacturing, energy and environmental management).

- **Innovation in Food processing and Food Safety.** Although the technologies involved may appear not as sophisticated as in the previous field, issues for developing *affordable, safe, attractive and sustainable food* "Made in Cambodia" involve many Scientific fields such as agronomy, food science, waste and by-products valorisation, food process design, biotechnological process, microbiology, biochemistry, analytical chemistry, materials science for food packaging aspects, …

Strategies and Activities for 2022-2023

- Facilitate with different departments at ITC to provide technical support to startup team (lab access and technical mentor)

- Organize Techno Innovation Challenges Cambodia 2021 (TICC 2021) to select the best innovative ideas/projects and most committed teams (6-8)
- Organize 10-weeks training on Business Plan Development to help startup teams to build completely build their business plan and improve their product/service prototype
- Provide technical, business and financial support to three best startup projects to commercial / testing their product on the market
- Organize Showcase and Networking Evening to showcase and connect the three best startup teams with investor (in partnership with Khmer Enterprise)
- Promote the result of the startup program (through seminar) to ITC's partners universities
- Collaborate with external entities to provide capacity building for students to learn entrepreneurship more effectively.

Expected output:

- At least one Laboratory under LBE project become a member of FabLab of the Incubation Center

3.16 Promotion of Library, Cyber University and Multimedia Centre

Library

- Establish Digital Education Center and Digital Library
- Establish Sustainable Library Management System and up-to-date System
- Web Portal for sharing electronic resources
- Social Media linked with other partner library local and global
- Create Web Portal that is a place where electronic resources can be shared online using the Internet or in a single network without using the Internet (Intranet) in the school
- Convert from required or popular hard book to digital book
- Change from using the library services directly to using the electronic system, such as borrowing books directly and requesting to use the discussion room
- Make the videos on the use of book catalog system and other electronic services
- Needs training of librarians and library users with knowledge of technology management and use

Cyber University and Multimedia Centre

- Organize online content development training to local partners: universities, NGOs, and institutions working on education and learning and teaching technology
- Support Royal University of Agriculture, National University of Battambang, Mean Chey University to setup and operate e-learning
- Support partners working on education to apply e-learning
- Promote collaboration with UNESCO-BEEP Learning Center (10)
- Provide free content operation to attract more partners
- Join partners seminar that promote teaching and learning technologies
- Join technology exhibition and education fair

- Continue to improve Learning Management System (LMS) functionalities and operation
- Increase LMS server capacity to improve content operation

3.17 Promotion of Soft Skills

Soft skill is an essential course which promotes personal attributions that sit outside the professional qualifications and work experience. Soft skills will be mainstreamed into technician and engineering program at ITC for building students' soft capacities. Among the other skills, Team Work is one of the principle skill to be considered. 2 Trainings on Teamwork will be given to ITC students annually.

Teamwork involves building relationships and working with other people using a number of important skills and habits:

- Working cooperatively
- Contributing to groups with ideas, suggestions, and effort
- Communication (both giving and receiving)
- Sense of responsibility
- Healthy respect for different opinions, customs, and individual preferences
- Ability to participate in group decision-making

4 Challenges

- The mobility program under faculty have been revised due to COVID19. Most of mobility program and capacity building over sea have been delayed and changed to conduct online.
- Covid-19 can still be a huge challenge in implementing many activities within graduate school and ITC as a whole, as many activities and plans are conducted under the support from and collaboration with foreign partner universities. Most short-term mobilities, seminars, trainings and research activities can be interrupted if the situation is not improved. It can slow the progress of implementation due its capacity to limit the availability of faculty members.
- Managing capacity building projects and collaborative projects requires more time and effort which need more capable administrative staff to help.
- Research facilities such as laboratories and journals are not yet fully capable or structured for advanced research, making it difficult for students to access and do research.
- Low number of available scholarships and research grants for research students, making it difficult to promote research activities and to attract outstanding students to work and study at ITC.

5 Receiving Capacity of ITC

For the academic year of 2022-2023, ITC plans to recruit about 1300 engineer students, about 1000 technician students based on the need of human resources and in accordance with the evolution of capacity of the Institute and increasing number of lecturers. Table below shows the current capacity of ITC.

Type of room	**Quantity**	**Capacity**
Big conference room	1	2000
Conference room	1	350
Auditorium (Building A)	2	200
Auditorium (Building F)	2	380
Lecture and (Tutorial) TD room	6	100
	43	50
Language learning room	11	25
Laboratory for student practice (TP)	52	25
Computer room (25 pc)	5	25
Two buildings under S4C project: – 23 Laboratories – 10 Classroom – 5 Computer rooms – 4 Training center – 3 workshops – 2 Amphitheather – Etc.		

For practical work (TP), rooms for TP or laboratories are directly under control of each department. Table below shows the number of TP rooms in each department.

Department	Number of TP room	Capacity
GCA	6	25
GCI	4	25
GEE	8	25
GGG	7	25
GIC	8	25
GIM	11	25
GRU	7	25
GTR	3	25
TC	3	25
Total	**57**	

Actually, maximum number of students in a session of lecture (C), TD and TP is presented in table below.

Department	Lecture (C)	TD	TP	Language
TC	180	50	25	25
Specialty	180	50	25	25

In the academic year of 2022-2023, estimated number of students is about **6800**. Based on group distribution, we can estimate the needs in terms of number of sessions per week and capacity of lecture, tutorial and practice rooms as following:

	Lecture (180 students)	Specialty course and TD (50 students)	TP (25 students)	Language class	Computer room
Number of sessions for technician		475	346		120
Number of sessions for engineer	149	1154	593	1456	104

Actual number of session (need)	**149**	**1629**	**939**	**1456**	**224**
Number of rooms at ITC	4	43	57	11	5
Possible number of sessions for 4.5 days (36 sessions/week)	144	1548	2052	396	180
Possible number of sessions for 5 days (40 sessions/week)	**160**	**1720**	**2280**	**440**	**200**

This table shows that ITC still have capacity to recruit proposed number of students with this infrastructure capacity. This table is not taken account of the building under construction under S4C Project (Skills For Competitiveness).

PART 2: PEDAGOGICAL DOCUMENT

6 Preparation of academic year 2022-2023

6.1 Academic Calendar 2022-2023

The academic calendar 2022-2023 is presented in Annex F.

6.2 Recruitment of students in 2022-2023

a) Technician students

The recruitment of Technician students is a document-based selection. Candidates shall pass or fail national examination of Bac II. Students could choose preferred department during the registration. It is a document-based selection.

Only candidates (Pass national exam) with grade A to E can continuer to Engineering Program after finished Technician Program.

b) Engineering students

All candidates (Bac II Grade from A to E) have to apply for an entrance exam. Two options have been considered for the recruitment of Engineering students:

- Option 1: An on-site entrance exam will be organized. This examination is focused on Mathematics, Physic-Chemistry and Logic.
- Option 2: An online entrance exam will be organized. This examination is focused on Mathematics, Physic-Chemistry and Logic.

6.3 Proposed Tuition Fee in 2022-2023

The tuition fee for Engineer and Technician Programs is proposed as below.

Engineering Program	***Technician Program***
600$ for male students 450$ for female students	300$ for male students 200$ for female students

6.4 Exemption of Tuition Fee

Every year, scholarships have been provided to 1st Year students as following:

- 80 first year engineer students enrolled at ITC-Phnom Penh will be exempted from tuition fee.
- 120 first year engineer students enrolled at ITC-Tbong Khmum will be exempted from tuition fee.
- 15% of first year technician students will be exempted from tuition fee.

To comply with the criteria of Department of Higher Education, this exemption will be divided into the following categories:

- merit (best result of entrance exam): proposition 60%
- financial difficulty: proposition 20%
- from remote areas: proposition 5%
- female students: proposition 15%

6.5 Proposed Number of Seats for 2022-2023

i. First year student (I1)

Number of first year students to be recruited is presented in table below:

	ITC-Phnom Penh	ITC-Tbong Khmum
I1	1300	120
T1	1000	-

ii. Third year of Engineering Program (I2 → I3)

The following table shows number of seats in the 3rd year (I3) in each department for academic year of 2022-2023.

Number of seats from I2 to I3

Faculty/Department	**I2 to I3**
GCA	190
GCI	190
GAR	90
GEE	190
GGG	100
GIC	90
GIM	150
GRU	150
GTR	80
GTI	80
AMS	80
Total	**1390**

iii. Possibility of enrolment to I3 for Technician Graduates

For the academic year of 2022-2023, 15% of T2 Graduates can enter to 3rd Year of Engineering Program if they passed a test on three subjects (mathematics, physics and foreign language) which conforms to the 2nd Year Engineering Program (I2) and an interview by relevant departments.

To ensure that students graduated from two-year technician program will be able to continue their studies in 3rd year of engineering program, ITC will organize an intensive preparation courses in the three subjects (mathematics, physics and foreign language) during summer holidays (August and September). This intensive course is paying.

iv. Others exams to I3

3 seats per department for Cambodian having a level of BAC + 2 and a good knowledge of foreign language or having a bachelor of science, and who will pass the tests of specific exam (written tests: math and physics and interviewed by the concerned department) in September.

v. Total seats to I3 in 2022-2023

The following table summarizes, for each department, total number of seats to I3 in 2022-2023.

Department	**Seat I2 to I3**	**Seat T2 to I3**	**Seat External**	**TOTAL**
GCA	190	7	3	**200**
GCI	190	9	3	**202**
GAR	90	-	-	**90**
GEE	190	10	3	**203**
GGG	100	-	-	**100**
GIC	90	-	3	**93**
GIM	150	4	3	**157**
GRU	150	-	-	**150**
GTR	80	-	-	**80**
GTI	80	-	-	**80**
AMS	80	-	-	**80**
TOTAL	**1390**	**30**	**15**	**1435**

7 Nomination of ITC Direction Board for 2022-2023

The 30th Board of Trustees propose to nominate the Direction Board of ITC for academic year 2022-2023 as following:

8 Annexes

Annex A

Pre-degree Foundation Program with Curtin

Level: International Pre-degree Foundation Program for Engineering and Science

Duration: 1 Year at ITC

Semester:2 Semesters

Maximum of hours per semester: 375

Lecture (L): 1L=15 hours

Tutorial (T): 1T=30 hours

Practice (P): 1P=30 hours

Table 15. Pre-degree Foundation Program for Engineering Stream

Year	Semester	Course Code	Subject	Credit	L	T	P	Hours
Y1	S1	FP-059	Effective Communication Skills	4	4	0	0	60
		FP-040	Engineering Mathematic I	3.5	2	1.5	0	75
		FP-060	Programming C++	3.5	2	1.5	0	75
		FP-050	Physic for Engineering I	4	2	1	1	90
		FP-022	History	2	2	0	0	30
		Total		17	12	4	1	330
	S2	FP-041	Engineering Mathematic II	5	3	2	0	113
		FP-028	Chemistry for Engineering	4	2	1	1	90
		FP-051	Physic for Engineering II	5	3	2	0	113
		FP-058	Writing and Research Skills	3	2	1	0	60
Total				17	10	6	1	375

Table 16. Pre-degree Foundation Program for Science Stream

Year	Semester	Course Code	Subject	Credit	L	T	P	Hours
Y1	S1	FP-059	Effective Communication Skills	4	4	0	0	60
		FP-040	Engineering Mathematic I	3.5	2	1.5	0	75
		FP-060	Programming C++	3.5	2	1.5	0	75
		FP-050	Physic for Engineering I	4	2	1	1	90
		FP-022	History	2	2	0	0	30
		Total		**17**	**12**	**4**	**1**	**330**
	S2	FP-041	Engineering Mathematic II	5	3	2	0	113
		FP-058	Writing and Research Skills	3	2	1	0	60
		FP-061	Business Information Technology	3	2	1	0	60
		FP-029	Introduction to Business Studies	3	2	1	0	60
Total				**14**	**9**	**5**	**0**	**292.5**

Annex B

Courses Description for Pre-degree Foundation Program with Curtin

No.	Code	Course Unit	Credit	Description
1	FP-040	Engineering Mathematic I	3.5	Basic Algebra includes solving absolute value of linear equations, and absolute value of linear and quadratic inequalities. Rational functions and its asymptotes, odd & even functions as well as piecewise defined functions are also introduced. Linear Algebra includes matrices and their determinants, and determining inverse matrices by the Gauss-Jordan method, as well as vectors and their applications in solving relative velocity, collision and shortest distance problems. Probability and its Distribution introduces basic probability principles and rules, as well as probability of discrete and continuous random variables. Analysis of Data consists of analysing the univariate and bivariate data through measure of central tendency, measure of dispersion, measure of association and linear regression line as well as introduction to statistical inference. Basic Trigonometry includes all trigonometric ratios, graphs, equations and identities.
2	FP-041	Engineering Mathematic II	5	The pre-requisite for this unit is Engineering Mathematics 061. Algebra consists of series and sequences as well as determining roots of equations by using factor theorem and remainder theorem. Trigonometry includes trigonometric identities involving compound and double angles, solving trigonometric equations and expressing trigonometric functions in harmonic form. Complex numbers cover different forms of complex numbers, loci of complex number on the Argand diagram, and the roots of complex numbers by De Moivre's Theorem. Calculus introduces first principle of derivatives, differentiation rules, numerical differentiation by Newton-Raphson's method, techniques of integration and numerical integration by Trapezium and Simpson's rules.
3	FP-060	Programming C++	3.5	This unit introduces students to C++ programming, and includes the topics of Computer fundamentals, Algorithms, Programming fundamentals & compiler basics, Flow control structures, Arrays, Modular programming, User-defined data types and Data storage types. It then introduces students to the basics of Object-oriented programming in C++ by including the topics of Class concept, Constructors, Inheritance & File processing.
4	FP-050	Physic for Engineering I	4	Physics 061 introduces students to the basics of physics, basic mechanics and thermal physics, basic electricity and basic optics. Basics of Physics includes SI units, measurement and error analysis.

