HO CHI MINH CITY UNIVERSITY OF TECHNOLOGY AND EDUCATION

FACULTY OF ELECTRICAL AND ELECTRONICS ENGINEERING

HCMUTE

SELF-ASSESSMENT REPORT FOR AUN-QA PROGRAMME ASSESSMENT

BACHELOR OF ENGINEERING IN BIOMEDICAL ENGINEERING

AUN-QA A Touch of Quality

The 305th AUN-QA Programme Assessment
29 November - 1 December 2022

AUN-QA SELF-ASSESSMENT REPORT

of the Bachelor of Engineering in

BIOMEDICAL ENGINEERING

We hereby confirm to approve this AUN-QA Self-Assessment Report of the Bachelor of Engineering in Biomedical Engineering programme for assessment according to AUN-QA Criteria (V4.0)**.**

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Dean
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LIST OF ABBREVIATIONS

No.	ABBR	Explanations
1	AAO	Academic Affairs Office
2	ACE	Automation and Control Engineering
3	AI	Artificial Intelligence
4	AIO	Academic Inspectorate Office
5	ASAO	Admissions and Student Affairs Office
6	ASU	Arizona State University
7	AUN	ASEAN University Network
8	BME	Biomedical Engineering
9	CE	Computer Engineering
10	FLC	Foreign Languages Center
11	CPEND	Center for Physical Education and National Defence
12	DMO	Dormitory Management Office
13	DLC	Digital Learning Center
14	EEE	Electrical and Electronics Engineering
15	ELOs	Expected Learning Outcomes
16	EMO	Equipment and Maintenance Office
17	ERO	Enterprise Relation Office
18	ESI	Embedded Systems and IoTs
19	ETET	Electronics and Telecommunications Engineering Technology
20	EXH	Exhibition
21	FCE	Faculty of Civil Engineering
22	FEEE	Faculty of Electrical and Electronic Engineering
23	FME	Faculty of Mechanical Engineering
24	FMO	Facility Management Office
25	FPO	Finance Planning Office
26	FTE	Full Time Employees
27	FVEE	Faculty of Vehicle and Energy Engineering
28	GAPAO	General Administration and Personnel Affairs Office
29	GPA	Grade Point Average

30	HCO	Health Care Office
31	HCMUT	Ho Chi Minh University of Technology
32	HCMUTE	Ho Chi Minh City University of Technology and Education
33	HEEAP	Higher Engineering Education Alliance Program - www.heeap.org
34	HOD	Head of Department
35	IoTs	Internet of Things
36	INC	Information and Network Center
37	IEC	Innovation and Entrepreneurship Center
38	ISO	International Organization for Standardization
39	ITC	Information and Technology Center
40	ITEC	Indian Technical and Economic Cooperation
41	IU	International University, VNU-HCMC, Vietnam
42	KPI	Key Performance Indicator
43	LMS	Learning Management System
44	MOET	Ministry of Education and Training
45	MOOC	Massive Open Online Courses
46	PC	Personal Computer
47	PDCA	Plan-Do-Check-Act
48	PI	Performance Indicator
49	PLC	Programmable Logic Controller
50	PMO	Press and Media Office
51	PO	Programme Objective
52	QAO	Quality Assurance Office
53	SAC	Scientific and Academic Committee
54	SAR	Self-Assessment Report
55	SSC	Student Services Center
56	STIAO	Science Technology and International Affairs Office
57	TDC	Thesis Defence Committee
58	TPP	Trans-Pacific Partnership
59	UTE-TV	University of Technology and Education-Television
60	YUSA	Youth Union and Students Association

PART I: INTRODUCTION

- Programme: **Biomedical Engineering**
- Institution: **Ho Chi Minh City University of Technology and Education**
- Faculty: **Electrical and Electronics Engineering**

1.1 Executive summary of the SAR

Biomedical Engineering (BME) programme was built in 2015 and approved by the Ministry of Education and Training (MOET) in Vietnam. In addition to social needs about BME engineers and Visions and Missions of faculty and HCMC University of Technology and Education (HCMUTE), this programme was focused on training students to have technical skills and technological knowledge related to medical instruments. In particular, graduation students have opportunities at business companies, hospitals and industrial zones.

HCMUTE has 14 undergraduate programmes assessed by the AUN organization from 2016 to 2019, in which FEEE had 3 undergraduate programmes as described in **Table 0.1**. The plan of HCMUTE is that 19 programmes will be registered to the AUN organization for assessment from 2022 until 2025 according to the decision No. 3319/QĐ-ĐHSPKT, in which the BME programme will be assessed in Oct. 2022.

Table 0.1. Programmes of FEEE

No.	Programmes	Year
1	Electrical and Electronics Engineering Technology	2016
2	Electronics Communication Engineering Technology	2017
3	Automation and Control Engineering Technology	2018

In Dec. 2020 the HCMUTE Board of Rectors selected the BME programme to be assessed by AUN according to the decision No. 3785/QĐ-ĐHSPKT, in which the member list for editing SAR was also approved. FEEE AUN/QA Committee was then established to complete the tasks of preparing documents, writing SAR and other related activities regarding the assessment at FEEE. The committee has twelve members including four members of the FEEE Dean Board, one HOD and seven faculty members in the involved departments, divided into 3 working groups according to related criteria of AUN-QA. Afterwards, a support team including secretaries and other faculty members was also formed to collect evidences. Each committee member is responsible for attending all meetings and writing their assigned criteria. Therefore, the Chairperson will finalize the SAR after several discussions and meeting minutes and then send it to all faculty members and QAO for reviewing and evaluating. All questions and comments from the first round of reviewing will be handled carefully to finish the second revision which will be sent to external experts to do the second round of reviewing and evaluating in January 2022. The final revision completed in June 2022 and ready to submit for AUN-QA assessment.

This SAR is an evidential document describing the quantitative and qualitative assessment of the strengths and limitations of the Biomedical Engineering, Faculty of Electrical and Electronics Engineering, Ho Chi Minh City University of Technology and Education for AUN accreditation. All the members of the faculty in the department of Biomedical and Industrial Electronics Engineering relating to BME participated in preparing this document. For further information on this document or other related materials please contact:

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1.2 Organization and Approach of Self-Assessment Report

With sustainability development of HCMUTE, the quality of training programmes plays an important role. BME programme is one of 5 programmes planned for doing AUN-QA in 2022 according to the decision No. 3785/QĐ-ĐHSPKT. For high performance of self-Assessment report, HCMUTE has particular plans, in which QAO made a plan with contents in detail on Dec 24, 2020 to send FEEE and relative function offices for performing it. From this plan, FEEE sent a member list for working out SAR to QAO on Dec 29, 2020. The whole plan for performing SAR was approved by the HCMUTE president. In this plan, SAR will be worked out following the standard of AUN-QA version 4.0, consisting of 4 parts as follows:

- Part 1: The introduction
- Part 2: AUN-QA Criteria
- Part 3: Strengths and Weaknesses Analysis
- Part 4: Appendices

1.3 Brief History of the University

Ho Chi Minh City University of Technology and Education (HCMUTE) is located in Ho Chi Minh City, Viet Nam. It was the first university to be established to offer the Technical Education Programmes when it was founded in October 1962. Since that time, it has grown to be one of the leading universities in training and supplying high quality human resources in Vietnam. The university currently has about 23,000 full-time undergraduate students and more than 610 academic staff, of which more than 170 are full time faculty members with doctorate degrees and 45 Assoc. Professors. It offers academic programmes in undergraduate, post-graduate, and doctoral studies in a variety of fields at high quality which is recognized locally and regionally. The university believes in the core values of lifelong learning: each learner needs to self- construct and enrich knowledge and skills by discovering, inquiring and learning by doing to improve creativeness potential to fulfill his/her own aspirations and to serve the community.

HCMUTE has the quality assurance system for monitoring the quality improvement of teaching, learning and scientific research in order to provide learners with the best conditions for comprehensive development of the capacity to meet development needs and international integration. In particular, it consists of quality assurance activities; preparation, organization of non-level evaluation of training programmes and educational institutions. The QAO deploys the activities such as Internal examination and evaluation of quality objectives for each semester and academic year; Quality assurance handbook; Survey stakeholders; Archives and evidence management; organization of courses for training on quality assurance; Preparation for external assessment of training programmes and the institution level.

1.3.1 Vision, mission and core values of HCMUTE

The academic activities are aligned with the vision and mission of the HCMUTE which are published in HCMUTE website *[http://en.hcmute.edu.vn/]*. The HCMUTE vision and mission statements are as follows:

- **Vision:** HCMC University of Technology and Education is a fully autonomous entity. The university aims at becoming a leading hub for training, research, innovation and entrepreneurship in Vietnam, which can be on par with other regional and international prestigious universities.

- **Mission:** HCMC university of Technology and Education provides services of practical training, applied research and community outreach. It is committed to continuous innovation and creativity, offering high quality human resources and scientific products to the fields of vocational education, science and technology to meet the demands of the socio-economic development of the country.

- **Educational Philosophy:** Humanity – Innovation - Integration
- **Core values:** The core values of a comprehensive and modern education system which HCMC university of Technology and Education has been appreciating, preserving and implementing creatively include: Upholding and implementation of Vietnamese people's humane traditional values; Cultivation of talent and creativity, with a focus on training professional skills and responsibility; Respect for the learners and community's benefits. Building an ever-learning society; High regard for quality, effectiveness, and innovation in activities; Integration, cooperation, and sharing.

1.3.2 Organizational structure of HCMUTE

HCMUTE has the president board, 15 academic faculties, 16 offices and 21 centers and is organized *[Appendix 0.1. Description of the organization structure of HCMUTE]*. In the academic faculties, all deans of the faculties and heads of academic departments have the PhD/Assoc. Prof. degree. The president board consists of the president and two vice-presidents, in which each vice-president is assigned one typical role such as scientific research-international Relations; Academic Affairs; Finance-Facility. All the vice-presidents are responsible to support the president to monitor functional offices and centers.

1.3.3 Quality assurance system of HCMUTE

The quality policy of HCMUTE is based on the following premise: Continuously upgrade the quality of teaching, learning and scientific research to provide students with the best conditions to develop comprehensively their professional skills in order to satisfy the demands of society and international integration. QAO was established in 2008 according to the MOET regulation in order to enhance the educational quality. QAO is responsible for developing the internal quality assurance system and implementing the quality assessment as well as supporting the programme accreditation process at institution and programme levels in accordance with national, regional and international standards. QAO has 6 staff who regularly attend the QA training courses annually to continue improving our internal quality assurance system based on the AUN-QA model. In particular, HCMUTE was assessed by ASEAN University Network for Quality Assurance (AUN-QA) for 14 programmes and accredited by MOET for the institution level in 2016 *[Appendix 0.2. Report on the Assessment and Accreditation of HCMUTE from 2016 - 2019]*.