				Basic Mechanics includes motion in one or two dimensions, dynamics, circular motion, rotational motion, work and energy, linear momentum, body in equilibrium, vibrations and waves. Thermal Physics includes heat, temperature and ideal gases. Basic Electricity includes Electric Currents and Direct Current Circuits. Basic Optics includes lenses and mirrors.
5	FP-051	Physic for Engineering II	5	The pre-requisite for this unit is Physics for Engineers 061. The syllabus as follows: Mechanics and thermodynamics will cover rotational motion, fluids and First Law of thermodynamics. Electricity and Magnetism will cover electrostatic, capacitors, magnetism, electromagnetic induction and introduction to alternating current. Oscillation and Modern Physics includes oscillatory motion (simple harmonic motion) and early quantum theory.
6	FP-028	Chemistry for Engineering	4	This unit is intended for the engineering foundation program of Curtin University Malaysia. It introduces students to Chemistry Foundations, Basic understanding of matter, Fundamental Physical and Organic Chemistry. • ***Chemistry Foundations*** including a brief review of basic concepts, atomic structure, electron configuration and periodic table, mole concepts, chemical equations and stoichiometry, solution and volumetric analysis, with a strong problem-solving orientation in addition to experimental approach. • ***Basic Understanding of Matter*** including chemical bonding, shapes and polarity of molecules, states of matter and intermolecular forces in order to support a systematic, logical approach to explain important phenomena of matter. • ***Physical Chemistry*** encompassed thermochemistry, chemical equilibria and chemical kinetics in order to account for the related natural phenomena, to carry out relevant calculations, and to facilitate chemical reactions for optimum performance in industry. • ***Basic organic chemistry*** includes systematic nomenclature for common organic functional group compounds, organic reactions and practical aspects of application in the daily life.
7	FP-058	Writing and Research Skills	3	This unit is primarily designed to introduce and develop capabilities and proficiency in the English language essential for tertiary education and for academic purposes, and to reinforce as well as extend existing skills and proficiency in the language. It specifically provides students with appropriate learning experiences to comprehend and interpret a variety of academic texts. It also develops further students' academic writing skills needed in tertiary education, so that students are able to research and write on contemporary topics that require discussion and development within an analytical report of 2000 words.

8	FP-059	Effective Communication Skills	3	This course is primarily designed to introduce students to the theories and practices of effective communication skills. Within this framework, students will develop an understanding of effective communication skills theories that are reinforced through individual and group activities.
9	FP-022	History	2	History is one of the most important social science subjects in the world. This course aims to significant contributes to the development of the basic knowledge and encourages student to understand their national identity through history. In addition, it also introduces student the historical development of the countries in the region and outside the world in terms of economic and trade activities, political trends, society, culture of Khmer people and other nations.
10	FP-029	Introduction to Business Studies	3	The fundamental concepts of business will be introduced at the beginning of the course followed by the management roles; functions and skills; and organization structures. This unit will familiarize students with the basic concepts and theories in business operations and in managing business organization. In addition, the unit will provide exposure to the functional areas of business such as management, operation, marketing, human resources and finance. There will be opportunity throughout the course to discuss current events in business as they apply to the topic being covered.

Annex C

Admission Requirement for Pre-degree Foundation Program with Curtin

To gain admission to the Curtin Foundation Program, students must have an overall IELTS score of 5.5 with no skill below 5 (or equivalent score in another recognized examination or having scored a C or better in the IGCSE/GCSE/O-Level, AS Level, A Level English exam) as outlined in **Table 1** and must meet the applicable academic requirement outlined in **Table 2** below:

Table 17. English Proficiency Requirement

English Language proficiency test requirements	**Foundation Program (Science, Engineering, Business stream)**
IELTS Academic	
Writing and Speaking	5.0
Reading and Listening	5.0
Overall	**5.5**
TOEFL iBT	
Reading	12
Listening	11
Speaking	17
Writing	20
Overall	**54**
PTE Academic	
Listening and Reading	40
Speaking and Writing	40
Overall Score	**42**
IGCSE/GCSE/GCE 'O' Level, AS Level, A Level English exam	C or better

Table 18. Academic Qualification and Minimum Entry Requirement

Academic Qualification and Minimum Entry Requirements	
GCE 'O' Level	Minimum of 5Cs including English or 5Cs and English competency, or equivalent as determined by Curtin.

Annex D

List of Human Resources at ITC for Pre-degree Foundation Program with Curtin

No.	ITC	Gender	Department	Degree	Specialist	Unit in Charge
1	LIN Mongkolsery	M	TC, RIC	Doctor	Functional Analysis, Analysis and Differential Equations	Engineering Mathematic 061/062
2	SIM Tepmony	M	GS, TC	Doctor	Applied Mathematics and Statistics	
3	PHAUK Sokkhey	M	TC	Doctor	Data Science	
4	LONG Sovann	M	TC	Master	Physic	Physic 061/062
5	HOUNG Peany	F	GCA	Doctor	Chemical Science and Engineering	Chemistry 063
6	KONG Phutphalla	M	GIC	Doctor	Computer vision and engineering	Programming C++ 063
7	Heng Rathpisey	M	GIC	Master	Natural Language Processing	
8	SIEN BROSS	M	ES	Master	Arts in teaching English	Effective Communicati on Skills 061
9	CHAT Koem Hong	M	ES	Master	Arts in English Education	Writing and Research Skills 062
10	HIN Raveth	M	GS, GCI	Doctor	Mechanics of materials	
11	Hiring Plan/Curtin Staff	N/A	N/A	N/A	N/A	Business Information Technology 061
12	Hiring Plan/Curtin Staff	N/A	N/A	N/A	N/A	Introduction to Business Studies 061

Annex E

Laboratories and Facilities for Pre-degree Foundation Program with Curtin

Table 1. Laboratory for Pre-degree Foundation Program

No.	Room number	Laboratory
1	F304-305	Physic Lab
2	F306-309-310	Computer Lab
3	Under construction	Data analytic lab

Table 2. Existing Facilities for Pre-degree Foundation Program

No.	Room number	Laboratory
1	A109	Class room
2	B221	E-learning studio
3	B220	E-learning content development

Urban Water and Sanitation Engineering (USE)

MASTER OF WATER AND ENVIRONMETAL ENGINEERING (MWEE)

Master of Water and Environmental Engineering
Specializing in
Urban Water and Sanitation Engineering (USE)

Introduction

1- Report of the consortium committee consultation

In the consultation of the consortium committee, Director of Graduate School and Head of the master program MWEE has discussed the proposal with Prof Adele MARTIAL, Representative of IRD in Cambodia on 29 April 2022, Dr. Sylvain Massuel, research scientist from IRD on 23 May 2022. In general, the committee agreed with the proposal to include the courses of guest lecture and internship in the current curriculum. They had constructive comments as below.

- **Course of Guest Lecture.** It should have Professional lecture. Prof. Martial agreed with this proposal and she recommended to improve its name as Professional lecture. The course can be provided by professional guest lecturers
- Prof. Martial proposed to formulize the **committee of the curriculum to review the program.** There should be a consultation meeting of the Master Program of the curriculum committee composing of industries, international scientists, experts of the areas, current students, governments to enrich ideas to improve the program.
- Prof. Martial mentioned there should be a **link project with industries**. The course should be enhanced by joining the industries companies by having the project topics proposed by the industries. That is the way to make the network for the students, it can be the project with foreigners' students from companies, partnership program and with the spirit of teamwork. And there should have the assessment of the projects including the **soft skills** such as leadership, communications…
- Prof. Martial proposed to have the course of **Environmental Law aspect**. It is important to let the students understand about the aspect of the environmental law for their future career. Dr. Ket mentioned that we have the course of Water Policy but it is not available.
- There should have indication of the **norm and standard** measurement in the courses of the water quality assessment both waste water and drinking water.
- Dr. Sylvain concerned about the soft skill of the students as mostly they did not perform the active learning by not asking question during the class and less interact with the lecturers. The skill should be enhanced to equip them with the critical thinking, active learning. The new 21th century skills should be introduced to the students.

The minutes meetings are attached in the Annex.

2- Modification of the curriculum proposal after the consortium consultation

After the swot analysis and the consultation meeting, we propose to add 2 courses, Professional lecture and internship courses to the existing curriculum of master of water and environmental engineering specializing in urban water and sanitation to enrich the program and answer to the market need. The importance and description of the course are provided as below.

Professional Lecture course

This course is a series of guest lectures. Using guest lectures can provide graduate students with the great opportunity to link theories with practice in the real world and networking. A

wide variety of guest lecturers from different industries and organizations will be invited to give lecture once per week. The guest lecturers can share their knowledge, expertise and especially an important professional experience for students based on their real-world life experiences that can reinforce the teachings of the instructor and the students' capacity. Students benefit greatly from being exposed to new pedagogies to get quality education. They can have the opportunity to meet passionate, committed and critical people and to learn from them in various ways. Guest lecturers can act as role models and bring an authentic, vivid picture of the real world to students, thereby enabling transdisciplinary learning. Experiences and perspectives from local actors and entrepreneurs inspire students in their own (entrepreneurial) projects, creating motivation and an action-orientation. They bring in special expertise and experiences that teachers cannot provide.

The students present an opportunity to utilize alternative technologies and teaching techniques into the course (flexibility). They increase the access to the experts. The experts can be from local and international agencies. They get to see the insight and perspective of the guest lecturers' specific field. The format can enable students to interact and engage with professionals to ask questions during and after class. Through discussions, interpersonal competence and communicative skills are fostered. Guest lecturers can contribute to have a single lecture, a lecture series over a specific topics and period.

Internship program

A three-credit internship program is designed to enrich the students with career-related work experiences to gain confidence and skills to become more mature professionally in any private company, government agency, or non-profit organization.

Students who successfully complete an internship will be able to i) Apply knowledge obtained from class to real-world challenges in an internship place, ii) improved skills and maturity in performing within professional work environments, iii) achieved specific learning objectives agreed upon between the student, academic adviser, and hosting internship place.

8.1 MWEE in Urban water and Sanitation Engineering

Program Objective

In Cambodia, there is urgent need of water and sanitation engineering specialist to address the problems of providing adequate water supplies, and design and management of urban drainage with water and wastewater treatment facilities. The Master Program of Urban water and Sanitation Engineering aims to produce highly capable human resources to operate and manage water supply and wastewater treatment and sewage system. The program will provide students with an in-depth knowledge of how to deliver effective modern water supply and sanitation engineering. The students will learn to deal with technical aspects of drinking water treatment and distribution, as well as sewage collection and treatment (on- and off-site), in an integrated way, design the treatment plant and pay attention to the choice of technologies and services. They will be able to manage the utility function of a supply and treatment plant. The program will also train the practitioners, technical persons and decision makers who have limited capacity to become experts with strong management and responsible leadership of a development project. Once students have successfully completed this program, they will obtain a position in the wider social, economic and environmental contexts of urbanization and municipal water and infrastructure services provision. This program aims also to provide students with the tools and knowledge to contribute to the development of innovative

approaches to the provision of sustainable and equitable municipal water, sanitation, environmental and infrastructure services in developing and transition countries.

Career Opportunity after Graduation

After graduation the student will become civil water supply and sanitary engineers working in water supply and waste-water companies, municipal assemblies, government ministries and consulting companies dealing with water supply, sanitation and municipal infrastructure.