1.4 Brief description of Faculty

1.4.1. Faculty Overview

Founded in 1964, FEEE is nationally recognized as one of the best undergraduate electrical and electronics engineering faculties in the country. FEEE has been continuously improving and developing in terms of facilities as well as education and research activities in order to meet the various demands of electrical and electronics engineering fields *[https://feee.hcmute.edu.vn/]*. FEEE has been, and remains, to provide high quality education to its students both theoretically and practically oriented. FEEE provides an inclusive and active learning environment and encourages students to engage in collaborative and creative work. Currently, FEEE has 90 lecturers, in which there are 9 lecturers studying PhD, 28 doctors and 11 Assoc. Professors serving on the faculty, and about 2300 undergraduate, master and PhD students, making HCMUTE among the largest Electrical and Electronics Engineering faculties in the nation. The faculty's areas of expertise include:

- Industrial Electrical Engineering Technology
- Industrial Electronics Engineering Technology
- Automation and Control Engineering Technology
- Semiconductor and Communications Engineering Technology
- Computer Engineering Technology

- Biomedical Engineering
- Embedded systems and IoTs

The faculty offers state-of-the-art teaching and research facilities, including 42 teaching and research laboratories, in which some laboratories were supported by famous companies such as Mitsubishi, Intel, Rockwell Automation, Omron, General Electric, Tektronix, Texas Instruments, Panasonics, Siemens, National Instruments, ABB, Cadence and amongst others. Moreover, the faculty is located just a few km from the Saigon Hi-Tech Park (SHTP), so the students have abundant opportunities for internships, co-ops, and employment with leading technology companies such as Intel Products, Datalogic, Rockweel Automation, USA Healthcare, Siemens, Grager, Microchip Technology, Samsung, Schneider Electric Manufacturing and others.

FEEE offers programmes of study leading to Bachelors of Science, Masters of Science, and Doctor of Philosophy degrees in Electrical, Electronics, Communications and Computer Engineering Technology, Automation and Control Engineering Technology. By attracting a large and diverse student population of some of the best and brightest young minds in the engineering and technology, the faculty has demonstrated excellence and commitment to the fields of academics, student support, and community.

1.4.2. Vision and mission

❖ **Vision**

To become the leading faculty in engineering education, scientific research, technology transfer, and service in Vietnam, and approaching regional and international standards.

❖ **Mission**

The mission of FEEE is to provide students with the best learning environment for acquiring knowledge, skill, and attitude from real-life problems, to conduct scientific research and technology transfer, to provide high-quality human resources for the industrialization and modernization of the country, to integrate internationally.

❖ **Function and Role of FEEE**

1. Function

FEEE is a professional organization with the function of managing, training and education research for teaching, learning of the university.

2. Role

- Research, build the objectives, curriculum, contents of general subjects; improve teaching and learning methods with a view to enhance quality of training.
- Manage teachers of the faculty according to the regulations of the university.
- Manage the quality, contents, teaching methods, and scientific research.
- Write curriculum, documents for teaching and learning work. Improve the teaching and learning methods.
- Manage and use facilities, equipment for teaching and learning according to the regulations of the HCMUTE effectively.
- Invite the lecturers, professors from the other organization for teaching and organize the site visit for faculty members and students.
- Manage the other activities of FEEE.

❖ **Organizational structure**

FEEE has the dean board with 1 dean and 3 vice-deans, and 6 departments, 1 Secretary office as shown in **Figure 0.2**. In FEEE, the dean, vice-deans and heads of academic departments have the PhD/Assoc. Prof. degrees. Each vice-dean is assigned one typical role such as Research-Science-Technology; Enterprise Relation- Facility; Academic Affairs. All these vice-presidents are responsible to support the dean to monitor and support all the departments.

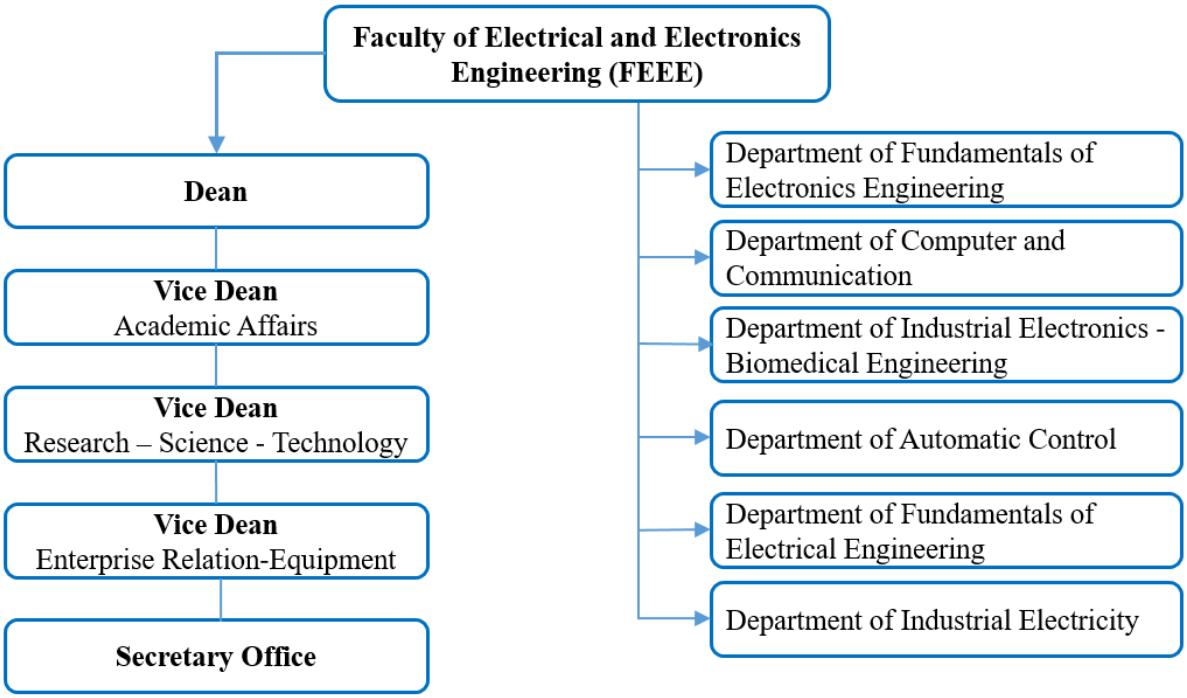


Fig. 0.2. Description of the organization structure of FEEE

1.5 Introduction to programmes

The engineering programme curricula of FEEE are generally designed to provide the fundamental principles of mathematics, natural sciences engineering technology, and general education essential to the continuing professional development of biomedical, electrical, electronics, automatic control, computer, telecommunication engineering engineers. The programme objectives listed below are also published in the catalog online at *[https://feee.hcmute.edu.vn]*.

- Our graduates will demonstrate the ability to use appropriate fundamental mathematical, scientific, and engineering technology principles in formulating and solving general electrical-electronics engineering problems to excel in their engineering careers and/or postgraduate education
- Our graduates will be able to communicate and work effectively in multidisciplinary teams and understand their professional and ethical responsibilities
- Our graduates will actively engage in life-long learning and/or continue into graduate programmes.
- Our graduates will demonstrate the ability to design, development, and manufacturing in their practice of electrical and electronics engineering technology.

The programme objectives were well defined to align with the framework of the mission of HCMUTE and the mission of FEEE. In addition, these programme objectives are designed to provide students a solid background in mathematical principles and the fundamental concepts of medical electronics engineering, and skills to be able to continue professional development throughout their careers. Moreover, in order to enter a new era of rapidly increasing economic globalization, the programme objectives consist of providing interdisciplinary teaming and communication skills for students to

prepare graduates to function effectively and responsibly in the diverse environment.

1.5.1 Brief History of the Programme

In the programme objective, the BME programme aims to train BME engineers with professional competence, ethics and good health to meet the social demand. Graduates have the knowledge and skills such as the ability to calculate, design and execute medical equipment systems; the ability to apply new technology in medical equipment; the ability to consult for the design and construction of medical equipment systems for medical centers or hospitals; the ability to participate in research and teaching at biomedical engineering training institutions; having civic responsibility, correct attitudes, manners and professional ethics at work; the ability to work in teams and leadership qualities; having professional, social and legal knowledge for building a solid profession.

BME training programme began to build in 2015 and was approved by the HCMUTE training committee in early 2016. The programme began to recruit students for the first course in September, 2016 and there will be about 150 graduates by 2022, of which an average of more than 50 graduates per year.

1.5.2 Job Opportunities

Students in Biomedical Engineering will be the ability of:

- Supporting and co-operating with doctors in the medical centers.
- Working in medical equipment trading companies.
- Teaching at universities, and colleges in the biomedical engineering field.
- Working at biomedical equipment research institutes or centers.
- Working in companies and industrial zones for manufacturing medical equipment.
- Studying postgraduate programmes related to biomedical science and engineering fields.

PART II: CRITERIA

Criterion 1. Expected Learning Outcomes

1.1. The programme to show that the expected learning outcomes are appropriately formulated in accordance with an established learning taxonomy, are aligned to the vision and mission of the university, and are known to all stakeholders

HCMUTE is one of the largest universities and has many training programmes with different fields such as economics, engineering and education. In order to orient the development of many fields for supplying human resources for society, HCMUTE has the vision and mission to provide quality technology human resources with the ability of scientific research and international integration *[https://en.hcmute.edu.vn/]*.

BME programme is built based on many different requirements, in which the objectives of the BME programme are based on the vision and mission of HCMUTE, FEEE as described in **Table 1.1.** In addition to that, with the requirements of social needs and the statements of stakeholders such as employers, alumni, teachers and students, the BME programme with 4 Programme Objectives (POs) and 9 Expected Learning Outcomes (ELOs) are expressed clearly, including the knowledge, skills, attitudes and professional ethics *[Exh. 1.1. The mission and vision of HCMUTE and FEEE]*.

The BME programme has 9 ELOs which are stated based on Bloom's Taxonomy (Revised), in which the ELOs are required the wide range of knowledge, professional ethics, and skills related to society, economy and global**.** In addition, 9 ELOs in the BME programme were built based on the statements of 4 POs and completely correlated among them *[Appendix 1.1. Correlation between POs and ELOs]*. In these 9 ELOs, a lot of knowledge related to application for forming electronics systems applied to

the BME field. Moreover, there are knowledge for operation, analysis, evaluation, creativity, and ethics, contributing to complete common work of teamwork, and international integration.

Table 1.1. The programme objectives aligned with the vision and missions of HCMUTE and FEEE at the level of F-Fully Fulfilled or M-Moderately Fulfilled

POs	Degree of alignment	HCMUTE's Missions	HCMUTE's Vision	FEEE's Missions	FEEE's Vision
PO1: Apply, formulate and solve scientific, technical and technological problems in biomedical engineering field with social benefit	F	To provides services of practical training applied research and community outreach	To aims at becoming the leading hub for training, research, innovation and entrepreneurship	To provide students with the best learning environment for acquiring knowledge, skill, and attitude from real-life problems	To become the leading faculty in engineering education, scientific research, technology transfer, and service
PO2: Identify, develop, conduct experiments for analysis, and apply new knowledge with professional responsibility and ethics in biomedical engineering field	F	To provides services of practical training applied research and community outreach	To be one university on a par with other region universities	To conduct scientific research and technology transfer	To become one faculty with approaching region and international standards
PO3: Recognize and apply effectively when working in teams, and communicate effectively to people and even in English	M	To meet the demands of socio-economic development of the country	To be on par with other regional and international prestigious universities	To integrate internationally	To approach regional and international standards
PO4: Operate, apply, analyze, evaluate, design and manage health and medical systems in term of considering economic, social and human factors.	F	To continuous innovation and creativity, offering high quality human resources and	To become a leading hub for training, research, innovation and entrepreneurship	To provide high-quality human resources for the industrialization and modernization of the country	To *become the leading faculty in engineering education, scientific research, technology transfer, and service*

		scientific products			

The BME programme has 9 ELOs which are stated based on Bloom's Taxonomy (Revised), in which he ELOs are required the wide range of knowledge, professional ethics, and skills related to society, economy and global**.** In addition, 9 ELOs in the BME programme were built based on the statements of 4 POs and completely correlated among them *[Appendix 1.1. Correlation between POs and ELOs]*. In these 9 ELOs, a lot of knowledge related to application for forming electronics systems applied to the BME field. Moreover, there are knowledge for operation, analysis, evaluation, creativity, and ethics, contributing to complete common work of teamwork, and international integration.