Courses

Urban Water and Sanitation Engineering (UWE)

Core Courses	Elective Courses	Specialized Courses	Research-oriented Courses
1. Applied Statistics	1. Hydrology	1. IWRM and Watershed Management	1. Research Methodology
2. Chemical Kinetics	2. Water Chemistry	2. Water Quality Assessment and Management	2. Seminar on Water and Environmental Engineering
3. GIS and Remote Sensing for WEE	3. Sustainable Solid Waste and Hazardous Management (not available)	3. Processes Engineering	3. Professional Lecture (New, 2 credits)
4. Entrepreneurship	4. Environmental Monitoring and Modelling	4. Micro-biology and Toxicology	4. Water and Environmental Laboratory
5. Project Management	5. Water Policy and Planning (not available)	5. Water Treatment and Distribution System Design	5. Mini-Project
	6. Water Induced Disaster Risk Assessment	6. Urban Drainage and Sewerage System Design	6. Internship (New, 3 credits)
	7. Sustainable Energy Management and Conservation (not available)	7. Wastewater and Sludge Treatment Process	
	8. Urban Pollution Control	8. Management of Water Supply and Sanitation	
	9. Environmental Impact Assessment		
	10. Climate Change Impacts and Adaptation		
	11. Environmental Law (New)		

Programme structure

First Year

Semester 1		Semester 2	
Course	**Credit**	**Course**	**Credit**
Chemical Kinetics	2	IWRM and Watershed Management	2
Project Management	2	Processes Engineering	2
GIS and Remote Sensing for WEE	3	Micro-biology and Toxicology	2
Research Methodology	2	Water Quality Assessment and Management	2
Seminar on Water and Environmental Engineering	1	Elective Course	4

Water and Environmental Laboratory	2	Internship (New)	3
Elective Course	2		
Second Year			
Entrepreneurship	2	Professional Lecture (New)	2
Applied Statistics	2	Research Proposal	3
Water Treatment and Distribution System Design	2	Scientific conference with presentation	3
Urban Drainage and Sewerage System Design	3	Master Thesis and Defense	6
Wastewater and Sludge Treatment Process	3		
Management of Water Supply and Sanitation	2		
Mini-project	2		
Elective Course	2		

SWOT analysis

Master of urban water and sanitation engineering has launched through the support of AFD/EU program since 2018. In order to improve and sustain the program, we do the SWOT analysis through a survey discussion with alumni and relevant stakeholders in 2021. The following table shows the SWOT analysis of the master program.

Strength	
Financial support	• Financial support from AFD and HIEP project until 2023 for the master program of Urban and Sanitation Engineering.
Leadership	• Leadership team with great motivation to lead the program toward the international reputation.
Reputation	• The reputation of the ITC school is strong in the local and international context. One Myanmar and French students have graduated from the master program and many other foreigner students from Indonesia, Laos, Vietnam, Africa contacted us for scholarship study.
Flexible curriculum	• Flexible curriculum allows students to engage in different pathway program such as course and research-based program and research-based program. From 2021-2022 academic year, the program has launched the research-based pathway. This has great attraction for many students of ITC to join this. There are 7 students join this academic year of 2020-2021. And one from the owner of a water supply company. That is a good sign of the program among the private industries.
Lecturers	• Highly qualified and dynamic teaching staffs. They provide sound scientific and technological knowledge for professional life to the master students. They have had grant to support students for research thesis.
Expertise	• The program is known as the leading academic and research experts in the field of water and environmental engineering.
Market need	• High market needs in the field of WASH sector both public and private sectors.
Graduation rate	• Successful 4-year graduation rates since 2018-2021.

Weakness	
Scholarship/Project grant	• Financial limitations and support. The current course-research based program depends heavily on the scholarship sponsor from AFD that will be end by 2023.
Instructors	• Some instructors' expertise is not fit to the courses designed.
Laboratory	• The laboratory activities of each course are still limited.
Study duration	• One-year system that request one semester for course and one semester for research is very limited the research period for course-research based study.
Research thesis qualification	• The research scope for qualified graduate is required to strengthen for ensuring the graduated student quality.
A mandatory internship or a field-implemented project	• A mandatory internship or a field-implemented project where students can demonstrate the knowledge, they are learning in the classroom would make their candidacy stronger. (Comments from companies and intentional organization)
Marketing	• Lack of awareness of the master program in the private sectors and public institutions. (Some provincial departments did not know about the program until we met them to show the program.). • Marketing strategy and skills are still limited to produce video for promoting the master program.
Teaching and learning methods	• It is heavily on lecturer-center study methods. The student center method should be enhanced.
Job Market	• Some master graduates commented having difficulty to find a job to match the field in a short time period. Limited industry linkage cooperation for being ready for the students to catch the job. No event/workshop to recruit the position of the fresh graduates. • Some lecturers advise also that to connect with market network, **industry internship** is important to let the students, lecturers and industry work together.
Competency	• Competency should be well defined for each course and align with the competency of the program.
Professional Management Skills	• Because the lecturers have less experience in the industries, therefore there are lacking on management part in their courses. Therefore, **Guest lectures/seminars** are important for the students to understand the experience from experts from potential industry. It will be more attractive for their future professionalism and job market network with industry.
Study space	• Limited study space for research-based students
Research sources	• Poor access to scientific literature
Quality assessment	• Internal quality assessments are not yet totally implemented.
Opportunities	
Partnerships and Grants	• There are great opportunities to extend more collaboration and partnerships both international and local stakeholders in the field of water and environmental engineering. GIZ, JICA, ADB are the

	potential partnerships for the further collaboration. Opportunities to collaborate with other donor stakeholders such as IRD.
Internship and industry linkage	• There should have an active collaborating with companies and public entities, namely through Projects/Internships as team work. This will create new opportunities for students, promoting multidisciplinary and multicultural teamwork.
Competency based pathway	• Competency or module-based pathway can be another study pathway that opens to different needs of the market need.
Solid waste management	• Solid waste management should be enhanced in the master program. • After a survey, the organizations mentioned in looking for expertise in the following area, e.g., fecal sludge management (on-site waste treatment) and solid waste management (trash disposal, recycling, and reuse) • They emphasized on other desired skills including computational analysis, critical thinking, ingenuity, presentation and writing skills, etc.
Threat	
Tuition fee	• Will we need to raise tuition or fees to support our growth after 2023 after reforming the program?
Pandemic impact	• Covid-19 continuity would limit the opportunities for many students

Annex G [Perspective-M-ETM-2022-2023]

CURRICULUM DEVELOPMENT PROPOSAL

Program Level: International Master's Degree

Major: Energy Technology and Management Engineering (ETM)

I. Background and rationales

While the Master program had been established initially by mainly focusing on electrical energy system, it has been expanded to be multidisciplinary program accessible to students from 4 departments of ITC (GEE, GIM, GCA, GCI). However, the program objectives still need more evaluation and improvement so that it can provide what the industry and market need. By reflexing on the current market trending, other aspect such as Energy Technology and Energy Management are vital for future energy industries in Cambodia. Thus, the ETM research unit under ITC had decided to extend the former electrical energy master curriculum to Energy, Technology and Management or ETM master. The objective is to modify the program in order to reply to the current and future market.

The proposed new ETM curriculum is created based on the joint efforts of qualified lecturers, researchers and teaching staff from relevant departments such as GEE, GIM, GGG, etc. The team is working on the data analysis from the primary result of the survey that has been implemented recently. Surely, we can finalize the final curriculum within this year and ready for the new academic.

Also, the program is backed by international partners such as ITB in Indonesia (under WB project), La-reunion University, Toulouse INP and Grenoble INP. This cooperation enables student exchange for course and internship at highly qualified establishments.

Another main aspect of the ETM master program is the availability of high-quality laboratories from the relevant departments and from the partner universities.

The first draft of the curriculum for Master ETM has been developed following the meeting, discussion and consultation involving stakeholders which clearly defined the Program Education Objectives (PEOs) as well as Program Learning Outcomes (PLOs).

II. Proposition to Update current curriculum

1. Description of updated program

Master of ETM is a minimum 54-credit (more than requirement from CQF) multi-disciplinary degree program, intended for students who have completed undergraduate degree in science and engineering, specialized in energy, electrical, mechanical, and other energy-related engineering fields. ETM master program is designed for the need of preparing graduates to solve real-world problems and become expert in the field of energy, energy technology, policy, management and audit. It is also inspired by the need for solutions to tackle the challenges the world will be facing in realizing a sustainable energy system, i.e. environmentally friendly, economically viable, and resilient in the face of natural risks. The master program will also provide necessary skills for future researchers who wish to use their abilities and capabilities to take part in the exciting challenge of solving energy-related issues.

2. Program educational objectives (PEOs)

Graduates of the Master of ETM Engineering will be able to:

PEO-1. Be a leader or influencing engineer in the various fields of Energy Management and Technology for the context of Cambodia as well as region.

PEO-2. Demonstrate an ability to apply advanced engineering methods to the solutions of complex energy-related engineering problems.

PEO-3. Become an entrepreneur equipped with basic technical knowledge, leadership, management and understanding of financial management.

PEO-4. Pursue advance degree in local or international universities.

3. Program learning objectives (PLOs)

The ETM master program aims to provide students a set of knowledge and technical skills in engineering that can be applied in a variety of disciplines. Upon successful completion of this major, graduates will:

Knowledge

PLO-1. Obtain knowledge of Energy Management

PLO-2. Obtain knowledge to use cutting-edge technology for problem-solving in the field of energy management and technology.

PLO-3. Obtain knowledge to prepare/develop an effective energy planning/regulation/policy in the framework of complex energy-related problems.

Cognitive skills

PLO-4. Be able to analyze the problem of energy management and technology for industrial /public sector.

PLO-5. Be able to create the Energy management platform for context of Cambodia.

PLO-6. Be able to predict the energy problem projection and propose solutions.

PLO-7. Be able to invent the tool or system to solve the energy management problem with cutting-edge technology.

Psychomotor skills

PLO-8. Use digital technologies and appropriate software competently to enhance study and practice.

Interpersonal skills and responsibilities

PLO-9. Be able to demonstrate leadership, autonomy and responsibility in managing resources.

PLO-10. Be able to demonstrate effective collaboration with stakeholders professionally.

PLO-11. Be able to engage self-advancement through continuous learning or professional development.

Communication, Information technology and numerical skills

PLO-12. Be able to demonstrate entrepreneurial skills with relevant knowledge and expertise.

PLO-13. Be able to evaluate numerical and graphical data critically using quantitative or qualitative tools in solving problems.

PLO-14. Be able to communicate effectively the knowledge, skills and ideas using appropriate methods to peers, experts and communities.

4. Program's Structure and Requirement

4.1. Program's Structure

In principle, students need to follow a 2 years course (M1 and M2). For qualified students who are graduated from ITC engineering program, they can follow only 1 year program (M2). The total credit is 54 credits. Students may take no longer than 3 years to obtain the required number of credits for graduation.

The program has 2 options:

- Course and Research Pathway:
  - 33 credits in course work
  - 12 credits in research project.
- Research-Based Pathway:
  - 12 credits of course work
  - 33 credits of research activities.
  - An article publication

Course-Research pathway:

Semester I (M1)	Semester II (M1)	Semester III (M2)	Semester IV (M2)
Specialized and Core Courses (12 credits)	Specialized and Core Courses (8 credits)	Specialized and Core Courses (12 credits)	Thesis: Research Proposal Defend, Presentation in Seminar or Conference, Report and Defend (12 credits)
Elective course (2 credits)	Elective course (2 credits)	Elective course (2 credits)	
	Project (3 credits)		

Master ETM

No	Code	M1	Semester I			Semester II			Nb. Credit	Comment from Maurice Fadel	Correction checklist
			CM	TD	TP	CM	TD	TP			
1		Energy Sustainability, Regulation, and Audit	16	32					2		
2		Electrical Energy and Smart-Power System	16		32				2		
3		Energy Conversion System (Power Electronics II)				32	16	16	3	More TD and TP	Done
4		Energy Efficiency	32	32					3	More TD and TP	
5		Energy life-cycle and emission analysis	32						2		
6		Engineering Optimization tool	16		32				2		
7		Energy Research Project 1 (Research Methodology)			32				1		
8		Thermal Energy Management				32	16	16	3	More TD and TP	Done
9		Thermal Energy Technology				32	16	16	3	More TD and TP	Done
10		Communication and interpersonal relation						32	1		
11		Energy Research Project 2						32	1		
12		Advance Control for Renewable Energy Integration	32		16				2	More TD and TP	Done
13		Energy Business Modeling				16	16		2		
14		Work Life and social psychology				32			2		
		Subtotal	144	64	112	144	64	112	29		
		Ratio CM/TD/TP	45.0%	20.0%	35.0%	45.0%	20.0%	35.0%			
		Total by semester	320			320					
		Total by year	640								

No		M2	Semester I			Semester II			Nb. Credit	Comment from Maurice Fadel	Correction checklist
			CM	TD	TP	CM	TD	TP			
1		Energy Management and Planning	32	16	16				3		
2		Renewable Energy Integration into Power System	16		16				2	French teachers, in particular from the INPT, may be solicited.	Done
3		Long project			32				2	Include project or BE (Bureau d'études) or BEI (Bureau d'Etudes Industriels)	Done
4		Project Management	32						2		
5		Techno-entrepreneurship	32						2		
6		Research Proposal			64				2		
7		Final Year Internship							12		
		Subtotal	112	16	128	0	0	0	25		
		Ratio CM/TD/TP	35.0%	5.0%	40.0%	0.0%	0.0%	0.0%			
		Total by semester	256			0					
		Total by year	256								
								Total Credit	54		

Remark: text in red is a modification according to France Prof.

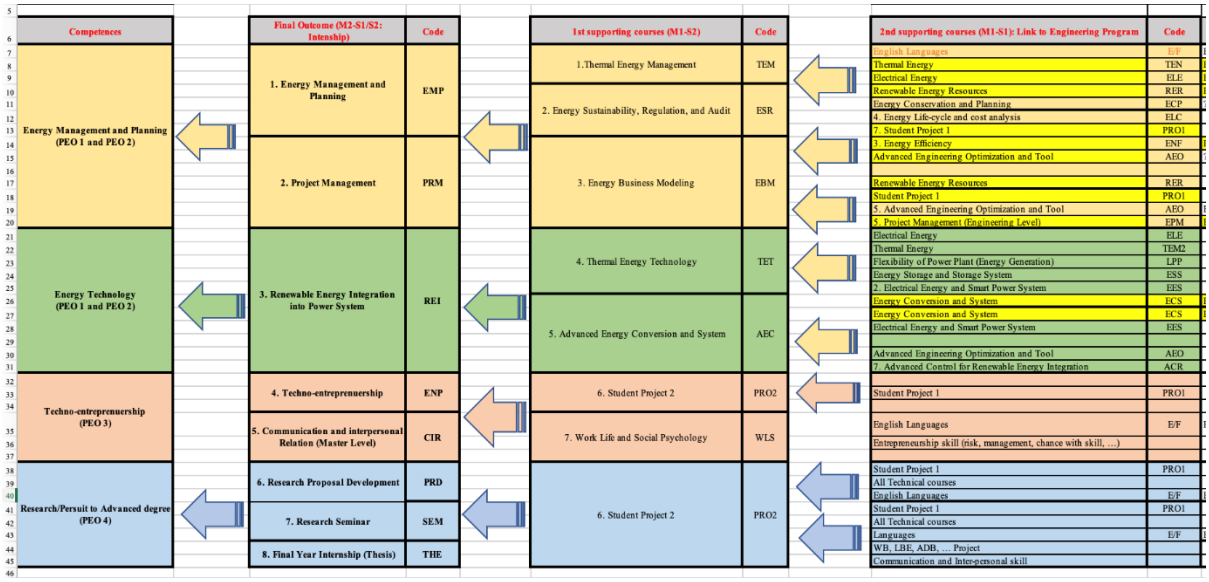
Research-based pathway:

Semester I (M1)	Semester II (M1)	Semester III (M2)	Semester IV (M2)
Choose courses based on topic: Core Courses, Elective Courses, Specialized Course (6 credits)	Primary research report and defense (9 credits)	Research-oriented courses (4 credits)	Publication in national or international journal (6 credits)
Research-oriented courses (2 credits)	Graduate Seminar (1 credits)	Detailed research proposal and defense (2 credits)	Thesis and defense (18 credits)
		Graduate Seminar (2 credits)	
		Presentation in scientific conference (3 credits)	

Course list and description

No	Courses	Descriptions
1	**Energy Efficiency and Audit**	This course will provide the knowledge and skills to conduct energy efficiency audit and provide the customers with solutions to their increasing energy costs. It teaches students to evaluate the energy efficiency, health, and safety of a home and to use diagnostic equipment to identify areas for energy savings.
2	**Electrical Energy and Smart-Power System**	This course presents the basics of electrical system and smart grids. The smart grid of the future is a complex electrical power system. Its study, design, and management requires the integration of knowledge from various disciplines including sustainability, technology and mathematics.
3	**Energy Conversion System (Power Electronics II)**	This course provides a basic background in static and electromechanical energy conversion devices; intended for students with interests in the control of electrical and electromechanical systems with applications to electric energy systems.
4	**Energy life-cycle and emission analysis**	This course will provide basic introduction to LCA and its relation with environmental decision support.LCA is a methodology used in environmentally-conscious manufacturing and supports the analysis of environmental burden accumulated during the product life cycle, with the intention of driving improvement programmes. This course is targeted at individuals who are aspiring to become product engineers, manufacturing engineers, industrial designers, etc., or any technology or engineering-related field.
5	**Engineering Optimization tool**	This course provides basic introduction to optimization methods for engineering students. Students should have basic computer programming skills using a language such as C, C++, MATLAB, or Python.
6	**Thermal Energy Management**	This course involves the application of the fundamentals of thermodynamics in internal and external energy gains, heating and cooling, duct and piping design, and overall thermal design specifications and system component design and selection.
7	**Thermal Energy Technology**	This course will provide basic and conceptual understanding about various thermal energy technologies.
8	**Communication and interpersonal relation**	This course presents concepts essential to understanding the complex dynamics that go into constructing and maintaining our relationships, offering a multitude of research-based insights that will help students better understand themselves, their relationship partners, and relationship dynamics.
9	**Advance Control for Renewable Energy Integration**	This course will enable students to develop an understanding of sustainability issues and renewable energy systems, to examine the role of microprocessor control in industry, and to design and build a control system for power conversion using static converters.
10	**Energy Business Modeling**	The course is designed to help students who wish to perform Energy Modelling of Building. It gives hand on practice to create the building, to apply energy efficiency measure and to predict the building performance before it is made. It is a consolidated course to understand Energy Modelling from scratch and to be expert in the same. All modules have explanation videos about What is energy modelling followed by details of eQuest software.
11	**Work Life and social psychology**	The pressure of an increasingly demanding work culture is one of the biggest challenges to society's mental health. This course offers some answers based on the latest research from social psychology. This course provides a brief introduction to classic and contemporary social psychology, covering topics such as decision making, persuasion, group behavior, personal attraction, and factors that promote health and well-being.
12	**Energy Management and Planning**	This course presents about the basic of energy management systems standard and how it can be applied to various cases. Students will also learn about the possible relevant financial benefits related to government energy and tax/funding policy.
13	**Renewable Energy Integration into Power System**	Renewable Energy Integration is essential in modern day electrical grid systems. This course focuses on how to incorporate renewable energy, distributed generation, energy storage, thermally activated technologies, and demand response into the electric distribution and transmission system. The solar power and wind turbines approaches are being used to conduct integration development and demonstrations to address technical, economic, regulatory, and institutional barriers for using renewable and distributed systems.
14	**Techno-entrepreneurship**	The courset provides students with technological knowledge about entrepreneurship as well as the skills to turn such knowledge into practice. The teaching and learning activities include case study and field work with the aim to inculcate entrepreneurship values and entrepreneurship acculturation with a view to successfully launch and subsequently manage their enterprises. Students will be exposed to the support systems available or government agencies in starting new ventures, including the tactics commonly employed by entrepreneurs starting a business.

Courses and Competencies Mapping



4.2. Program's Requirements

2.1. Admission Requirement

Students can register for the program if they can fulfill the required conditions. Students who are graduated with a bachelor degree in the field of electrical, mechanical engineering, and some other related engineering fields are accepted for this program. However, graduated students from ITC can directly register for M2 program after evaluation from technical committee (passing certain qualification). Graduate students from other institution have to start and to register for M1 program (they need 2 years to complete program) after evaluation from technical committee.

2.2. Graduate Requirement

In order to graduate, students are required to obtain a minimum number of credits and fulfill certain condition depending on the pathways or other conditions as defined by graduate school.

- Course and Research Pathway:
  - 33 credits in course work
  - 12 credits in research project.
- Research-Based Pathway:
  - 12 credits of course work
  - 33 credits of research activities.
  - An article publication

4.3. Methodology

The students have to follow a 2 years course to obtain the required number credits. For M1, students follow mostly course work. In M2, they follow additional courses in the first Semester. In the second semester, they need to do internship with private sector or industry or in the research laboratories.

Students learned through course-based, project-based research activities and internship at industries. For research-based pathway, students can do their research through projects linked with research labs at ITC. For course-research pathway, students can apply for joint project with industries in order to experience real practical problem solving.

III. Resources

1. Human Resources and Planning

Backing this program is a curriculum development committee that has been formed to help in developing the needed improved program curriculum. Qualified lecturers and teaching staffs are already available from relevant departments such as GEE, GIM, GCI, GCA and GGG.

Nevertheless, there are few newly proposed courses which will require additional staff upgrading and new recruiting.

2. Facilities and Laboratories

All facilities and laboratories that are ready for this ETM master program includes:

- Thermal lab: coordinated by Dr. VONGCHANH Kinnaleth.
- Power System lab: coordinated by Dr. VAI Vannak.
- Renewable energy lab: coordinated by Dr. VAI Vannak.
- Control system and automation lab: managed by Dr. KIM Bunthern
- Biomass lab.
- Petroleum lab.
- Environmental Microbiology lab.

3. Planning

Under the Higher Education Improvement Project (HEIP), a certain number of staffs are expected to follow higher degree program for staff upgrading. For instance, a PhD degree with partner university under joint project is granted to Mr. CHHENG Monyvathna under the partnership program with ITB. with the research grants, more laboratories will be set-up and upgraded. A new Fab-Lab in new building (under ADB grant) is also established to support the program.

IV. Partnership and Supports

1. Partnership

The ETM master program have engaged and cooperated with a number of international institutions and universities. These include ITB (Indonesia), Toulouse INP, Grenoble INP, La-reunion University, and ECAM LaSalle. With the partnership program under HEIP project, ITB are cooperating with ETM program in developing its curriculum, proposing joint research activities, upgrading staffs and training ETM staffs.

For industry, one partner of the master ETM is the French Company Sirea. Sirea is implementing a training factory and a design office in ITC for capacity building in renewable energy electrical energy systems. Under the ETM research unit, cooperation with Energy Consultant company such as Sevea has already been established.

The ETM program is also seeking to create more connection with more institutions including EDC, and the Ministry of Energy and Mines. It will also develop specific partnerships with companies in Cambodia for seminars and technical visits with different teaching units and collaboration within specific projects and master thesis work.

2. Development Projects

Currently, the ETM program is being developed and improve with the partnership program under HEIP project with ITB, a highly rated university in Indonesia. ETM is cooperating with ITB to improve its curriculum, propose joint research activities, upgrade staff's qualification and train ETM staffs.

Annex H : Perspective-M-AIE-2022-2023]

CURRICULUM UPDATE PROPOSAL

Program Level: Master's Degree

Major: Agro-industrial Engineering (International program)

I. Background and rationales

In 2017, ITC launched the master program of Agro-industrial and Environment which was under department of food science and technology (now become Faculty of Chemical and Food Engineering). Since then, about 30 students have enrolled to pursue their master's degree with this program and now some of them are working for their research thesis. Recently, the graduate program in ITC is modified to comply with the five-research thematic (Research unit). Among those five thematic, Food Technology and Nutrition unit is one of the main research field in ITC. As the previous program was too broad which it was combined two research units together (WAE and FTN), so to avoid the duplication of the field, graduate school has modified the previous master program which is called Master of Agro-Industrial and Environment to the specific name as Agro-industrial Engineering (M-AIE) in 2019 by eliminated the environment part while ITC has also established Master of Water and Environment in 2019 as well. Even though, graduate school has narrowed down and specialized the M-AIE program, but this program is still not inclusive enough and well structure. We have done the SWOT analysis to find the strength and weakness of the program and propose to modified this program base on the analysis.

1. **SWOT analysis of the current program**

Master of Agro-industrial Engineering of Institute of Technology of Cambodia	
SWOT ANALYSIS	
STRENGTH	**WEAKNESS**
Have strong collaborations with universities both local, region and in the world	The old program is not inclusive enough and well structured
Have research structure to support research students	The old program's curriculum is more relavent to environment courses almost 40% which isnot fit with its own shmeme
Most of the courses can be adapted to and conducted in English	The curriculm of course base and research base are not well structure and not yet standardize
Have adequate ICT facilities to support teaching and learning	The old program isnot atractive enough to get attention from students inside and outside ITC
More than 70% of faculty/staff have terminal degrees.	The programs lack addressing the market needs as more than 50% of graduates earn less than expected standard income
Have strong support from bachelor program (faculty of chemical and food engineering)	Lack of competitive scholarships to attract outstanding students
	Lack of supports and colaboration from industrial/SME in research activities for graduate students
	The only local program and certificate is not so favorable and atrractive to students while they prefer more international program and certificate
	Teaching capacity is yet to be ameliorated to meet standard requirement
	Lack of research fund/grant to support student research activities
	Currently used technology and equipements are far behind the industrial needs
	Poor connections with local industries and SMEs
OPPORTUNITY	**THREAT**
Growing demands in STEM skills in Agro-food industry	Outstanding students seek for scholarships abroad
Growing demands in international programs regarding food science	Decreasing number of students enrolling (no willing to pay by themselve)
Growing new startup and incubation center regarding agri-food chain development	Cambodia readiness in preparing new skills to challenge international market is slow
Agri-food product development /Agro-insudtry is one of the main target in SDG of Camboian government to improve and increase GDP	Society undervalues local degree
Growing demands in technological innovatoin in food product development skill	Sttaffs of SMEs/Industries/Mistries donnot get full support to pursure and extended their knowledges at university from their firms.
Growing demand in skillset for food industrial-revolution market	Industries are isolate from university in research colaboration and innovation
Increase the demand of standardize on agri-food products for exportation both local and international	Very few SMEs have willing to colaborate with University while the rest ignore
Needs for improvement to address the weakness	**Priorty**
Improving the old curriculum to be standandized and internation acceptance	Develop the new curriculum that answer to the competency of job market needs
Offering dual degree (local+internation) program to atract more students	Colaboration with famous rigional university in the field of Ago-industry to establish the dual program
Need sustainable fund/grant for research activities for graduate students	To seek for fund/grant for research activities, from national/international partners including universities, public/private institutions, NGOs, industries, and other possible donors.
Increase number of staff to be equipemnt with solid one skill per person	Gather sufficient human resources
Upgrade staffs' capacity in terms of skills set and new technology adoption	
Improving the connection with industries and SMEs	
Need a better straitergy or detail planing to attract SMEs/Industiries involving in staff buiding capacity through gratuate research	

1. Analysis on the demand of skills and competencies

The survey for skill needed and competency is conducting with SMEs in Cambodia for primary data analysis and collecting secondary data from Cambodia Industrial Development Policy 2015-2025, Cambodian's science technology innovation roadmap 2030, and other government related policies, FoodSTEM, and Foodi programs to support some integrated courses in the revised curriculum.