With the vision and mission of HCMUTE and FEEE, the BME programme will train engineers to gain knowledge and skills such as application, operation, scientific research ability, hard work, business, leadership, integration and responsibility with the profession and thinking about society. In order for the BME curriculum can reach everyone, especially enterprises and potential students, it has been developed to be three types of descriptions to apply at HCMUTE, for enterprises and potential students. The curriculum makes it easier for the enterprises to understand core issues for employing engineers. Furthermore, the curriculum for potential students is designed to be easy to understand for selecting the training programme and it is often sent on opening days at HCMUTE *[Exh. 1.2. Curriculums for potential students and enterprises]*. In addition to this curriculum, the videos with main contents related to POs, ELOs, knowledge for an engineer to be able to work professionally in companies and they can develop and have the opportunity of jobs after completing the programme *[clips on the department website]*.

1.2. The programme to show that the expected learning outcomes for all courses are appropriately formulated and are aligned to the expected learning outcomes of the programme

The BME programme was designed based on many requirements such as MOET and HCMUTE regulations, HCMUTE vision and mission, FEEE, labor needs of the region and stakeholders. In particular, the stakeholders gave feedbacks, in which businesses, experts, alumni, teachers and the final year students showed different feedbacks corresponding to their positions. It is obvious that these feedbacks are very important for designing the training programme with suitable POs and ELOs *[Exh. 1.3. HCMUTE and MOET regulations]*.

In addition to the feedbacks from stakeholders, HCMUTE is always oriented to train technology engineers who always have high practical skills and diligence. Therefore, ELOs in the BME training programme mainly focus on skills of applying, operating and then analyzing and evaluating for the creation of new applications in the biomedical field and being useful for society. In particular, CLOs of each courses are often built closely related to ELOs of the training programme so that a graduate can achieve the desired skills. In particular, 4 POs of the programme is built to meet social demands, in which knowledge and skills are distributed into ELOs related to 4 POs. In addition, courses in this programme are assigned to ELOs and lecturers will edit their contents to align CLOs and ELOs with the assigned PIs *[Appendix 1.2. The relationship between POs-ELOs-PIs-CLOs of Courses]*. For adjusting and evaluating ELOs of the programme, PIs are always statistically worked out and this will bring the BME programme with ELOs better and more efficient *[Exh. 1.4. Syllabus sample with the relationship of ELOs/PIs and CLOs].*

1.3. The programme to show that the expected learning outcomes consist of both generic outcomes (related to written and oral communication, problem-solving, information technology, teambuilding skills, etc) and subject specific outcomes (related to knowledge and skills of the study discipline)

In the BME programme, ELOs were built to show the generic and specific knowledge related to skills

such as “understand, conceive, operate, apply, analyze, evaluate, design and create”. To achieve ELOs, many CLOs in courses have been designed for learning and assessment methods through a variety of different activities. In particular, depending on courses of theory, Labs/practical courses, which lecturers can design many different methods for teaching and assessing students through doing PIs in ELOs *[Exh. 1.4]*.

Table 1.2. ELOs related to knowledge and skills and levels of learning

ELOs	Domain (Bloom’s Taxonomy)	Level of learning	Knowledge/ Application/ Skill/Social Attitude	Generic learning outcome	Specific learning outcome
ELO-1. Ability to apply, formulate and solve principles, theorems, concepts of engineering, science and mathematics in the field of biomedical engineering	Apply	3	K	✓	
ELO-2. Ability to develop, conduct, and operate appropriate experiments and devices on boards, machines, and data obtained to interpret and produce results	Apply	3	K-A		✓
ELO-3. Ability to recognize professional and ethical responsibilities associated with biomedical engineering issues that affect the social, environmental, economic, and global contexts	Affective	3	SA	✓	
ELO-4. Ability to recognize and apply knowledge in appropriate and long-term learning strategies	Apply	3	K-A	✓	
ELO-5. Ability to effectively apply knowledge to teamwork, to provide Entrepreneurship and leadership to achieve objectives	Apply	3	A	✓	
ELO-6. Ability to explain, demonstrate, and communicate technical issues to people in the BME field and even in English	Understand	2	SA	✓	
ELO-7. Ability to analyze and interpret data obtained from the experiments to apply appropriate circuits and systems	Analyze	4	S		✓
ELO-8. Ability to effectively evaluate issues, systems and applications in biomedical field that can impact on social, economic, environmental and global contexts to have conclusions.	Evaluate	5	S		✓
ELO-9. Ability to create biomedical engineering systems using new knowledge and skills.	Create	6	S		✓

The BME programme has 9 ELOs basically consisting of generic learning outcome and specific learning outcome. In particular, in order to achieve the generic learning outcome, students study courses of natural science, information technology, biomedical science, digital electronics, digital signal processing and others which related to ELO-1, ELO-3, ELO-4, ELO-5, and ELO-6. For the specific learning outcome, students can study specific courses which can help them to have knowledge and skills for applying, operating, analyzing, evaluating and creating biomedical systems. In addition, the specific courses can be theories and Labs or practices related to ELO-2, ELO-7, ELO-8, and ELO-9 as shown in **Table 1.2**. Therefore, the generic courses are often designed to appear from the 1st semester to the 5th semester and students will study them before the specific courses. In addition to the outcomes of generic and specific learning, 9 ELOs are designed so that students achieve knowledge and skills with the domains of "Understand, Apply, Affective, Analyze, Evaluate, and Create" which are assigned the levels of learning from 2 to 6 as shown in Table 1.2. For one BME graduate, the BME programme is built to cover important issues as described in the following words:

- **Knowledge (K)**: Understanding of or information about a course acquired by experience or study.
- **Application (A)**: Applying skills and knowledge into real world situation in biomedical field.
- **Skill (S)**: Ability to work out an activity or a job because of practicing, developing or creating through training and experience.
- **Social Attitude (SA)**: Coordination, communication, teamwork, high responsibility, moral and professional ethics

Moreover, courses for generic and specific learning are scientifically distributed in 8 semesters, in which knowledge, skills, application and social attitude in the courses are arranged so that students can study at increasing level. In the BME programme, courses are also arranged to be prerequisite, previous and elective. Finally, students will perform a thesis course, called existing course, in which topics of the thesis are real systems/prototypes worked out in a team at least two students. Therefore, with the thesis topics, students apply a lot of knowledge and skills which they have studied previous semesters for completing.

1.4. The programme to show that the requirements of the stakeholders, especially the external stakeholders, are gathered, and that these are reflected in the expected learning outcomes

HCMUTE has an ISO procedure for adjusting a training programme and also it is based on the MOET regulation. Therefore, AAO and FEEE will organize meetings to deploy steps: ***Plan (AAO)-feedbacks, evaluating, updating contents of the programme (FEEE)-Checking (AAO)-Approving (HCMUTE board)-Applying (AAO)*** *[Exh. 1.5. The ISO procedure for designing programmes]*. The process for performing one curriculum, 4 years once, in which ELOs of the curriculum are considered to change or adjust to be suitable with the development of society based on feedbacks from stakeholders. In particular, the BME programme was designed in 2015 and ELOs were adjusted in 2020 from 19 ELOs to 9 ELOs to enhance soft skills, self-study ability of students with technology applications based on feedbacks from stakeholders *[Appendix 1.3. Feedback Contents from Stakeholders and Survey Methods]*. In addition, the feedbacks have several contents related to 9 ELOs as shown in **Table 1.3**. the adjustment of the curriculum with 9 ELOs makes student assessments more accurate through the statistics of 29 PIs. It is obvious that the objectives of the BME programme can achieve clearly and allow us easy to recognize for updating to meet learners' requirements.

In 2018, the BME curriculum with 19 ELOs was updated to be 132 credits compared to the 150 credits of the 2015 BME curriculum. In particular, in the BME curriculum, there were 6 interdisciplinary courses which students can choose to study for adding knowledge from the relevant programmes. In addition, the BME programme allows students to register for studying MOOC courses which are built scientifically *[Exh. 1.6. Interdisciplinary courses and MOOC list]*. With these courses, students can self-study using information technology tools on lecturer's LMS pages, in which

students can directly learn, read, download documents, directly contact with lecturers for discussing and do online exams. Students who register to study these MOOCs, are reduced 50% the course fee *[Exh. 1.7. MOOC pictures and regulation for studying MOOCs]*. Furthermore, 2 credits to study 6 topics with enterprises can help students to learn directly with enterprises for practically understanding careers, necessary skills and basic knowledge in business *[Exh. 1.8. Regulation for 2 courses]*. In addition to the 2 credits, HCMUTE enhances knowledge and concepts of business and leadership through 2 other credits by creating group activities such as scientific research, seminars with business representatives and others *[Exh. 1.9. Pictures of course with enterprises]*. In the adjusted programme, the credit of the internship course was increased from 2 to 4, this helps students to have much more practical time for studying at companies or hospitals *[Exh. 1.10. BME curriculums]*.

Table 1.3 Alignment between 9 ELOs and Stakeholders' Expectations and Requirements

Requirements	ELOs	Notes
Enhance the ability to apply scientific and engineering knowledge	**ELO-1.** Ability to apply, formulate and solve principles, theorems, concepts of engineering, science and mathematics in the field of biomedical engineering	Apply
Enhance to work out experiments and obtain results for interpreting	**ELO-2.** Ability to develop, conduct, and operate appropriate experiments and devices on boards, machines, and data obtained to interpret and produce results	Apply
Enhance professional ethics, especially ethical issues in in biomedical systems. Enhance to understand ethical knowledge about violations of plagiarism.	**ELO-3.** Ability to recognize professional and ethical responsibilities associated with biomedical engineering issues that affect the social, environmental, economic, and global contexts	Affective
Enhance knowledge about writing reports, in which there are citation, summary, conclusion.	**ELO-4.** Ability to recognize and apply knowledge in appropriate and long-term learning strategies	Apply
Enhance a lot exercises, course topics, projects, scientific research proposals	**ELO-5**. Ability to effectively apply knowledge to teamwork, to provide Entrepreneurship and leadership to achieve objectives	Apply
Enhance to team-works, activities with representation skills	**ELO-6.** Ability to explain, demonstrate, and communicate technical issues to people in the BME field and even in English	Understand
Enhance skills of analysis in projects.	**ELO-7.** Ability to analyze and interpret data obtained from the experiments to apply appropriate circuits and systems	Analyse
Enhance skills of evaluating results and produce ways to interpret better in projects	**ELO-8.** Ability to effectively evaluate issues, systems and applications in biomedical field that can impact on social, economic, environmental and global contexts to have conclusions.	Evaluate

Enhance skills of creating new problems in projects or systems in biomedical field	**ELO-9.** Ability to create biomedical engineering systems using new knowledge and skills.	Create

To be able to review and update the BME curriculum, the BME department will collect feedbacks from enterprises, alumni, graduates after 6 months or 1 year, teachers and students. Surveys are often performed by QAO, FEEE and the BME department and done 1-2 times each academic year or each semester through Online Google forms, face-to-face meetings, seminars, PSC pages. In addition, there are experts with training experiences who will review syllabi and curriculums before applying to train students. The BME department, FEEE and QAO often send surveys following plans and receive feedbacks from businesses after students graduate from 6-12 months for enhancing knowledge and skills such as understanding basic business laws, business basics, English skills, particularly communication, application software and knowledge of Artificial Intelligence (AI) *[Appendix 1.3.] [Exh. 1.11. Information of reviewing the BME curriculum, surveys and feedbacks]*. The department meetings with lecturers are organised to consider and select suggestions with reasonable knowledge related to many enterprises for adjusting contents and syllabi, ELOs which can align with the vision and mission of FEEE and HCMUTE *[Exh. 1.12. Department meetings about student assessment]*. In addition, student assessment during doing internship at the enterprises is performed through ELOs, except ELO2 and ELO9. The assessment results from the enterprises show that the rate of achieving these ELOs are from 85% to 90.8%, respectively as shown in **Table 1.4**. This proves that the ELOs related to the practical skills have met the needs of society.

Table 1.4 Student assessment during studying and working at enterprises

Contents related to ELOs	ELOs /PIs	Max mark	Average mark	Ratio (%)
Ability to read and understand technical English documents, apply and complete the job	ELO6 /PI6.4	12	10,9	90.8
Apply scientific and social knowledge to equipment systems at company/hospitals	ELO1 /PI1.2	14	12,6	90
Recognizing responsibility and professional ethics in activities at the company/hospital	ELO3 /PI3.2	12	10,3	85.8
Ability to estimate reasonable costs for building equipment models, calculate and contribute to the business	ELO3 /PI3.4	12	10.2	85
Ability to apply the right techniques, skills and tools to actual equipment systems taking into account economic, social, human and overall safety impacts	ELO4 /PI4.2	14	12.2	87.1
Ability to analyze a system engineering hardware, actual software processes to obtain results applied in a system	ELO7 /PI7.2	12	10,7	89.1
Ability to make statistics and evaluate results and propose new options to improve the medical device system	ELO8 /PI8.2	12	10,8	90
Individual contribution to the process of teamwork and leadership qualities in the process of working	ELO5 /PI5.2	12	10,8	90

1.5. The programme to show that the expected learning outcomes are achieved by the students by the time they graduate

In the BME curriculum, ELOs were designed with different levels based on the Bloom's Taxonomy related to many courses and each course has CLOs related to the ELOs of the curriculum. Therefore, the achievement of the ELOs through formative and summative assessments shown in syllabi. From the academic year 2019-2020, HCMUTE has a plan to do step-by-step to measure ELOs through Performance Indicators (PIs) of the curriculum *[Appendix 1.4 Measurement of ELOs achievement*

through PIs related to courses and other activities]. Thus, in the 2020-2021 academic year, the PIs measurement is the achievement of 50% of the ELOs and then will increase gradually according to the roadmap in the plan *[Exh. 1.13. 50% (2020-2021) and 100% (2021-2022) of PIs measured]*, in which each courses will be planned to measure at least one ELO. It is clear that the PIs measurement will help teachers look back at their contents, teaching and assessment methods to be able to correct and improve and also serve for adjusting and improving contents and ELOs of the training programme *[Exh. 1.14. Student assessment samples]*.

In order to achieve reliability for the ELOs of the training programme, a variety of teaching and assessment methods and assessment tools are designed and applied differently depending on different courses such theory, laboratory, practice. After each semester, the department organizes meetings for discussing about the feedbacks of students and lecturers for enhancing. In addition, courses are taught by many teachers, group meetings are organized to produce common teaching and assessment methods at the beginning of each semester. In relation in teaching and learning performance, HCMUTE always enhances and invests facilities such as internet system, self-study spaces, LMS pages, support services from SSC, INC, FMO, in which ERO often organize for visiting factories or hospitals and internships for enhancing skills *[Exh. 1.15. Group meeting reports of common courses]*.

In the BME curriculum, in each semester, the department always has the plan to do statistics of student assessments of courses through PIs *[Exh. 1.16. Plan for measuring PIs of courses and measured samples]* for obtaining information related to fail/pass rates of students for looking back the training programme. The BME programme has 8 semesters and the department will consider courses and has choices for suitably doing PIs statistics related to ELOs for enhancing the programme. Furthermore, the courses related to different educational and social knowledge need to have their assessment methods for PIs statistics for enhancing ELOs *[Appendix 1.4.]*. In order to achieve ELOs measurement, the department makes a plan and send to FEEE before working out, particularly the BME department makes a list with assigning ELOs related to courses in a semester and then sends to lecturers for performing PIs of courses at the beginning of each semester. Thus, the department will do statistics of all PIs which the lecturers completed to send FEEE and QAO. In addition, after the statistics of PIs results, lecturers and the department will consider the achievement of PIs for improving. In particular, if one PI measurement is lower than the initial threshold, lecturer needs to update teaching and assessment methods or contents and ELOs, inversely if it is higher than the initial threshold, that PI threshold needs to be setup higher for the next semester *[Exh. 1.17. FEEE quality objectives of academic years]*.

The BME curriculum was designed with 4 POs and 9 ELOs, in which knowledge and job opportunities are shown as published on the HCMUTE, FEEE and the department websites. In addition, the department built different BME curriculums for HCMUTE, enterprises and potential students and this is better for each relative group. For new students to study better, in the first semester, the course of introduction to BME will helps students to obviously understand the BME programme, as well as some knowledge, skills and HCMUTE offices that students need to know and prepare during studying time for achieving ELOs of the BME curriculum, meaning that for finishing on-time graduation. In particular, the training programme is built so that students after graduation will have strength skills in engineering and practical technology, mostly the attribute to work hard in a professional environment at enterprises, hospitals and industrial zones.

Criterion 2. Programme Structure and Content

2.1. The specifications of the programme and all its courses are shown to be comprehensive, up-to-date, and made available and communicated to all stakeholders

The BME programme specification with contents and structures coherently followed by MOET and HCMUTE regulations consists of the following information:

- Awarding institution: Faculty of Electrical and Electronics Engineering, Ho Chi Minh City University of Technology and Education.
- The name of the final award: Engineer of Biomedical Engineering.
- Programme title: Biomedical Engineering is oriented to train engineers of Biomedical Electronic Engineering.
- Expected learning outcomes of the programme.
- Admission criteria or requirements to the programme: based on the result of national graduation examination of the high school and the required minimum score of MOET. Moreover, students with the 1st/2nd/3rd prizes of province/city/national, high international English certificates, from specialized high schools are prior for recruitment.
- The structure and requirements of the BME programme are divided into courses with many different contributed levels to ELOs including the basic and advanced courses. The programme was constructed with 150 credits, in which there are 62 credits for the general knowledge and 88 credits for the professional knowledge as described in **Table 2.1**. In addition, teaching plan in the programme has eight semesters and courses in each semester are designed to be relevant. The curriculum map, which is the arranging flowchart of courses, is divided into eight semesters with columns and rows so that students are easy to know how to reasonably register courses for each semester. In addition, the description of each course with its code and credits in the programme is shown.
- Date is written on the programme specification revised/modified (will update at final version).

Table 2.1. Description of knowledge and credit distribution in the BME programme

Name	Credits		
	Total	**Compulsion**	**Elective**
1. General knowledge	**62**	**58**	**04**
Political Education and General Laws	13	13	0
Humanities and Social Sciences	04	0	04
English	12	12	0
Mathematics and Natural Sciences	27	27	0
Informatics	03	03	0
Introduction to BME	03	03	0
2. Professional knowledge	**88**	**79**	**09**
Biomedical and Electronics Core	30	27	3
Biomedical and Electronics Advanced Core	9	9	0
Biomedical Electronics Specialization	17	11	6
Laboratories and Practices	21	21	0
Internship and Graduation Thesis	11	11	0

In addition to this academic programme specification, 2 BME programme specifications for enterprises and potential students were designed, particularly the enterprises can be easy to recognize knowledge and skills which engineers achieve after graduation. With the potential students, knowledge, skills, job opportunities and places to work after graduation are very clearly shown. These programme specifications are posted on the website of Faculty/Department and on the official facebook page of the department *[Exh. 2.1. Programme specialisations for* enterprises and potential students*]*, *[Appendix 2.1. BME training programme specifications]*.

In the BME programme, syllabi are very important and standardized for all courses. In a syllabus, parts of main contents, teaching and assessment methods and others are built to achieve Course Learning Outcomes (CLOs) of the course based on Expected Learning Outcomes

(ELOs)/Performance Indicators (PIs) of the BME programme as described as follows *[Exh. 2.2. Syllabus sample with PIs]*.

- The course title is used both English and Vietnamese.
- Course requirements are consisted of the number of credits and the requirement of prerequisite and previous courses.
- Expected learning outcomes of the course in terms of knowledge, skills, and attitude are described through CLOs with the course contribution corresponding to ELOs/PIs in the programme using the Bloom's taxonomy and competence levels, including knowledge, skills, and attitudes of the students
- Brief description of the course is to talk about main contents of the course.
- The main contents are outlined
- Teaching methods such as representation, teamwork and others are shown
- The student assessments are shown, including 50 percent for the formative assessment and the remaining 50 percent for the summative assessment.
- Textbooks and references of the course are noted, in which there is the UTEx page with relevant materials, video clips, syllabus and others which are uploaded by lecturers.
- General information is academic integrity, flexibility notice, intellectual property
- Dates of writing, modification or revision are noted.

HCMUTE has the ISO procedure for designing and updating training programme specification. In particular, all training programmes are planned to consider for possible changes of POs, ELOs, courses and credits dependent on the needs of society, faculty development, the integration of HCMUTE with Vietnam and international universities or Vietnam with other countries. The programme specification and courses after finishing are posted on the FEEE/department websites and also sent to stakeholders for reviewing and taking feedbacks.

2.2. The design of the curriculum is shown to be constructively aligned with achieving the expected learning outcomes

HCMUTE has the ISO procedure for designing the curriculum, in which 9 ELOs are designed based on 4 POs related to knowledge, attitude and skills for BME engineers. In particular, after collecting feedbacks from enterprises, students and lecturers, the department will organize an academic meeting with lecturers to discuss and then choose the suitable contents for completing the curriculum. The chosen contents will be assigned to lecturers to complete before sending the FEEE committee to consider before approved by HCMUTE for applying to students (AAO). In addition, the curriculum has 150 credits for 8 semesters distributed the knowledge of basic, core, elective theory courses, Labs, internship, projects and thesis. It means that the courses are scientifically arranged so that students can easily understand and arrange their studying to achieve ELOs of the training programme *[Exh. 1.10. BME curriculum]*.

In addition, the curriculum with 9 ELOs and 29 PIs are divided into 62 credits for general knowledge and 88 credits for professional knowledge and teaching plans for semesters. **Table 2.2** describes courses distributed to map with 9 ELOs. In particular, course groups of humanities-social science, electric-electronics core, biomedical-electronics core and specialization are scientifically arranged in each semester, in which many courses of Labs, practices, projects, internship and thesis are designed so that each semester students can study 1 to 2 credits to increase practical skills with high engineering technology. It is obvious that the curriculum is scientifically arranged so that students can possibly achieve the desired ELOs and complete this BME training programme.

Table 2.2. Description of the number of the courses related to 9 ELOs

ELOs	ELO1	ELO2	ELO3	ELO4	ELO5	ELO6	ELO7	ELO8	ELO9

Total course	44	34	21	30	28	26	28	9	6

In the curriculum, ELOs were distributed knowledge, technological skills, general skills, attitudes and technical areas through courses *[Appendix 2.2. Relationship between ELOs with knowledge, skills and attitudes, and professional ethics]*. Most of the courses, which are purely theoretical or basic, are in ELO1, because many principles and formulas are applied in the biomedical engineering field related to knowledge and skills in courses of other ELOs. In addition, ELO2 is for courses with practical skills, operating and using software to produce results for evaluating and often used rubrics for assessing students. While parts of implement, calculation, analysis, and design in engineering usually focuses on courses of projects, internship and thesis related to ELO7, ELO8, and ELO9. In particular, knowledge and skills related to these ELOs are practical courses such as Labs, projects, internship and thesis. For ELO3, ELO4, ELO5, skills and knowledge of teamwork, communication, presentation, as well as long-term learning strategies can assess students in courses such as Humanities-Social Sciences, projects, Internship, Graduation Thesis, Topics with Enterprises and Leader and Entrepreneurship. For example, Microprocessor Lab is designed to relate in ELO1 to ELO7; the courses of Project 2 and Graduation Thesis for enhancing many skills and knowledge of BME field cover the most of all 9 ELOs with the high competence levels. In particular, when students work out their thesis, they need to finish a lot of knowledge and skills such as applying, designing, evaluating their products, showing new points and others in their reports, communicating their understanding, obtained results and responding questions at TDCs *[Exh. 2.3. Rubrics samples]*.