II. Proposition to update current curriculum

1. Description of updated program

The Master of Agro-industrial Engineering (M-AIE) is a 54- credit multidisciplinary degree program, intended for students who have completed undergraduate degree in science and engineering, specialized in food science and technology, chemical engineering, and agriculture. M-AIE is modified its program to be more internationally and competency by develop its curriculum up to date and standardized base on the requirement of the skill needs from current job market competency in the field of agro-food industry by locally, regionally and globally. This modification program also established a double degree program with Kasetsart University of Thailand which the modification will be 100% approve and parallels with Kasetsart university's program. The program has two pathways, research base and course research base program. The course requirement is categorized into Core Course, Elective Course, Specialized Course and Research Oriented Course. The program is designed to train the master students learn not only technical skills but also management capacities with critical thinking following the requirement of educational quality framework of Cambodia for higher education in science and engineering. The students will learn some courses of soft skills including entrepreneurship, and project management. To maintain our good educational quality and professionalization, the students will be required to conduct a professional internship at public or private institution which is working on their related field. On the other hand, instead of internship at public or private institution, the student can choose to do research work with their adviser at ITC/Kasetsart (for double degree) if needed. To graduate, for course research base program, the students are required to pass research proposal and then write the thesis and pass the thesis defense which will be evaluated by thesis evaluation committee and get approval from all juries. The topic of thesis must be composed based on the works for professional internship or research at ITC and it needs to be specific and agreed by adviser. Other course requirement needs to be completed for graduation. For research base program, the students are required to complete some requirement credit from course works, pass primary research report defense, pass the detailed research proposal defense, participate by presenting research work in scientific conference, publishing their research work in national or international journal, and then write the thesis and pass the thesis defense. For dual degree program, the student has to fulfill the requirement of graduate requirement of Kasetsart university and ITC graduate requirement.

2. Program educational objectives (PEOs)

The M-AIE program aims to equip the students with knowledge and skills in the agro-industrial field to promote their creativity, capability and problem-solving skills through advanced knowledge and various experiences including agro-product processing design and modeling, research methods in the agro-industry, product innovation and entrepreneurship. The two pathways. (1) Course-research, and (2) Research based pathway, provide the options for any individual in the agro-industrial related area to advance their knowledge and skills either in research and development, or seeking high-skilled employment, or starting their own business in the agro-industry.

After successfully graduating in Master Program of Agro-industrial Engineering at ITC, the graduates shall be able to:

Program educational objectives (PEOs)

PEO-1. Be a professional engineer in the multidisciplinary fields of Agro-product processing and management.

PEO-2. Gain the intellectual ability and advance technology to engage in critical thinking, problem solving, and research and innovation in the Agro-industry.

PEO-3. Become an entrepreneur equipped with soft skills, management, and cost analysis in the field of Agro-industry.

PEO-4. Engage in independent and life-long learning for professional, ethical, and social skills.

Knowledge

PLO-1. Deeply understand all relevant problems through theoretically and practically regarding Agro-product processing.

PLO-2. Use the problem solving, critical and innovative skills to develop and initiate ideas regarding Agro-product processing.

Cognitive skills

PLO-3. Critically analyze the complex problems related to agro-product processing and be able to interpret or demonstrate the results from the data in scientific way and in simplified way to the public.

PLO-4. Develop process toward solutions and prototypes to tackle the problems in agro-industry by using advanced technical skills and knowledge.

PLO-5. Evaluate any possible risk in the agro-product processing to provide safety solutions in the factory or industry in practices.

PLO-6. Predict the work process by using simulation analysis and be able to improve and develop the process in agro-product processing.

Psychomotor skills

PLO-7. Use analytical instruments for evaluating agro-product qualities and agro-product developments.

Interpersonal skills and responsibilities

PLO-8. Show desire to learn through individual and group project-based and research activities, project implementation, supervision guiding by supervisor/mentor, and work independently as a responsible entrepreneur/scientist.

PLO-9. Demonstrate strong leadership and negotiation skills.

PLO-10. Collaborate effectively, entrepreneurially, professionally, responsibly, and integrally with team members and others.

Communication, Information technology and numerical skills

PLO-11. Effectively use the ICT software, statistical and numerical methods to generate and analyze data.

PLO-12. Demonstrate effective presentation skills on experimental results and conclusions using scientific and simplified methods.

PLO\PEO	PEO1	PEO2	PEO3	PEO4
PLO1	**F**	**F**		
PLO2	**F**	**F**		
PLO3	**F**	**F**		
PLO4	**F**	**F**		
PLO5	**F**	**F**		
PLO6	**F**	**F**		
PLO7	**F**	**F**		
PLO8				**F**
PLO9			**F**	
PLO10			**F**	**P**
PLO11	**P**	**P**		
PLO12	**P**	**P**		

-P: Partially fulfill

-M: Moderately fulfill

-F: Fully fulfill

4. Job opportunities

After graduation from Master of Engineering of Agro-industrial Engineering, students can have job opportunities as below:

- Private sector such as laboratory manager; production manager, technical consultant in agro-product processing, or entrepreneur in an agro-processing company

- Governmental institutions such Ministry of Education, Youths and Sports, Ministry of Industry, Science, Technology and Innovation, Ministry of Commerce – Department of Cam Control, Ministry of Health, Ministry of Agriculture, Forestry and Fisheries, Ministry of Environment,

- Non-governmental organizations working the agro-industry related fields.

- Pursuing research or Ph.D. programs in the agro-industry related fields.

5. Program's Structure and Requirement

5.1. Program's Structure

Based on the educational qualification framework of Cambodia, for master degree program of engineering, the students are required to pass 45 to 57 credits. The credit requirement for the program needs to be complied with the qualification framework of ministry of education youth and sport. The structure of the program consists of core course, elective course, specialized course and research oriented course. Number of credits requirement in each course categories is different between Plan A (Course-Research Based) and Plan B (Research-Based). However, the total minimum requirement for the number of credit is set to be 54 credits which is the same for both Plan A and Plan B.

This master's degree will accept the applicant from two categories which are ITC students and non-ITC students. ITC students referring to those who graduated Bachelor of Engineering degree from ITC with Faculty of Chemical and Food Engineering or Faculty of Geo-resources and Geotechnical Engineering. Non-ITC student refers to those who graduated bachelor's degree from other university/institute aside from ITC but their background must be in the field of science and engineering related to food science and technology, chemical engineering, agriculture engineering, and chemistry and biological Science and engineering.

In order to strengthen the research activity particular in the research unit Food Technology and Nutrition and encourage the student to involve with research as young researcher initiative, the program needs to divide into Plan A and Plan B. Plan A is referred to "Course-Research Based pathway" while plan B is referred to "Research-Based pathway". The requirement of academic plans is described as the following:

A. Plan A (Course-Research Based Pathway)

❖

- The total credit requirement is 54 credits. It includes 42 credits of coursework (minimum requirement based on qualification framework is 33 credits) and 12 credits of research thesis.
- Professional Internship at a professional institution or at ITC with advisor.
- 1 year for ITC student with his/her minimum grade-point average (GPA) greater than 2.5 (C+) on a 4.0 scale, and 2 years for non-ITC students or ITC students with his/her GPA between 2.5 and 2.0.

- For double degree with Kasetsart University, both ITC and non-ITC students have to enroll at least 2 years in which 1 year in Cambodia (for course-research work) and 1 year at Kasetsart university (only research work). The eligibility to enroll in the program unless her/his minimum grade-point average (GPA) greater than 3.0 on a 4.0 scale.
- Summary of credits
    - Core courses 8 credits
    - Specialized courses 16 credits
    - Elective courses 8 credits
    - Research oriented courses 10 credits
    - Research activities
        - Presentation in scientific conference Required (No credits)
        - Research thesis 12 credits

B. Plan B (Research-Based Pathway)

- The total credits requirement is 54 credits. It includes 12 credits of course work (minimum requirement based on qualification framework is 12 credits) and 42 credits for research.
- 1 year for ITC student with his/her minimum grade-point average (GPA) greater than 2.5 (C+) on a 4.0 scale and 2 years for Non-ITC students and ITC students with his/her GPA less than 2.5
- Full-time research student at ITC/ KU (for double degree)
- For double degree with Kasetsart University, both ITC and non-ITC students have to enroll at least 2 years which 1 year in Cambodia and 1 year at Kasetsart university. The eligibility to enroll in the program, unless her/his minimum grade-point average (GPA) greater than1 3.0 on a 4.0 scale.
- Summary of credits
    - Specialized courses 6 credits
    - Elective courses 2 credits
    - Research oriented courses 4 credits
    - Research activities
        - Primary research report and defense 9 credits
        - Detailed research proposal defense 3 credits
        - Graduate seminars 3 credits
        - Presentation in scientific conference 3 credits

Publication	6 credits
Research thesis	18 credits

5.2. Program's Requirements

Master of Agro-industrial Engineering is a full-time graduate program developed for all nationalities from all over the world. To be eligible for the program, an applicant must hold a BSc. /BEng Degree or equivalent and also meet the requirements of the Graduate School. The applicants can be ITC student or non-ITC student which details below:

ITC student

The students who graduated from ITC with the faculties listed below will start at M2 if her/his GPA greater than 2.5, but will start from M1 if his/her GPA less than 2.5.

- Faculty of Chemical and Food Engineering

Non-ITC student

An applicant must hold a bachelor's degree or equivalent in the field of science and engineering such as field of science and engineering related to food science and technology, chemical engineering, agriculture engineering, and chemistry and biological Science and engineering. However, the applicant will be assessed case by case. The additional courses will be required for the applicant who found to be lack of basic course of this engineering field.

5.3. List of courses

Table 1. List of courses in each course category

Core Course	Elective Course	Specialized Course	Research-oriented Course
1. Project 1 on Agro-product processing and simulation 2. Agro-product processing and factory design and simulation and modeling in agro-process 3. Bio-refinery Process 4. Industrial Symbiosis 5. Postharvest management of agro-product	(Course from I4 and I5 of Bachelor's degree of GCA faculty)	1. Project 2 on Product Innovation and Entrepreneurship 2. Product Innovation and Entrepreneurship 3. Agro-products quality and safety, and risk management 4. Bio-industry 5. Cold chain logistic and management 6. Agro-products supply chain 7. Agro-products laws and certification system 8. Agricultural-waste processing and management	1. Research Methodology 2. Seminar on agro-industrial Engineering I 3. Seminar on agro-industrial Engineering II 4. Project 3 in Agro-industrial Engineering 5. Applied statistic in agro-processing

5.4. Course for Agro-industrial Engineering (AIE) for Plan A

- ***ITC Student***

Table 2. Course requirement of Course-Research based for Agro-Industrial Engineering for ITC Student.

		AIE for ITC Student course-research base				
Year	**Sem.**	**Course Code**	**Type of Course**	**Note**	**Course**	**Credit**
M1	***S1***		Courses taken under faculty: • GCA			17
	S2		Research Oriented Course	Old	Internship as requirement for Bachelor's degree of Engineering from GCA faculty	9
					Total (M1)	**26**
M2	**S1**		Core Course	New	Postharvest management of agro-product	2
				New	Industrial Symbiosis	2
			Elective Course	Old	Course to be selected from Elective Course	**2**
			Specialized Course	New	Product Innovation and Entrepreneurship	2
				New	Project 2 on Product Innovation and Entrepreneurship	2
				New	Agricultural-waste processing and management	2
			Research Oriented Course	Old	Research Methodology	2
				Old	Applied statistic in agro-processing	2
					Total (M2-S1)	**16**
	S2		Research/Internship	Old	Professional Internship, Master Thesis and Defense	**12**
					Total (M2)	**28**
					Grand Total	**54**

Elective Course for ITC Student					
No.	**Code**	**Course**	**Credit**	**Sem.**	**Lecturer**
1	GCA-I5	Entrepreneurship	2	I	Mr. LUON Vireak
2	GCA-I5	Computing software for chemical reaction	2	I	Mr. KONG Sela
3	GCA-I5	Industrial Chemical process	2	I	Mr. KONG Sela
4	GCA-I5	Chemical Plant Safety	2	I	Ms. SIENG Sreyvich
5	GCA-I5	Project Management	2	I	Dr. YOEUN Sereyvath
6	GCA-I5	Automation and regulation	2	I	Dr. KIM Bunthern
7	GCA-I5	Seminar	2	I	Dr. SIEV Sokly
8	GCA-I5	Food Processing II	2	I	Ms. HENG Soukim/ Ms. MOM Vattana
9	GCA-I5	Product Development	2	I	Dr. MITH Hasika
10	GCA-I5	Agro-Food industrial Management	2	I	Mr. LUN Vireak
11	GCA-I5	Sensory Evaluation	2	I	Dr. HOR Sivmey
12	GCA-I5	Quality Assurance	2	I	Mr. YIT Soukea
13	GCA-I4	Materials Science II	2	II	Dr. Ms. AUN Srean

- ***Non-ITC Student***

Table 3. Course requirement of Course-research base for Agro-Industrial Engineering for Non-ITC Student

AIE for Non-ITC Student Course-research base					
Year	**Sem.**	**Type of Course**	**Code**	**Course**	**Credit**
M1	***S1***	Core Course	New	Agro-product processing and simulation	2
			New	Bio-refinery Processing	2
			New	Project 1 on Agro-product processing and simulation	2
		Elective Course	Old	Course to be selected from Elective Course	2
		Research Oriented Course	Old	Research Methodology	2
			Old	Seminar on Agro-industrial Engineering I	2
			New	Project 3 in Agro-industrial Engineering	2
				Total (M1-S1)	***14***

	S2	Specialized Course	New	Agro-product quality and safety, and risk management	2
			New	Bio-industry	2
			New	Agro-products supply chain	2
			New	Agro-products laws and certification system	2
			New	Cold chain logistic and management	2
		Elective Course		Course to be selected from Elective Course	2
				Total (M1-S2)	***12***
				Total (M1)	**26**
M2	**S1**	Core Course	New	Industrial symbiosis	2
		Elective Course	Old	Course to be selected from Elective Course	4
		Specialized Course	New	Product Innovation and Entrepreneurship	2
			New	Project 2 on Product Innovation and Entrepreneurship	2
			New	Agricultural-waste processing and management	2
		Research Oriented Course	Old	Seminar on agro-industrial Engineering II	2
			Old	Applied statistics in agro-processing	2
				Total (M2-S1)	**16**
	S2	Research/Internship		Professional Internship, Master Thesis and Defense	**12**
				Total (M2)	**28**
				Grand Total	**54**

Elective Course for AIE for non- ITC Student					
No.	**Code**	**Course**	**Credit**	**Sem.**	**Lecturer**
1	GCA-I5	Entrepreneurship	2	I	Mr. LUON Vireak
2	GCA-I5	Computing software for chemical reaction	2	I	Mr. KONG Sela
3	GCA-I5	Industrial Chemical process	2	I	Mr. KONG Sela
4	GCA-I5	Chemical Plant Safety	2	I	Ms. SIENG Sreyvich
5	GCA-I5	Project Management	2	I	Dr. YOEUN Sereyvath
6	GCA-I5	Automation and regulation	2	I	Dr. KIM Bunthern
7	GCA-I5	Seminar	2	I	Dr. SIEV Sokly

8	GCA-I5	Food Processing II	2	I	Ms. HENG Soukim/ Ms. MOM Vattana
9	GCA-I5	Product Development	2	I	Dr. MITH Hasika
10	GCA-I5	Agro-Food industrial Management	2	I	Mr. LUN Vireak
11	GCA-I5	Sensory Evaluation	2	I	Dr. HOR Sivmey
12	GCA-I5	Quality Assurance	2	I	Mr. YIT Soukea
13	GCA-I4	Materials Science II	2	II	Dr. Ms. AUN Srean

8.2 5.5. Course for Agro-industrial Engineering (AIE) Plan B (Research Based)

Table 4. Course requirement of Plan B for Agro-Industrial Engineering for ITC Student and Non-ITC Student.

AIE for ITC student and Non-ITC Student Plan B					
Year	**Sem.**	**Type of Course**	**Code**	**Course**	**Credit**
	S1	Elective Course		Course to be selected from Elective Course	2
		Specialized Course	New	Product Innovation and Entrepreneurship	2
			New	Agricultural-waste processing and management	2
			New	Project 2 on Product Innovation and Entrepreneurship	2
		Research Oriented Course	Old	Research Methodology	2
			Old	Seminar on Agro-industrial Engineering I	1
			Old	Applied statistics in agro-processing	2
				Total (M1-S1)	***13***
	S2	Research	Old	Primary research proposal and defense	9
				Total (M1-S2)	9
				Total (M1)	**22**
		Research	Old	Detailed research proposal and defense	3
M2	**S1**	Research	Old	Presentation in a scientific conference	3
		Research	Old	Scientific publication	6
		Research	Old	Graduate seminar II and III (Seminar on agro-industrial Engineering II)	2
	S2	Research	Old	Master Thesis and Defense	**18**
				Total (M2)	**32**
				Grand Total	**54**

Elective Course for non-ITC and ITC Student					
No.	**Code**	**Course**	**Credit**	**Sem.**	**Lecturer**
1	GCA-I5	Entrepreneurship	2	I	Mr. LUON Vireak
2	GCA-I5	Computing software for chemical reaction	2	I	Mr. KONG Sela
3	GCA-I5	Industrial Chemical process	2	I	Mr. KONG Sela
4	GCA-I5	Chemical Plant Safety	2	I	Ms. SIENG Sreyvich
5	GCA-I5	Project Management	2	I	Dr. YOEUN Sereyvath
6	GCA-I5	Automation and regulation	2	I	Dr. KIM Bunthern
7	GCA-I5	Seminar	2	I	Dr. SIEV Sokly
8	GCA-I5	Food Processing II	2	I	Ms. HENG Soukim/ Ms. MOM Vattana
9	GCA-I5	Product Development	2	I	Dr. MITH Hasika
10	GCA-I5	Agro-Food industrial Management	2	I	Mr. LUN Vireak
11	GCA-I5	Sensory Evaluation	2	I	Dr. HOR Sivmey
12	GCA-I5	Quality Assurance	2	I	Mr. YIT Soukea
13	GCA-I4	Materials Science II	2	II	Dr. Ms. AUN Srean

5.6 Course Description and Lecturers

Table 5. List of courses with descriptions and responsible lecturers

No.	Note	Course Code	Course	Credit	Description	Lecturers
1	New		Agro-processing design and simulation	2	This course is the combination of principles of process design and simulation of that process. The agro-processing design section focuses on the design principles of design agro-industrial systems/components/processes to transform agricultural raw material into the products. With the conceptual design of the processes, simulation and modeling section aims to instruct students to learn how to simulate their conceptual design processes before scaling them up into pilot scale or industrial scale. A path of simulation is designed for students to get fundamental knowledge for problem-solving skill. In this course students will be able to use varieties of numerical method and algorithm to solve the problem effectively. Student will be able to use program language by converting algorithm data.	Dr. EK Pichmony and Dr. TY Boreborey
2	New		Project 1 on Agro-processing and simulation	2	This project-based course is a complimentary course to the agro-processing design and simulation. In this course, students will work as a team (2-3 members) to apply their knowledge in agro-processing design and simulation in a mini-project of their choice. Instructors will supervise and evaluate their project.	Dr. EK Pichmony and Dr. TY Boreborey

3	New		Post-harvest management of agro-products	2	This course introduce student in a holistic view of the systematic handling of agricultural products/commodities after harvesting. Case studies of different commodities will the focal points to instruct students specific technical aspects (biochemistry of a specific agricultural commodity and operations in handling their post-harvesting). The postharvest chain involves a series of operations starting immediately after taking a product from the field to its consumption. Agricultural commodities – fruits and vegetables, cassava, rice and cereal grains, fishes, wood, raw rubber etc…	Dr. HOR Sivmey and Dr. MORM Elen
4	New		Agro-product supply chain	2	This course aims to provide the principle of agricultural supply chain which typically have three main steps: (1) from framers to intermediate warehouse, (2) from intermediate to processing plants, and (3) from processing plants to consumers. The management systems and decision makings throughout the supply chain to ensure the efficient flow from raw materials to products in consumers' household will be introduce in the course.	Dr. PHOUNG Hengsim and Dr. HOR Sivmey
5	New		Product innovation and Entrepreneurship	2	This course is designed to combine the product development and innovation process with the business model in mind. The course mainly focuses into two sections – (1) new product development process from ideation into launching the products and (2) a business model creation process to launch	Dr. KHEOUN Kimleang and Dr. HOUNG Peany

					and commercialize the new products with entrepreneurial spirit. Case studies of agro-products will be presented in the courses.	
6	New		Project 2 in production innovation and entrepreneurship	2	This project-based course is a complimentary course to product innovation and entrepreneurship. In this course, students will work as a team (2-3 members) to apply their knowledge in product innovation and entrepreneurship in a mini project of their choice. Instructors will supervise and evaluate their project. Three parts have to be included in their project – (1) new product (applying new product development process), (2) a business model of that new product (3) work flow of the team.	Dr. HOUNG Peany and Dr. KHEOUN Kimleang
7	New		Agro-products quality, safety, and risk management	2	This course focuses on the holistic view and technical aspects to manage food quality, analyze risks to ensure food safety and how to tackle with risks in the agro-food industry.	Dr. IN Sokneang and Dr. PENG Chanthol
8	New		Bio-industry	2	General knowledge of Bio-Industry. Logistic and management. Quality control. Innovation creativity. Case study of Bio- Industry business. Trends in Bio-Industry.	Dr. Tan Reasmey and Dr. SOUNG Malyna
9	New		Cold chain logistic and management	2	8.3 Cold chain is an important aspect in postharvest handing and product processing, especially fresh produces, meat and seafoods. The whole aspect of cold chain logistic and management will be introduced to student by case studies.	Dr. SROY Sengly and Mr. Kong Sela

10	New		Bio-refinery Process	2	8.4 This course focus on converts biomass to energy and other beneficial byproducts (such as chemicals). The course is stated on sustainable processing of biomass into a spectrum of bio-based products (food, feed, chemicals, materials) and bioenergy (biofuels, power and/or heat). The course is provided multiple chemicals by fractioning an initial raw material (biomass) into multiple intermediates (carbohydrates, proteins, triglycerides) that can be further converted into value-added products.	Dr. MITH Hasika and Ms. Heng Soukim
11	New		Agro-product laws and certification system	2	8.5 This course introduces different laws and regulations in Cambodian concerning agro-products. In addition, certification systems that are needed to integrate the products in to high-end retails or export to a specific region/country will be introduce to students.	Dr. PHAT Chanvorleak and Ms. Yin Molika
12	New		Agricultural waste processing and management	2	8.6 This course focuses on the handling and managing the agricultural waste as well as value adding of agricultural waste into value-added products. Lab practices will be included.	Dr. YOEUN Sereyvath and Ms. Sieng Sreyvich
13	Old		Research Methodology	2	Research methodology is designed for students to be able to understand about how to do research, the difference between research and experiment, step to conducting a research, types of research method. Moreover, students can understand how to use and	Dr. PENG Chanthol and a visiting professor (IRD)

					analyze the previous research results, methods to create new idea, how to evaluate the research work, how to evaluate the research work, how to write a paper or an article, and understand about the copyright.	
14	Old		Seminar on agro-industrial Engineering I	1	The seminar arms to make the student to understand more on the thematic of Agro-industrial engineering and make the student to feel more curious for research on the related topics. The seminar will: - Discussion of special topics related to environment and water resources engineering; analysis of data and conclusion; presentation of reports 8.7 Invited speakers from government industry and various professionals will present these seminars. Every student is expected to present a paper on his own research interest.	Dr. TY Boreborey and Advisors
15	New		Seminar on agro-industrial Engineering II and III	2	The seminar arms to make the students present their research result progress and evaluated by several committees for improving their work until their work is acceptable for master thesis defense.	Dr. TY Boreborey and committees
16			Project 3 in Agro-industrial Engineering	2	A mini project is considered as the research-oriented course which is required by educational qualification framework of Ministry of Education Youth and Sport. The course of mini-project will be managed by adviser. The	Advisors and Dr. TY Boreborey

					students can work with their adviser on the topic should be related to their research thesis.	
17			Applied statistic in agro-processing:	2	Applied statistic in agro-processing is designed to analyzing data has become common practice in virtually all scientific and engineering discipline. This course provides a comprehensive introduction to those model and methods most likely to be encountered and used by students in their career in engineering and data analytic. The examples and exercises have been designed with scientists and engineers in mind, most of the methods covered are basic to statistical analyses in many other discipline, so that students of engineering, computer science, and data science will profit from this course.	Dr. EK Pichmony and Dr. Phauk Saukkhey
18	New		Industrial Symbiosis	2	The course is designed how a network of diverse organizations can foster eco-innovation and long-term culture change, create and share mutually profitable transactions and improve business and technical processes.	Dr. MORM Elen and Ms. NAT Yukleav