2.3. The design of the curriculum is shown to include feedback from stakeholders, especially external stakeholders

For the design of the curriculum, the curriculum is designed based on HCMUTE and MOET regulations, the development direction of FEEE and the feedbacks from stakeholders, students and lecturers. In addition, the BME curriculum is designed based on not only the needs of human resources for society, but also suggestions of stakeholders. In order to perform this, there are the following steps: ***Plan (AAO)- feedbacks, evaluating, updating contents of the programme (FEEE)-Checking (AAO)-Approving (HCMUTE board)-Applying (AAO)*** *[Exh. 2.4. Process for design of one curriculum]*. It means that the feedbacks are collected from medical and educational experts, doctors, medical equipment companies, alumni, lecturers and students:

Enterprises: The feedbacks are collected from business associations, annual job fairs, seminars with enterprises, cooperation in research and training between enterprises and FEEE, TDCs and sending surveys. In particular, the curriculum was sent to about 21 enterprises for receiving feedbacks and the seminar with enterprises and hospitals about knowledge and skills focusing on mainly related to ELO2, ELO5, ELO6, ELO9. In particular, the director, Dang Quoc Viet, said that he was very impressive with female student contributions to complete thesis and also students should learn and evaluate similar products on the market before implementing. In order to have the better products and commerce them, enterprises are ready to co-operate to HCMUTE so that students can complete their thesis products *[Exh. 2.5. Survey forms of the department and QAO and feedbacks]*.

Hospitals: The feedbacks are from meetings with doctors at hospitals, visiting hospitals, seminars between doctors and lecturers, TDCs. The head of the medical equipment office, Dang Thanh Hung, from Children's Hospital Ho Chi Minh City said that students see doctors for understanding about the needs of hospitals for designing products which can be used in practice. While the medical doctor, Pham Quang Co, evaluated very high and impressive about skills of thesis products with applying technique and technology. In addition, skills and knowledge can be necessary to meet applications in hospitals, in which the programme should add the knowledge about one quality process related to in the hospital *[Exh. 2.5.]*.

Alumni: The feedbacks are often collected on annual alumni day at HCMUTE/FEEE, through surveys sent by QAO and the department to graduates after 3 months, 1 year and more years. These

surveys often focus on their employment, job satisfaction, job positions and other suggestions such as the knowledge and skills for updating in the curriculum *[Exh. 2.6. Survey forms and alumni feedbacks]*.

Students: Every semester, FEEE often organizes a meeting face to face at the HCMUTE large Hall so that the department and FEEE members receive feedbacks and respond for all students. Moreover, FEEE and the department send surveys to students using Google form links for satisfaction about teaching quality, student supports, assessment methods, and other feedbacks *[Exh. 2.7. Survey forms and student feedbacks]*.

Educational experts: The curriculum was sent to educational experts such as academic lecturers in biomedical fields with a lot of experience from different universities Hanoi University of Science and Technology, Vietnam. They were invited to read the BME programme and then sent feedbacks related to general and professional courses, credits, training time and direction. In addition, visiting lecturers, who are often invited to teach some courses in the BME programme, could give feedbacks related to mindset about business law, how to build a quality hospital system with modern technologies, law on bidding for medical equipment *[Exh. 2.8. Feedbacks of education experts]*.

Lecturers: The feedbacks are through department meetings, the annual FEEE conferences and surveys, in which there are many suggestions about courses, assessment methods and contents after each academic year. From the suggestions, the curriculum was updated new knowledge for meeting studying needs such as AI, IoTs, and Python *[Exh. 2.9. Department meetings and updated contents in syllabus, projects]*.

From the feedbacks of the stakeholders, lecturers, alumni and students, the department has the meetings with lecturers and consider these feedbacks for building and updating the curriculum. After the meeting, the department selects the suitable points which can enhance or improve the curriculum and then send them to the FEEE scientific and training council for reviewing and approving before improving. In particular, the department could perform to update the number of credits, integration, change of courses and content improvement *[Exh. 2.10. FEEE scientific and academic committee, department meetings and updated problems in the BME programme]*.

2.4. The contribution made by each course in achieving the expected learning outcomes is shown to be clear

Syllabi of courses in the BME curriculum were designed with many parts, in which there are CLOs with main contents designed to contribute to ELOs. In addition, PIs measurements are performed following exam questions during studying. It is obvious that 29 PIs are added to all courses and they are chosen to measure each semester for improving many things such as teaching and assessment methods; ELOs; courses in the curriculum. The department registers to FEEE and QAO to work out PI measurements each semester until all ELOs in the curriculum are completely measured *[Exh. 2.11. Decision, department plan and results of PI measurements]*.

Courses were designed in relation to 9 ELOs in the BME curriculum, in which ELOs with the Bloom's taxonomy related to the courses are very clearly described contributions in the programme. In particular, contents of many courses are designed to relate in ELO1, ELO3 to ELO6 so that students may achieve general knowledge and basic skills with applying, formulating and solving problems in the biomedical field. While ELO2, ELO7 to ELO9 focus on intermediate to specialized knowledge and skills, in which students may study how to design, analyse, evaluate and create to produce products. Therefore, they will mainly study courses of Labs, projects, internships, graduation thesis and courses with enterprises. Furthermore, a course has CLOs designed to achieve ELOs depending on the type of the courses such as theory, practice, project, internship, thesis.

ELOs show relationships with professional knowledge (88 credits), in which there are 21 credits for Labs, 6 credits for projects, 4 credits for internship and 7 credits for thesis. In particular, the course of Digital Systems has 4 CLOs related to ELOs 1, 2, 6, 7; the Lab course of Microprocessor Lab with CLOs is related to ELOs 1, 2, 3, 4, 5, 6, 7; the course of Graduation Thesis is designed with CLOs so

that students may achieve all 9 ELOs with the high competence levels. In particular, the thesis course is the last major project of the curriculum, involving virtually all the knowledge and skills about building a product, designing, analyzing, evaluating and creating. In the BME curriculum, students can be trained to have specialised knowledge in the application, operation and manufacture of medical devices. Therefore, courses with the specialisations including theory and practice such as "Biomedical circuit design", "Medical equipment", "Biomedical signal processing", "Image processing". biomedical", "Health Information System", "Diagnosis Technology" are related to ELOs 1, 2, 5, 6, 7. Not only that, but CLOs of different courses contribute to ELOs to varying the competence levels. One of the important factors to determine the performance of the output standards of the curriculum is that CLOs of the course related to ELOs are PIs which are measured based on the assessment questions of the course.

2.5. The curriculum to show that all its courses are logically structured, properly sequenced (progression from basic to intermediate to specialised courses), and are integrated

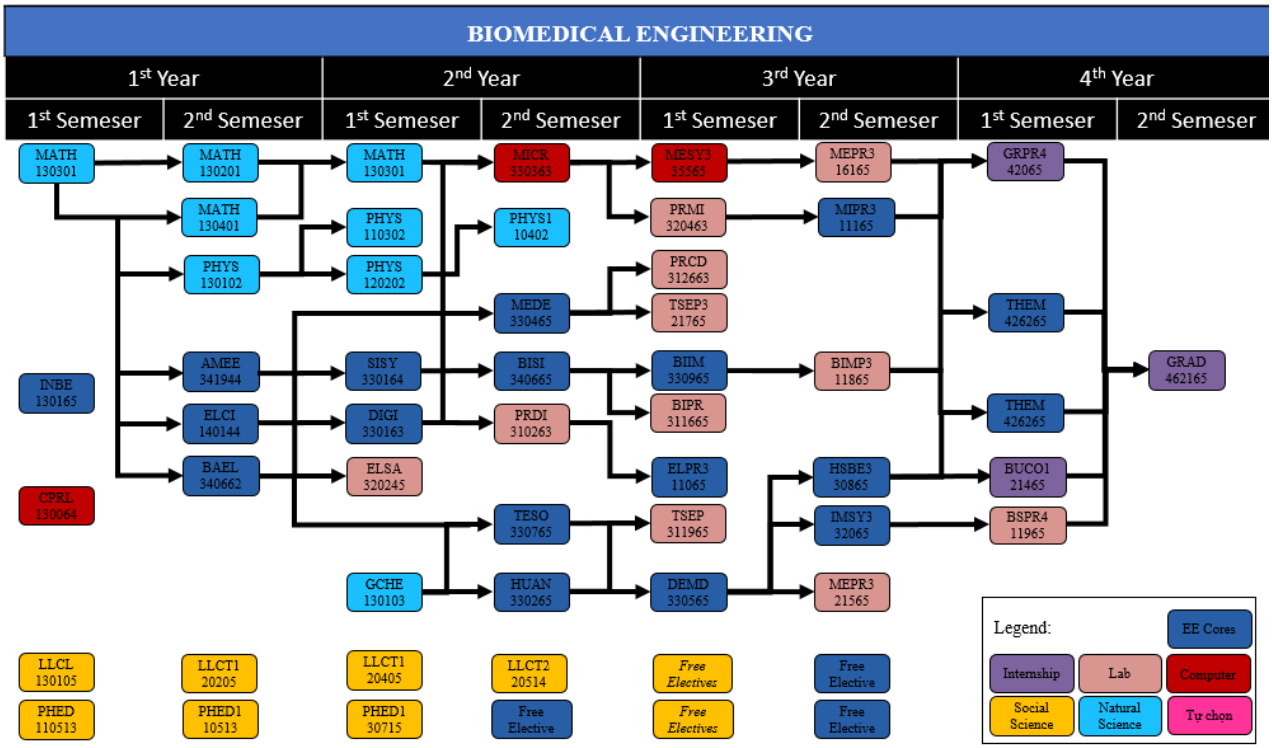


Figure 2.1 Teaching plan distribution map of the training programme

The BME programme is designed to train students following the direction of Biomedical Electronic Engineering in 4 years according to MOET and HCMUTE regulations. In addition, students are allowed to extend up to 8 years based on their reasonable reasons. In addition to lasting study, the curriculum allows students to complete sooner from 3 or 3.5 years. In 8 semesters, courses are arranged in order of knowledge and skills increased from basic to intermediate to specialized problems. The curriculum is designed in a coherent way among the knowledge modules related to general knowledge, professional knowledge, in which there are modules of biomedical electronics such as core, election, Labs, projects, internship and graduation project as described in **Figure 2.1**. In particular, with modules of core knowledge, students must finish to be able to study next modules. While the elective modules are for students to possibly select a desired direction to study. Moreover, graduation thesis is an important course, because students have to complete a practical product model with a lot of relative knowledge and skills such as completing products, writing reports to present before a thesis committee, system's design, evaluations of results, and conclusion. Therefore, they need to show their designed products to convince the thesis committee for achieving the best assessment results.

In **Figure 2.1**, in the 1st year, students learn courses with basic knowledge such as math, introduction to BME, electric circuits, basic electronics, human and animal physiology and anatomy and other theories. After the theory courses, students are studied Labs in the next semester. Moreover, from the 2nd year, students study specialised courses and do small projects with designing practical models related to electronics engineering. From the 5th and 6th semesters, specialized courses are arranged and elective courses are for students to choose the desired knowledge. Elective courses are divided into groups of courses in the direction of deeper development. Doing the projects helps them enhancing practical skills from basic to complex, teamwork contributions, presentation skills. In the 7th semester, students only focus on studying internship at enterprises or hospitals and 2 specialised Lab courses. studying internships at companies and hospitals can help students to familiarize the real environments with practical skills and knowledge, as well as having ideas for doing graduation thesis. In the 8th semester, students will perform their graduation theses, in which students can make a practical model such as a prototype involving a lot of knowledge related to 9 ELOs. Moreover, students can take more pedagogical courses to enhance their pedagogical knowledge for development of pedagogical profession.

In addition, the programme has core courses designed to be previous or prerequisite, this is to ensure that students need to pass the core courses before studying next courses or Labs. For example, in the 3rd semester, when students want to register the course of Digital Systems, they must take the prerequisite course of Basic Electronics. Furthermore, students who want to study practical courses are required to complete that theoretical course. For improving technical English, many specialized courses with English PowerPoint slides are designed to teach students. It is necessary to update new and modern knowledge such as AI, IoTs and application software such as Python for practical models *[Exh. 2.12. Exams and projects related to updated and integrated knowledge and skills]*. These knowledge parts are integrated to teach students in project courses or Labs such as biomedical image processing, capstone project. A TDC assess student's reports and their models using rubric with parts of knowledge and skills related to ELOs/PIs. In the curriculum, there are 2 courses such as Business and Leadership; Topics with Enterprises for increasing practical skills related to future jobs. In particular, students will be studied with enterprises following topics built in syllabi *[Exh. 2.13. Thesis slide samples and pictures with enterprise activities]*. Moreover, each semester, students are consulted and instructed to register courses through the websites of HCMUTE, FEEE and the department. In addition, HOD can advise students through his email address, by face to face meeting, by announcement on the department website, the department face-book *[Exh. 2.14. Information for counseling students]*.

In practice, human resources of the BME field for serving companies or hospitals in the South are very necessary. Currently, there are the biomedical physical programme, Ho Chi Minh City University of Technology; the BME programme, International University, VNU, Ho Chi Minh city; the BME programme, Ho Chi Minh City University of Technology (Hutech), the BME programme, Nguyen Tat Thanh University. However, the directions of these programmes do not focus deeply on training biomedical electronics engineers. In particular, the curriculum of International University is designed to train different directions such as "1. Regenerative Medicine; 2. Pharmaceutical Engineering; 3. Signal and image processing; 4. Medical electronics Design", where the electronics direction would not be enough depth of knowledge for a medical device engineer due to less credits for this direction. While, with a very strong electrical-electronics background, the BME programme, HCMUTE is oriented to train biomedical electronics engineers with specialized knowledge and skills for applying, operating, analyzing, evaluating results to create new problems. In addition, FEEE has many Labs of biomedical electronics which are very appropriate to orient for training students *[Appendix 2.3 Information of domestic and international BME programmes]*.

Moreover, in order to have a basis, similarity and integration, during building the BME programme, we compared it with a number of training programmes of surrounding universities, other regions. In particular, the BME programme has been compared with BME programmes of the International

University (IU), VNU-HCM city; Hanoi University of Science and Technology (HUST); Arizona State University (ASU), National University Singapore (NUS), in which each school has its own characteristics. It is obvious that these BME programmes were built with different orientations, credits and programme objectives depending on the vision and missions of each university. Therefore, the BME programme of HCMUTE with 150 credits was designed to train students to become "biomedical electronic engineers" who apply knowledge and skills for operating medical machines and systems, creating new medical systems *[Exh. 2.15. Information of other programmes]*.

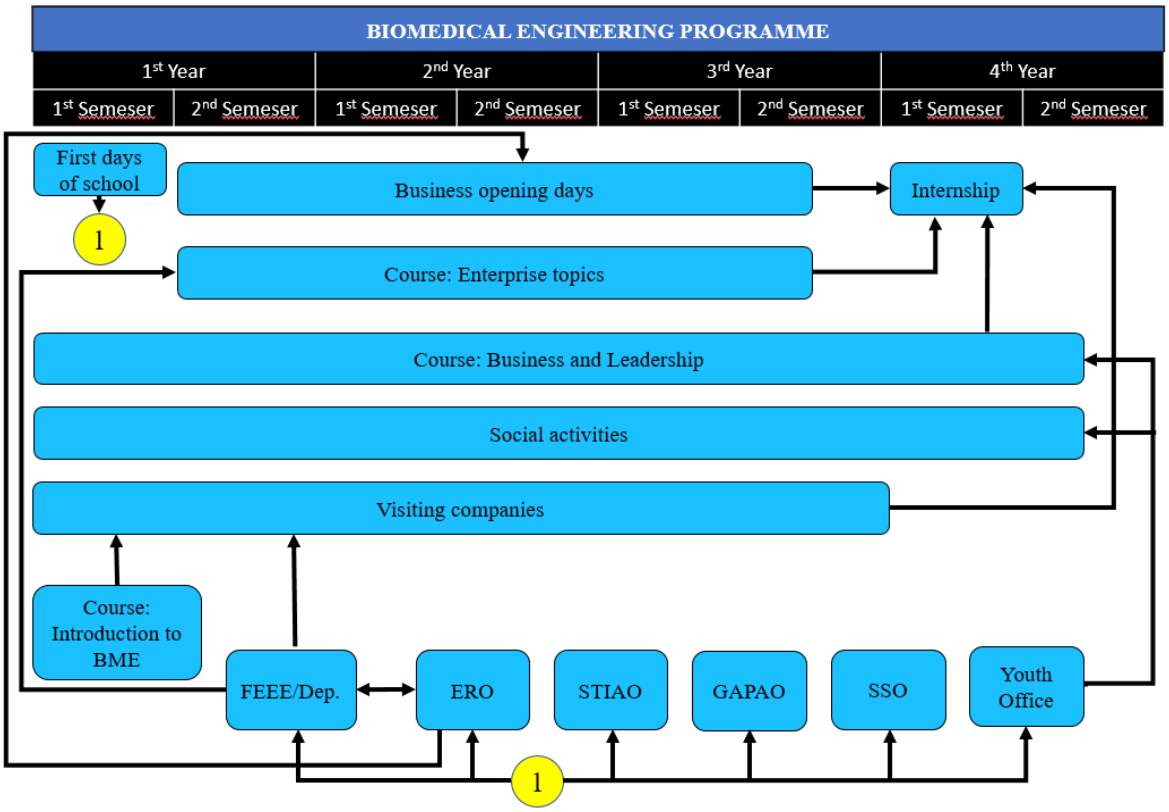


Figure 2.2 Co-curricular of students during semesters

Moreover, throughout the programme, students are often guided to visit companies or hospitals such as Thu Duc Regional General Hospital, Oncology Hospital in Ho Chi Minh city, medical equipment companies. Students are invited to attend seminars organized by companies or FEEE/Department, for example, the seminar of Agfa Healthcare Vietnam and this is a good opportunity for students to interact with many businesses during the academic exchange process *[Exh. 2.16. Visiting Enterprises and Hospitals]*. Students can meet businesses and hospitals through academic seminars with lectures and business seminars and will be transmitted knowledge and skills about job opportunities, investment, basic law in business and others. For new students, the BME course of Introduction to BME is very important because it can help students to understand the overview of the BME programme, skills in presentation, communication, practical participation, teamwork and other activities *[Exh. 2.17. Syllabus of Introduction to BME course]*. After studying the general and core courses, students will study practical subjects such as doing projects, capstone, thesis, which helps them to increase a lot of skills related to many ELOs. In addition, subjects with different knowledge and skills of basic, social science/humanities, cores, practice/Labs have the logic relationship are shown in **Figure 2.2**, in which the map shows contributions of co-curricular activities such as "Green Summer", visiting factories, opening days, topics about many practical skills with enterprises and internships related to 9 ELOs during 8 semesters in the BME programme *[Exh. 2.18. Pictures of co-curricular activities]*.

2.6. The curriculum to have option(s) for students to pursue major and/or minor specialisations

The BME curriculum has 8 semesters, in which the 1st to 8th semesters are scientifically arranged so that students can pursue specialisations as described in **Figure 2.1**. In particular, in the 1st semester, students study courses of sciences, societies and the curriculum introduction such as Advanced Mathematics-1, General Physics-A1, Informatics, Introduction to BME and the 2nd semester has courses with electric-electronics and sciences such as Advanced Mathematics -2, General Physics-A2, Chemistry, Electric Circuit, Basic Electronics, Digital Systems. In the 3rd and 4th semesters, students study courses with minor specialization related to biomedical and electronics problems such as Human and animal physiology and anatomy, Microprocessor, Biomedical Signal Processing and Biomedical Electronic Circuit Design. Courses with major specialization such as Biomedical Image Processing, Medical Instrument, projects and Labs are in the 5th and 6th semesters. The 7th semester is for internship and Graduation thesis is in the 8th semester. In addition, elective courses with humanity and society are designed so that students can choose to study in the 1st to 6th semesters. In this curriculum, there are 2 elective courses of 8 courses for students to pursue a minor specialization of biomedical electronic systems or medical imaging and processing technology in the 6th semester *[Exh. 2.19. Teaching plan of the BME programme]*.

In addition to the courses designed to study at classrooms, there are the courses which students study with enterprises at HCMUTE meeting rooms or online seminars in the Covid-19 condition. Furthermore, in the BME curriculum, some elective courses from other programmes are designed so that students can choose to study. Especially, the BME curriculum has MOOCs such as Digital Systems, Microprocessor which lecturers with experience design and students can choose to study. Moreover, in order to enhance knowledge of modern technologies such as IoTs, AI, Python software, topics and exercises in some major courses such as Biomedical Signal Processing, Biomedical Image Processing, Machine Learning, Projects are added. In the minor specialization of the BME programme, students can choose two courses of 8 courses which are divided into 4 minor directions as described in "**Elective Biomedical and Electronics Advanced Core (Select 02 courses)**" *[Appendix 2.1. BME training programme specifications]*.

2.7. The programme to show that its curriculum is reviewed periodically following an established procedure and that it remains up-to-date and relevant to industry

HCMUTE has the ISO procedure for updating the training programme, so the BME curriculum can be periodically reviewed, including planning, evaluating, collecting feedbacks, discussing and adjusting. In particular, the department can update parts such as teaching methods, assessment, CLOs, Syllabi content, ELOs and POs in the BME curriculum after each of 1 academic year, 2 years, 4 years. The steps to perform the change of the BME curriculum are described as follows *[Exh. 2.20. ISO procedure for updating programme and reviewing information]*:

- Planning to update and evaluate the BME programme (Plan).
- Organizing to collect information and evidence through meetings of FEEE and department, surveys and feedbacks from stakeholders and students (Do).
- Considering feedbacks, suggestions and sending the FEEE scientific and training council for updating (Check).
- After the FEEE scientific and training council, the department and FEEE will update and adjust (Act).
- After the adjustment, the department will send a list of the adjusted problems to FEEE for reviewing before sending to AAO for applying.

The BME curriculum with 150 credits was built in 2015 and applied in 2016 and updated in 2018 and 2020, in which the curriculum was decreased to be 132 credits by integrating courses and increasing self-study time of students. In 2020, the curriculum with 132 credits was changed to be 150 credits following the MOET requirement for the engineer standard *[Exh. 2.21. Plan and decision for the BME programme of years 2016, 2018, 2020]* and the BME curriculum was updated with courses to increase online studying, internship credits, Lab credits, knowledge of entrepreneurship, leadership.