5.7 Course-PLOs Mapping

Table 6. PLOs mapping

Course	**PLO1**	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**
Agro-product processing and simulation	**F**	**F**	**F**	**F**	**P**	**F**	**P**	**F**	**P**	**F**	**F**	**F**
Project 1 on Agro-product processing and simulation	**F**	**F**	**F**	**F**		**F**	**P**			**F**	**M**	**P**
Postharvest management of agro-products	**F**	**F**	**M**	**F**		**P**	**P**			**M**	**M**	
Agro-products supply chain	**F**	**F**	**M**	**F**		**P**				**M**	**M**	
Product Innovation and Entrepreneurship	**F**	**F**	**F**	**F**	**P**	**F**		**F**	**M**	**F**	**F**	**F**
Project 2 on Product Innovation and Entrepreneurship	**F**	**F**	**M**	**F**	**P**	**F**		**P**	**F**	**M**	**M**	**P**
Agro-product quality and safety, and risk management	**M**	**M**	**P**	**M**	**F**	**P**		**P**		**M**	**M**	
Bio-industry	**F**	**F**	**M**	**M**		**P**	**F**				**P**	**P**
Cold chain logistic and management	**M**	**M**	**P**	**F**	**P**	**P**				**M**	**M**	
Industrial Symbiosis	**F**	**F**	**M**	**M**		**P**					**P**	**P**

Agro-products laws and certification system	**M**	**F**	**P**	**P**					**M**	**P**	**P**	
Agricultural-waste processing and management	**F**	**F**	**F**	**F**	**P**	**P**	**F**			**M**	**M**	
Research Methodology	**M**	**F**	**F**	**P**				**P**		**F**	**F**	
Seminar on agro-industrial Engineering I	**F**	**F**	**F**	**P**		**P**		**F**		**F**	**F**	**F**
Seminar on agro-industrial Engineering II	**F**	**F**	**F**	**P**		**P**		**F**		**F**	**F**	**F**
Project 3 in Agro-industrial Engineering	**F**	**F**	**F**	**P**	**P**	**M**	**F**	**F**	**F**	**F**	**F**	**F**
Applied statistic in agro-processing	**F**	**F**	**F**	**F**		**F**				**F**	**F**	
Bio-refinery Processing	**F**	**F**	**M**	**M**		**P**	**F**				**P**	**P**

-P: Partially fulfill

-M: Moderately fulfill

-F: Fully fulfill

5.8. Methodology (Course syllabus)

Describe steps and how students will acquire knowledge and skills

- Competency- and project-based…

- Modality of teaching…

III. Resources

1. Human Resources and Planning

Table 7. List of faculty members and staffs

No.	Name	Profile
1	Dr. CHHUN Heangthavrith	Université de Montpellier, France Food and Biotechnology Engineering,
2	Dr. TY Boreborey	Philippine Diliman, Philippine Hydro-geochemistry
3	Dr. IN Sokneang	AgroParisTech, France Science and Processing of Food and Bio-products
4	Dr. KHEOUN Kimleang	Hokkaido University, Japan Sustainable Resources Engineering
5	Dr. TAN Reasmey	Tokyo Institute of Technology, Japan Bio-engineering
6	Dr. SOUNG Malyna	University of Montpellier, France Molecular plant pathology
7	Dr. PHAT Chanvorleak	Chung-Ang University, Korea Food Chemistry
8	Dr. PENG Chanthol	Tokyo Institute of Technology, Japan Life Science and Technology
9	Dr. EK Pichmony	Washington State University, USA Food Extrusion and Processing
10	Dr. HOUN Peany	Tokyo Institute of Technology, Japan Chemical Science and Engineering
11	Dr. HOR Sivmey	Agro/SupAgro Montpellier, France Physicochemistry and Food Biochemistry
12	Dr. MITH Hasika	University of Liège, Belgium Food Science

13	Dr. YEOURN Sereyvath	Chonnam National University, Korea Biotechnology
14	Dr. MORM Elen	Université libre de Bruxelles, Belgium Drying technologies and models
15	Dr. SRUY Sengly	University of Montpellier, France Nutrition and Food Science
16	Dr. PHOUNG Hengsim	University of Nantes, France Processing Engineering
17	Ms. YIN Molika	Institute Agro/SupAgro Montpellier, France Food Science and Nutrition
18	Ms. THANH Chanmony	University of Montpellier, France Health and Food Science
19	Ms. MOM Vattana	Kasetsart University, Thailand Food Science
20	Ms. CHANTO MonychotTepy	Kanazawa University, Japan Environmental Design
21	Ms. HENG Soukim	Kasetsart University, Thailand Food Science
22	Ms. SIENG Sreyvich	Gadjah Mada University, Indonesia Chemical Engineering
23	Ms. PHAL Sophoan	Kasetsart University, Thailand Packaging Technology
24	Mr. NGET Sovanmony	Ecole Nationale Vétérinaire Oniris, France Meat Preservation
25	Ms. PHAL Sivchheng	Kanazawa University, Japan Environmental Design

2. Facilities and Laboratories

Table 8. Existing laboratory for Agro-industrial Engineering

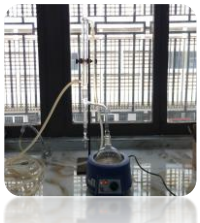
No.	Room number	Laboratory
1	B111	Food Processing Lab
2	B201	Physico-chemical Lab
3	B202	Pathogen chemical Lab
4	B203	
5	B204	General microbiology lab
6	B205	Culture room
7	B210	Biochemistry Lab
8	B301	Molecular biotechnology Lab
9	B302	Food Processing Lab
10	B303	Unit operation Lab/ Analytical Chemistry Lab
11	B304	Food Fermentation Lab
12	B306	Biotechnology Lab
13	B307	HPLC and GC-MS Lab
14	B310	AAS LAb

Table 19. Available existing equipment and analyzer for supporting Agro-industrial laboratory

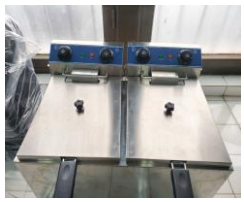
No	Equipment/analyzer	State of Equinments/analyzer
1	Nabertherm heating furnace	

2	Water Activity meter	
3	pH-meter	
4	Moisture balance analyzer	
5	Spectrophotometer	
6	Refrigerated Centrifuge Machine	
7	Microwave-assisted extraction	
8	Soxhlet extraction	

9	CM-5 Spectrophotometer	
10	Laminar Air Flow Cabinet	
11	Microscope	
12	Autoclave	
13	Microscope	
14	Laminar air flow cabinet	
15	Freezer	

16	Plant growth chamber	
17	Incubator shaker	
18	Freezer	
19	Hydro-distillation	
20	Memmert incubator	
21	Rotary Evaporator	
22	Distilled water machine	

23	Nabertherm heating furnace	
24	Ultrasonic tank	
25	HPLC	
26	GCMS	
27	Capillary viscometer NVB classic	
28	AAS	
29	Microwave digestion system	

30	Freeze-dryer	
31	Benchtop Centrifuge	
32	Ultrasonic bath	
33	Gas baking oven	
34	Full Automatic Desk Boxy Cup sealer	
35	Electric Deep Fryer Twin Tank Oil	
36	Fruit grinder	

37	Mixer	
38	Vacuum Packager	

2. Planning

2.1. HR development

Currently there are 5 Ph.D candidates are conducting their research in abroad and most of them have contract to help and support ITC after they graduate. And for 2021-2022, we have 4 Ph.D who just recently graduate their study abroad are joining to support our program.

Under HIPE and FOODI projects, many professional training will be offered to train our staffs (25 staffs) with their specialty courses to support Agro-industrial program and developing and revising the course contents to become standard and international contents.

2.2. Laboratory development

With the total budget of 342000 USD under HIEP project, ITC is planning to purchase the equipment and analyzer supporting M-AIE program for academic year of 2020-2024.

IV. Partnership and Supports

1. Partnership

Table 9. Private and academic partners with ITC which is supporting in project development of Agro-industrial Engineering

No.	Partner
1	UNIDO
2	CAVAC
3	INP-TOULOUS

4	ENSAT
5	Kasetsart University(KU)
6	University Technology Malaysia (UTM)
7	University of Malaya
8	Universiti Technology Mara
9	Universiti Kuala Lumpur
10	Asian Institute of Technology
11	Ministry of Education, Cambodia
12	Prince of Songkla University
13	University of the Aegean
14	University College Dublin
15	University of Salerno
16	ReadLab
17	Athens Metropolitan College

2. Development Projects

Table 10. List down all projects that support the program

No.	Projects
1	HEIP-Partnership (ITC-KU)
2	FOODI (Erasmus+ KA2 Project) (MSc course in Food Processing and Innovation)
3	FOODSTEM (Erasmus+ Project): Training a new generation of entrepreneurs in sustainable agriculture and food engineering
4	(HEIP) Biotechnology for Integrated Pest Management towards pesticide reduction in Cambodia

5	(HEIP) Valorization of high-value dry food products (agricultural products including herbal and spices) and other by-products in Cambodia
6	(HEIP) Improvement and development of rice-based products toward the growth of SMEs/Industries in Cambodia
7	(HEIP) Development of Cambodian Soy Sauce by Fermentation Method
8	(HEIP) Development of Cooking Oil Processes for Commercialization
9	(HEIP) Improvement and development of fish and meat products for better preservation using innovative technology
10	(HEIP) Valorization of agricultural by-products in Cambodia through extractions and formulations of essential oils and bioactive compounds
11	HEALTHYRICE (IRD)
12	Agroecology and Safe Food System Transitions (ASSET) EU/AFD and GRET
13	Nutritional profile of freshwater fish and fish powder from Tonle Sap Lake in Cambodia (BGF)
14	CAPFish-Capture: Post-harvest Fisheries Development Project (UNIDO)

Annex I [Perspective-M-MIC-2022-2023]

CURRICULUM UPDATE PROPOSAL

Program Level: International Master's Degree

Major: Mechatronics, Information and Communication Engineering

9 I. Background and rationales

Master of mechatronic engineering is a multidiscipline program that integrates several fields such as mechanical, electrical, computer and software skills in order to work with smart technologies, such as robots, automated guided systems and computer-integrated manufacturing equipment. Owing to recent advancement and strong demands in communication and information processing to achieve smart and intelligent system thereby making smart mechatronics device more interactive, the existing program need to be revised and modified appropriately considering new subjects that reflects to communication and information processing.

The strength is that ITC already has engineering fields that can support this program such as GEE, GIM, GIC, and GTR. In addition, new program such as data science and ECAM program are strongly linked through a number of subjects. Our human resource is mostly educated with strong background in PhD degree in engineering. Laboratories from different departments can be exploited to support the program. The weakness is sustainable integration of all the departments and the staff mobility across various discipline. In addition, new skills need to be trained, and our staffs need capacity building to keep themselves up to date. The opportunity is that students, under this program, is able to obtain knowledge and skills in field of mechatronics engineering that meet future market trends including industry 4.0, which strongly links with ubiquitous connectivity and information processing such as artificial intelligent. ITC will also obtain new program that transform engineering-diploma students to next level equipped the skills need in the 21st century. This program is also implemented to provide international double degree with ECAM program. Threats include the challenge in recruiting students from different field to be matched with program since subjects are new that need fundamentals knowledge. The market sector in domain of mechatronics is still earlier birth for the context of Cambodia, which leads to lack of interest from general audiences is also a threat for attracting students to enroll in this program.

Based on the market trends, it is shown that there is strong governmental endorsement to push education sector to support the industry 4.0 in Cambodia. Government has very clear path and plan for digitalization that will penetrate in every part of the industry ranging from smart agricultures to smart manufacturing. Moreover, ITC lunched a new international program called ECAM in which the final-year student can migrate to this new program double degree in master degree of mechatronics, communication and information engineering.

10 II. Proposition to Update current curriculum

10.1 1. Description of updated program

Master of Engineering in Mechatronics, Communication, and Information (M-MIC) is 54-credit multidisciplinary degree program, which is the improved version of traditional mechatronics engineering considering new subjects and skills in the area of communication and information engineering in order to upgrade the student's capacity and ability to meet new market trends. This program will move the traditional mechatronics to be ICT-centric mechatronics. More importantly for the future of mechatronics, there is a shift from systems based around the interconnection of physical components in which transmitted data has been used to facilitate control systems in which information is at the heart of the system and serviced by smart objects. An underlying concept of such cloud based, or Internet of Things system models is treating information as a commodity whose value is determined by user or system need or context, allowing for negotiation between system components as required.

Students graduated from Master of MIC Engineering are equipped with a broad range of skills and knowledge, facilitating careers in engineering disciplines ranging from mechanical design to software engineering as well as those more purely focused on mechatronics, automation, and robotics. Graduates from this program are employed in industries ranging from mining to manufacturing, agriculture and defense.

10.2 2. Program educational objectives (PEOs)

Graduates of the Master of Engineering in Mechatronics, Communication and Information will:

PEO-1. To produce master graduate equipped with advanced multidisciplinary knowledge and technical skills to solve complex system in mechatronics integrated with information and communication technology (ICT).

PEO-2. To produce master graduates to become responsible entrepreneurs, leaders and managers in mechatronic engineering and ICT.

PEO-3. To produce master graduates who are able to conduct independent research and advanced studies in the related fields.

10.3 3. Program learning objectives (PLOs)

The Master of Engineering in Mechatronics, Communication and Information aims to provide students a set of knowledge and skills in engineering that can be applied in a variety of disciplines. Upon successful completion of this major, graduates will obtain the following PLOs:

10.3.1 Knowledge

PLO-1. Demonstrate interdisciplinary knowledge and technical skills used to solve complex engineering problems in mechatronics integrated with information and communication technology. (PEO1, PEO3)

PLO-2. Demonstrate entrepreneurial and management knowledge and expertise in the area of multidisciplinary engineering. (PEO2)

10.3.2 **Cognitive skills**

PLO-3. Develop information-centric mechatronic projects and modern mechatronic products by integrating advanced techniques in information technology and communication system into traditional mechatronic techniques. (PEO1, PEO2)

PLO-4. Select smart solutions to complex engineering problems encountered in industrial and other sectors by taking into account not only economic benefit, but also cultural, societal, and environmental responsibilities. (PEO1, PEO2)

10.3.3 **Psychomotor skills**

PLO-5. Show desire to learn through individual and group project-based and research activities, project implementation, supervision guiding by supervisor/mentor.

PLO6. Be competent in using software and hardware tools in mechatronics engineering and information and communication engineering for project analysis and implementation and mechatronic product development. (PEO1, PEO3)

10.3.4 **Interpersonal skills and responsibilities**

PLO-7. Argue appropriately and reasonably on proposed ideas and solutions with team members, supervisor /mentor, and instructors. (PEO2, PEO3)

PLO-8. Accept broader instruction and critical ideas and comments from team members, evaluation committee and reviewer, supervisor/mentor's guidance to improve results and productivity as well as their personal improvement. (PEO2, PEO3)

PLO-9. Work independently as a responsible engineer/entrepreneur/scientist.

10.3.5 **Communication, Information technology and numerical skills**

PLO-10. Explain effectively on complex engineering problem to general audience using visualization, simple diagram, and statistics. (PEO1, PEO2, PEO3)

PLO-11. Develop effective communication materials for presenting and communicating the results to scientific community and public audience using documentation and visualization tools. (PEO1, PEO2, PEO3)

10.4 4. PEO and PLO Mapping

PLO\PEO	PEO1	PEO2	PEO3
PLO1	F		F
PLO2		F	
PLO3	F	P	
PLO4	F	P	

PLO5	P		F
PLO6	F	P	
PLO7	P	F	F
PLO8	P	F	F
PLO9			
PLO10	P	F	P
PLO11	P	F	P

10.5 5. Program's Structure and Requirement

10.5.1 5.1. Program's Structure

The candidate that is eligible to enroll this program need to have bachelor's degree in one of the following degrees: Mechanical engineering, Electrical and Electronic Engineering, Information Technology, or Mechatronics Engineering itself. This program is a two-year program with **54 credits** distributed over four semesters, and it is applied to all candidate except the student from Institute of Technology of Cambodia (ITC) with GPA greater or equal 2.5/4.0, who can start from second year (third semester) of the program.

The course description is categorized into four group: Core Courses, Elective Courses, Specialized Courses, and Research-Oriented Course.

Mechatronics, Information and Communication Engineering (MIC)			
Core Courses	Elective Courses	Specialized Courses	Research-Oriented Courses
1. Entrepreneurship 2. Project Management 3. Modern control system 4. Analog and digital communication 5. Applied statistics	1. Power electronics 2. Embedded system 3. Computer vision for robotics 4. Introduction to control theory 5. Numerical method and optimization 6. Digital electronics and microprocessor	1. Design of machinery and robotics 2. Sensor and actuator 3. Signal processing 4. Advanced digital communication 5. Mechatronic design project 6. Introductory of machine learning	1. Research methodology 2. Graduate seminar I 3. Graduate seminar II & III 4. MIC internship

	7. Mechatronics engineering 8. Wireless communication 9. Object-oriented programming 10. Digital circuit design with VHDL 11. Mechanical Theory 12. Finite Element Method 13. Selection of Materials	7. Neural network and deep learning 8. System engineering	
Notes: Subjects highlighted in yellow color are revised based on the comments from IMT Mine Ales			

Program structure is divided into four semesters based on each pathway. There are two pathways that are implemented in this master program: Course-Research Pathway and Research-Based Pathway. In Course-Research Pathway, student need to earn at least 32 credits from through coursework participation, 10 credit through research activities with guidance from advisor and/or supervisor, and 12 credits through thesis preparation, presentation, and publication. In Research-Based Pathway, student need to earn minimum credit of 12 through course participation in which 6 credits are from major courses and 6 research-oriented courses, 30 credits through research activities led and/or supervised by his/her advisor, and 12 credits through thesis preparation, presentation, publication.

10.6 5.2 Course-Research Pathway

Year I			
Semester I		**Semester II**	
Course	**Credits**	**Course**	**Credits**
Entrepreneurship	2	Design of machinery and robotics	2.5
Project management	2	Sensor and actuators	2
Modern control system	2.5	Signal processing	2
Analog and digital communication *Or* Applied Statistics	2	System Engineering	2
Elective course I.1	2	Elective course II.1	2
Elective course I.2	2	Elective course II.2	2

		MIC internship	3
Total	**12.5**	**Total**	**15.5**

Year II			
Semester I		**Semester II**	
Course	**Credits**	**Course**	**Credits**
Advanced digital communication	2	Research project Thesis report and publication Thesis defense	**12**
Mechatronic design project	3		
Introduction to machine learning	3		
Neural network and deep learning	4		
Elective course III	2		
Total	**14**	**Total**	**12**

Course-Research Pathway

All compulsory and elective courses	Type of courses	Credit	Semester	Hours	CM	TD	TP	Remark (One semester should have 6 courses with: TP & TD: 16h (0.5credit) CM (16h = 1credits)
Entrepreneurship	common/core	2	S1	32	32	0	0	
Project Management	common/core	2		32	32	0	0	
Modern Control System	core	2.5		48	32	16	0	
Analog and digital communication *or* Applied Statistics	core	2		48	16	16	16	
Elective Course I.1	elective	2			-	-	-	
Elective Course I.2	elective	2			-	-	-	
Minimum Credits		**12.5**						
Design of machinery and robotics	specialized	2.5	S2	56	24	16	16	
Sensors and Actuators	specialized	2		48	16	16	16	
Signal Processing	specialized	2		48	16	16	16	
System Engineering	specialized	2		40	24	16	0	Revised based on comments from Mines Ales Team
Elective Course II.1	elective	2		-	-	-	-	
Elective Course II.2	elective	2		-	-	-	-	
MIC Internship		3		-	-	-	-	2-month period (July to September)
Minimum Credits		**15.5**						
Advanced Digital Communication	**specialized**	2	S3	40	24	16	0	
Mechatronic Design Project	**specialized**	3		72	24	0	48	
Introduction to Machine Learning	**specialized**	3		64	32	16	16	
Neural Network and Deep Learning	**specialized**	4		80	48	16	16	
Elective course III	**elective**	2			-	-	-	
Minimum Credits		**14**						
Research Project		12	S4	6-month research				
Thesis Report				One (1) Research Thesis				
Thesis Defense				One (1) Presentation				
Credits		**12**						
Total credits		**54**						
Elective Course I and III (available in 1st semester of fiscal year)								
Power Electronics	elective	2		40	24	16	0	
Embedded Electronics	elective	2		40	24	0	16	
Computer Vision	elective	2		32	32	0	0	
Industrial Internet of Things	elective	2		32	32	0	0	
Mechanical Thoery	elective	2		40	24	16	0	Revised based on comments from Mines Ales Team
IoTs and Cloud Technology	elective	2		40	24	0	16	
Elective Course II (available in 2nd semester of fiscal year)								
Numerical Methods and Optimization	elective	2		56	24	16	16	
Digital circuit design with VHDL	elective	2		48	16	0	32	
Object-oriented programming	elective	2		48	16	0	32	
Wireless communication	elective	2		40	24	0	16	
Mechatronics engineering	elective	2		40	24	16	0	
Finite Element Method	elective	2		40	24	16	0	Revised based on comments from Mines Ales Team
Selection of Material	elective	2		40	24	16	0	

10.7 5.3 Research-Based Pathway

Year I	
Semester I	**Semester II**

Course	Credits	Course	Credits
Graduate seminar I	1	Research activities	12
Specialized/Elective course I.1	2		
Specialized/Elective course I.2	2		
Specialized/Elective course I.3	2		
Preliminary research report and defense	9		
Total	**16**	**Total**	**12**

Year II			
Semester I		**Semester II**	
Course	**Credits**	**Course**	**Credits**
Graduate seminar II and III	2	Research activities	18
Research methodology	2	Detail research proposal defense	
Entrepreneurship	2	Presentation in scientific conference	
Project management	2	Journal peer review and publication	
		Thesis report and defense	
Total	**8**	**Total**	**18**

10.8 5.4. Program's Requirements

10.8.1 Admission Requirement

The admission requires student to have bachelor's degree in the related fields such as those who has background in mechanical engineering, electrical engineering, automation engineering, information technology, and communication engineering with solid foundation in mathematics and physics.

- Students from ITC with GPA greater than or equal 2.5/4.0 can enroll in second year of the program, where some credits can be exempted from fourth year and fifth year of engineering diploma in ITC, and the period of study is one academic year consisting of two semesters.
- Except ITC student with GPA greater than or equal 2.5/4.0, the candidate needs to have at least bachelor's degree in the fields related the abovementioned or equivalent, and the period of study is two academic years consisting of four semesters.
- All the candidate needs to have certificate of English proficiency with the score of at least 5.0 for IELT or equivalent.

The important date in the process of admission includes, deadline of application form submission is 30 September, result announcement is 8 October, and registration period is from 10 October.

10.8.2 Graduate Requirement

In order to graduate from this program, student need to fulfill credits system as mentioned in each pathway. To obtain the credit of each subject, student need to receive GPA greater than 2.0.

10.9 5.5. Methodology

This program is implemented in two different pathways. In course-research pathway, student will obtain more competencies than project-based knowledge because the students focus more on coursework. Moreover, student will gain experience through short internship from the industry sector. Owing partial involvement in the research and project participation with his/her advisor, student will also receive knowledge through project-based learning. In research-based pathway, student will acquire knowledge and skills through research activities and project implementation with his/her supervisor. In addition, student will partially obtain knowledge which is fundamentals to research activity through 12-credit coursework.

The teaching methodology will follow model of higher education program in which students will works and go through themselves with proper guidance from their instructors and advisor. In each coursework, the course is divided into lecture, practice problem solving, and laboratory work. Also, student will be engaged with project implementation led by their advisor and/or instructor through short-term project or long-term project.

11 III. Resources

Curriculum Committee includes key person from the direct of Graduate school, head department of GEE, head department of GTR, and head of ECAM program, and other-related field lecturers.

This program borrows staffs mainly from GEE, GIM, GIC, and ECAM.

11.1 1. Facilities and Laboratories

There are several laboratories equipped with research and experiment facilities to support this program such as

- LBE research Lab led by GEE and GTR department
- Dynamic Lab led by Dr. Srang Sarot
- Digital Fabrication Laboratory (FabLab) led by Dr. PEC Rothna
- Control and Robotic Laboratory led by Dr. Kim Bunthean

11.2 2. Planning

Currently, this program has challenging human resource in the field of digital electronic and embedded system with degree of PhD or Doctoral degree. Also, we lack specialty in the field of mechatronics engineering. Due to this issue, we try to upgrade ITC's staff from bachelor's degree to master degree and master's degree to PhD degree through HEIP project.

In term of Laboratory development, it is necessary to be fully equipped with tools and facilities to allow students to work on experiment as well as project implementation. Under HEIP project, we have been establishing Fablab intended to support digital electronic, signal analysis and in-house fabrication in small scale.

12 IV. Partnership and Supports

12.1 1. Partnership

Our current partner includes:

- IMT Mine Ales working on program improvement of MIC and capacity building
- ECAM LaSalle working on student migration from ECAM to M-MIC for double degree
- JICA through LBE implementation for research supportability
- Erasmus+ to support scholarship
- Local partnership from different department such GEE, GIM, and GIC

12.2 2. Development Projects

Currently, we have project led by various researchers that related the program:

- Project led by Dr. Srang Sarot in the area of mechanic and control such as satellite development project, smart-system project
- Project led by Dr. Kim Bunthean in area of control system and automation such e-Tuk Tuk with collaboration with France partner.
- Project led by Dr. Pec Rothna in the area of electronics, communication, and signal processing such IoT and embedded system for smart system.

Annex J. Academic Calendar 2022.2023.