In addition to these, the programme can be updated based on feedbacks from stakeholders, alumni, lecturers and students *[Appendix 1.3. Feedback contents from stakeholders and survey methods], [Exh. 2.22. Information related to TPP and the 4th Industrial Revolution]*.

For changing the curriculum, QAO, AAO, FEEE and the department often organize seminars to discuss together before giving lecturers a common guideline. In particular, the change or improvement of the programme is courses, integration, credits, exchange of courses between semesters, ELOs, syllabus contents. Therefore, when the change of the number of credits of the training programme is performed, it can be courses, internship, thesis. If it is the change of syllabi, teaching and assessment methods and the number of exam times are suggested, in which courses of Labs, projects, internship and thesis are suggested to use rubrics. After changing and updating, the curriculum and syllabi are posted on the department website and lecturers and students can refer and apply during teaching and studying.

Based on the relations and economic integration between Vietnam and other countries such as TPP or the 4th Industrial Revolution or the orientation and policy of Ho Chi Minh City for smart development in next years, the curriculum can be updated knowledge such as AI technology and IoTs to be suitable to the development of society *[Exh. 2.23. HCMUTE decision for online teaching and assessments and syllabus, online exams]*. Especially, with the appearance of the Covid-19 pandemic affecting the development and activities of all fields, in which there is education and training, so the curriculum needs to urgently adjust in terms of contents, teaching and assessment methods so that students can study online for completing their courses. Therefore, with courses such as Labs, projects, lecturers may enhance teaching and instructing students to study design calculation and simulation at home *[Exh. 2.24. Online projects, grade lists, online pages]*.

In particular, some courses were integrated and changed based on feedbacks such as 2 courses of Medical Safety and Ethics in Medicine integrated into the course of Safety and health in biomedical engineering or Embedded Systems in Biomedical Engineering designed to replace Embedded Systems and others. In addition, some courses are changed to enhance design skills related to system design in healthcare such as “Digital Electronic Circuit Design Center”, or new knowledge such as AI and IoTs in courses such Biomedical Signal Processing, Biomedical Image Processing, Machine Learning and projects. For improving teaching, lecturers often register to participate one-hour classes of other lecturers for sharing experience together about teaching methods each semester. At the beginning of each semester, the department has the meeting to look back last semester about feedbacks and problems and deploy new semester about teaching and scientific research plans and teaching and assessment methods. In particular, lecturers can update teaching and assessment methods, rubrics, how to teach and assess students in the Covid-19 using Zoom, Google Meet.

Criterion 3. Teaching and Learning Approach

3.1. The educational philosophy is shown to be articulated and communicated to all stakeholders. It is also shown to be reflected in the teaching and learning activities.

The BME programme was built according to the vision and mission of HCMUTE and FEEE alongside HCMUTE's educational philosophy “Humanity – Innovation - Integration” *[https://en.hcmute.edu.vn/]* and FEEE's philosophy “Cooperation – Sharing - Integration” *[https://feee.hcmute.edu.vn/]* and also based on HCMUTE and MOET regulations to meet the requirements of stakeholders, students, alumni and lecturers. Educational philosophy is displayed on the boards in meeting rooms, conferences, halls, and symposiums *[Exh. 3.1. HCMUTE educational philosophy]*. Therefore, the BME programme has been built to follow the education philosophy to collect international students in **Table 3.1**. In particular, Mailorkham KhengKham is one Laos student studying the 2019 year of the BME programme *[Exh. 1.3. HCMUTE and MOET regulations]*.

With HCMUTE humanity philosophy, lecturers understand and apply suitable methods for teaching with student-centered design of teaching activities to help students to develop their potential.

Therefore, students' feedback on each course can help lecturers to adjust teaching activities for increasing understanding and they can be left behind, including weak and handicapped students. The "exam review" programme is a supplementary activity that helps students share experiences, master knowledge, and progress. In terms of student life, HCMUTE is very interested in supporting students in difficulty by establishing "sharing corners", "sharing Tet" campaigns. Especially, during the COVID-19 pandemic, HCMUTE mobilized donations to support students stuck due to the isolation of daily necessities *[Exh. 3.2. Channels for receiving feedback from students and support campaigns].*

Table 3.1 The relationship between the education philosophy and ELOs

HCMUTE Educational Philosophy	ELOs
To educate, inspire and support to be competent, conscientious and responsible individuals; To bear new skills for individuals, for global citizenship, for entrepreneurship and other core skills.	ELO1, ELO5
To provide opportunities for a comprehensive development of cognitive competence, social and behavioral competence and technical competence; To be the core values of life-long learning for self- constructing and enriching knowledge and skills to improve creativeness potential to serve the community.	ELO3, ELO4
To be linkages between HCMUTE and Industries; To construct an innovative educational environment and move beyond standards based on the deep learning through integrating proper technologies and applying active and experiential teaching methods; To meet the various needs and diverse changes of the society most effectively	ELO2, ELO6
To provide manpower with an excellent educational background, creativity and realizing ideas.	ELO7, ELO8, ELO9

Students have the opportunities to demonstrate and develop their intellectual and creative abilities through projects. Therefore, they can choose different topics for their purposes and reasons. In addition, they can participate in many creative contests organized by FEEE and HCMUTE such as Logo Design or Maze Solving Robot. From the obtained results at the HCMUTE contests, they can register to participate in other competitions outside HCMUTE such as Eureka organized by Ho Chi Minh City Youth Union or Scientific Research Student Award by MOET *[Exh. 3.3. Students participate in competitions and awards].*

Globalization of higher education is an essential factor to which HCMUTE pays particular attention. One of the main factors is the English proficiency of lecturers and students, so it can not only help to enhance knowledge, but also the international cooperation about training and scientific research. Furthermore, HCMUTE organizes several training courses and seminars abroad in India and Philippines for lecturers to experience and enhance English and specialization at enterprises or universities. Occasionally, HCMUTE and BUILD-IT annually organize courses related to training programmes and domestic and foreign experts are invited to deliver these courses. The BME programme allows students to participate in internships at foreign universities to carry out projects with foreign university professors *[Exh. 3.4. Foreign training and internship courses].*

3.2. The teaching and learning activities are shown to allow students to participate responsibly in the learning process

Table 3.2. Teaching methods corresponding to Bloom Taxonomy levels

ELOs	Bloom Taxonomy levels	Teaching methods
1, 2, 4, 5	Apply	Problem solving, group presentation, group discussion
3	Affective	Group presentation, problem solving
6	Understand	Lecture, model, solve exercises

7	Analyse	Project, visualization
8	Evaluate	Group presentation, report writing
9	Create	Group presentation, report writing

The student-centered teaching methods help students to be more responsible in their learning activities. Lecturers can use various teaching methods to communicate contents to students to achieve the desired CLOs of courses. Contents, teaching and assessment methods, and CLOs/ELOs/PIs of one course are outlined and announced by the lecturer to students on the course's first day. The BME programme has various teaching methods such as group presentations, group discussion, problem-solving, demonstrations, extensive exercises, and group reports as shown in **Table 3.2**.

All courses in the programme are designed according to ELOs which are basically divided into three knowledge-based categories: basic, intermediate, and specialisation. Basic courses begin in the first three semesters and the remaining semesters are for the intermediate and specialized courses. To achieve ELOs in the programme, students need to complete all courses, so they extremely work out requirements of the lecturer for each course. In particular, classroom time, time for self-assessment questions and drill problems, exams, how to work in a team, to make products and others. It means that they must understand the curriculum and syllabi to achieve studying performance *[Exh. 3.5. Syllabus sample with CLOs]*, *[Exh. 1.10. BME curriculum]*.

For example, for the course of Digital Systems, students must attend classes to understand basic concepts and principal parts. In particular, students have to do exercises and self-assessment questions after each lecture on the UTEx system and discuss together through the class forum. During study, students participate in online quizzes, simulation topics with groups, and other exams. Digital System Lab with one credit is one of Lab courses which students will study in the BME programme. The students are introduced to the experimental document and instructed how to study this course, in which they need to prepare tasks before studying at Lab using knowledge of Digital Systems theory. In addition, they are instructed how to use equipment, relative tools and assignments for assessments during studying Lab *[Exh. 3.6. Exams of Digital systems and its Lab]*. To be able to adjust teaching and assessment methods, lecturers will get feedbacks from students through Google Form *[Exh. 3.7. Surveys and feedbacks for students from the lecturers]*.

Lecturers are assigned to teach the same courses, they will take the meeting at the beginning of each semester for agreeing contents, teaching and assessment methods. With the thesis course, students are required to choose any appropriate research topics to work in one group with a supervisor. At the start of a topic, the supervisor will instruct the students how to work out projects step-by-step, including the topic overview, contents, goals, objectives, literature review, product design, instrumentation, construction, installation, assembly, and final report writing. Moreover, students are required to send weekly reports and discuss with the supervisor so that their projects can achieve high quality *[Exh. 3.8. Thesis teaching profiles and report]*.

3.3. The teaching and learning activities are shown to involve active learning by the students

Lecturers implement active learning techniques that empower students to take the initiative throughout their studies. Lecturers play the coordinator role in providing and guiding learners with background knowledge and learning methods to help them actively or experientially engaged in the learning process. In particular, several methods have been adopted, including online video lectures on the UTEx pages, self-assessment and drill questions and online multiple-choice assessments during studying time. Moreover, lecturers employ teaching methods to increase self-study, including reducing lecturing time and allowing students to work on reports and participating more in classroom discussions *[Exh. 3.9. UTEx page sample]*. In addition, during studying courses, lecturers often send brief surveys to students for receiving feedbacks for adjusting teaching and assessment methods, homework, materials on the UTEx page *[Exh. 3.10. Exercises and Quizs on UTEx]*.

In the BME programme, Labs and projects provide good practical hands-on experience for students. Nearly 20% of the total specialised course credits are for Labs and projects via 7 thesis credits. For Lab courses for studying practical problems, lecturers will instruct students how to use equipment and work out experiments, particularly they need to prepare Lab tasks at home with relative knowledge studied in theory courses before doing experimental tasks. Moreover, students need to perform simulation homework before studying Lab tasks, this help them well understand during studying Labs *[Exh. 3.11. Lab samples and assessments]*. With the projects, students are instructed how to do a real model, write a report, and assess during performing time. Therefore, students have around 2 weeks for choosing suitable topics and they can perform these topics after discussing with their instructors. Lecturers will evaluate studying performance through week reports, real models and representation using rubrics *[Exh. 3.12. Project samples and rubrics]*. In order to well understand what need to do, students can be rubrics which are posted the department website.

In addition, students study internships for at least 8 weeks at enterprises or hospitals, particularly they are introduced to the enterprises or hospitals to learn practical problems such as the organizational structure, the company operation process and to directly participate in the production work of the company *[Exh. 3.13. Information of studying with enterprises and rubric samples]*. In the collaboration and relationship program between Japan and Asian youths (SSEAYP 2019) organized by Ho Chi Minh City Youth Union, the student, Pham Tan Thanh with excellent studying achievement, was chosen to participate in an internship at Chung Yuan Christian University, in Taiwan, August 2019 *[Exh. 3.14. Oversea internship information]*.

For co-curricular activities, the department, FEEE and ERO will invite reputable enterprise or hospital representatives to organize seminars and students will be studied practical knowledge related to the operation of enterprise and also discussed with them for more understanding. In addition, the courses of Leadership and Entrepreneurship, Topics with Enterprises are aimed at enhancing the practical learning environment, skills and knowledge for students. These courses will help students directly attend to discuss with enterprises many practical issues *[Exh. 3.15. Lists of students participating in scientific research and seminars]*. From these activities, students have good ideas for performing projects during studying and develop them after graduating. Moreover, students will practically think about more active problems and have more realistic approaches for learning to achieve good results to be able to be successful in the future.

3.4. The teaching and learning activities are shown to promote learning, learning how to learn, and instilling in students a commitment for life-long learning (e.g., commitment to critical inquiry, information-processing skills, and a willingness to experiment with new ideas and practices)

HCMUTE's educational philosophy emphasizes the importance of life-long learning for students. Throughout the BME programme, students are acquired fundamental knowledge and skills from courses such as mathematics and other life sciences taught in the first semesters. Moreover, they can develop English competency, freely explore and enrich their understanding alongside other activities that will help them improve their creative potential and to meet their aspirations for serving the surrounding community. The reference competence frameworks can be shown as follows:

1. Communication in the mother and foreign tongues;
2. Mathematical, basic and Digital competences in science and technology;
3. Learning to learn;
4. Social and civic competences;
5. Sense of initiative and entrepreneurship and leader;
6. Cultural awareness and expression.

Students are gradually trained to communicate in their mother tongue through reports of projects, internship and thesis and presentations. In particular, students can respond to questions from

lecturers or committee members as well as demonstrate the students' ability to communicate different problems. These courses offer many ELOs through rubrics and students well understand the contents corresponding to ELOs to enhance communication and presentation skills to achieve high efficiency, fairness and reliability. In addition, for assessing students' life-long learning, the rubrics basically enable to assess skills such as writing reports, how to cite references, oral representation, how to do teamwork *[Exh. 2.3 Rubrics samples]*.

HCMUTE always has solutions for improving students' English ability for enhancing understanding of the world outside Vietnam, overseas studying and life-long learning *[Exh. 3.16. English clubs and sample teaching slides in English]*. In addition to English courses at classrooms, students can improve their English skills by participating in English-speaking clubs on or off-campus. To complete the programme, students must achieve the English outcome with the TOEIC English certificate of 550 points or equivalent. HCMUTE encourages lecturers to teach subjects with English power-point slides so that students can improve reading and writing *[Exh. 3.17. English outcome (TOEIC 550) of HCMUTE regulations]*.

Regarding information technology, students learn basic programming, application programming, and specific simulation software in courses such as C programming or Python's language and application programming to draw electrical circuits and design 3D models. In particular, students can apply the programming knowledge in courses such as Microprocessor, Biomedical Signal Processing, Biomedical Image Processing, and Embedded systems in biomedicine, projects and thesis. In addition, lecturers focus on teaching skills such as searching and information processing for study and research. For doing projects or thesis, lecturers often allow students to choose their research topics which they are interested in or have skills to finish them. In addition, lecturers give advice, comments related to writing, doing real models, self-study skills and others. In addition, HCMUTE library regularly organizes seminars to introduce new updates, guide how to search documents, and collect student feedback for improving services *[Exh. 3.18. Syllabus of Introduction to Biomedical Engineering and guide to finding information of the library]*.

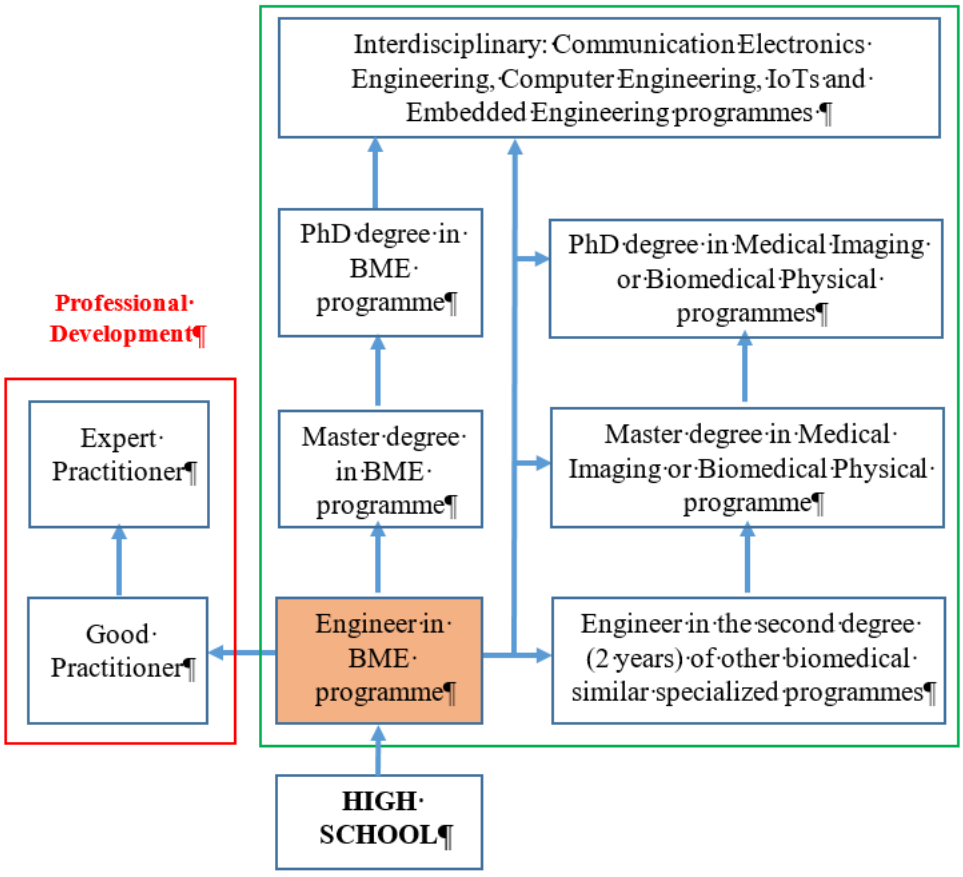


Figure 3.1. Diagram blocks for development of graduates

The BME programme is designed to promote students' self-study and help them learn more easily from the proper arrangement of different knowledge blocks. In the course of Introduction to BME, new students are familiarised with their study programme and the curriculum; also they are introduced to Labs and provided opportunities to discuss many courses and study environments with former students. It means that fundamental courses can contribute knowledge for students to self-study and develop their competence for lifelong learning. From the 2nd and 3rd years, students are introduced to practical subjects and projects for developing reflective learning. In the project courses, students are instructed step by step to choose a topic, define objectives, write out contents and a plan to perform and finish them. For the practical courses, students need to perform exercises which lecturers require such as analysis, designing, testing, completion of reports. With the studied knowledge and skills from the BME programme, graduates can study postgraduate programmes or professional development with relative fields as described in **Figure 3.1** *[Exh. 3.19. Syllabus and project reports of students].*

Especially, in some subjects such as: embedded biomedical systems, biomedical sensor technology, medical information systems, etc., learning activities have enhancement of doing essays and presentations. In particular, students are required to search documents, process information, analyze and synthesize for their reports. Furthermore, students need to enhance skills of reading English documents, presentation, discussion, teamwork and critical thinking *[Exh. 3.20. Sample essay reports of students]*. Furthermore, Students are encouraged to join the Youth Union/Student Union for community service activities and they can study a sharing attitude and learn how to become a civilized person in society. Students are encouraged to make donations for support of disadvantaged students and people affected by natural disasters *[Exh. 3.21. Support donation lists].*

For graduation, in addition to the good completion of courses in eight semesters of the programme, students need to complete a lot of knowledge, skills, social and scientific research activities. In particular, students are encouraged to conduct scientific research in order to develop critical thinking, creative thinking and research competence. Students can participate in competitions organized by the department, FEEE and HCMUTE such as LOGO Design, I - The Student Leader, Historical Years *[Exh. 3.22. Photos of students participating in competitions], [Exh. 3.3].* In the practical activity, students can register for factory tours, internships which help students to study practical knowledge and skills and understand about activities of companies or hospitals *[Exh. 2.16. Visiting enterprises and hospitals]*. Cultural awareness is conveyed through civic activities at the beginning of the academic year. HCMUTE and FEEE often organize activities for students to visit and donate to SOS children's villages (March 2021), with gifts to policy families (April 2021), the Central region affected by floods. (11/2020) and others *[Exh. 3.23. Social activities].* These activities teach students to understand and know thinking about community and society.

3.5. The teaching and learning activities are shown to inculcate in students, new ideas, creative thought, innovation, and an entrepreneurial mindset

Active teaching methods and co-curricular activities have encouraged students to participate in scientific research and make projects for developing and applying new ideas, creative thought, innovation, and an entrepreneurial mindset. Besides theory courses, Labs and projects will enhance students' specialized knowledge and practical skills, particularly they can study the connection of small and basic circuits on KITs for understanding their operation and how to make it. From these Labs and projects, students basically know how to apply, analyse, evaluate their models or products and then can improve and complete them with new ideas or innovation. After that, they can perform a Capstone Project in the 7th semester and graduation thesis in the final semester with creative thought based on knowledge and skills studied from previous semesters and co-curricular activities with the highest competence level. In addition, they know how to calculate the cost of one model

or product and think about an entrepreneurial mindset of their product *[Exh. 3.24. Thesis report sample and product video clips]*.

HCMUTE always encourages students to do scientific research, particularly they can register student projects and are supported with fees for buying electronic devices. In addition, they can be the members in lecturer projects and have opportunities to study how to do scientific research from the lecturers for improving practical knowledge, skills and creativity *[Exh. 3.25. Student project working with lecturer and paper]*. Moreover, when students work out research with lecturers, they will learn how to think about new ideas, creative things, analyzing, and computing price for a real model. As a result, students gain a vast amount of valuable experience and skills in engineering designs, simulation and modelling of machinery and equipment. In addition, FEEE has open-access workshops and laboratories such as C206 (Electronic Circuit Design and Biomedical Image Processing), C305 (Medical Equipment) and C306 (Medical Signal Processing) to support students in undertaking projects and scientific researches and this encourages them to create novel products and enhances real skills. *[Exh. 3.26. Pictures of BME LABs and student activities]*.

Entrepreneurship creates new value for a specific audience towards serving the community, solving people's problems alongside sustainable development. In addition, the programme aims to train students with specialized knowledge related to entrepreneurial mindset through two courses of Entrepreneurship and Leadership; Topics with Enterprises courses from the 2018 academic year. In particular, students will attend these courses from the 1st to 7th semesters through seminars or workshops organized at companies or HCMUTE. In addition to those two courses, projects and thesis help students to know how to create products, to calculate price, to analyse, evaluate, compare the effectiveness of the products for commercialization in the market *[Exh. 3.27. Tables of estimated costs in student's graduation thesis]*.

3.6. The teaching and learning processes are shown to be continuously improved to ensure their relevance to the needs of industry and are aligned to the expected learning outcomes

HCMUTE has the ISO procedure for quality assurance of all programmes, particularly the teaching and learning activities are deployed by the departments in collaboration with FEEE and they are monitored, reviewed and evaluated by QAO and AAO. In particular, the BME department and lecturers are responsible for dealing with the quality of teaching and learning. After each semester, the department has a meeting with the lecturers to discuss and evaluate the teaching and learning process based on feedback and then give problems for improving *[Exh. 3.28. Department meetings for teaching and learning]*. For example, possible improvements are exam questions of courses, the security of printing paper exams, exam submission, offline or online examination, assessment and teaching methods, updating exam questions *[Exh. 3.29. ISO procedure of AAO]*.

FEEE and HCMUTE often organize meetings with students at the end of each semester to collect feedbacks, opinions, needs and answer their inquiries *[Exh. 3.30. Meetings pictures, student feedbacks]*. The correct and suitable feedbacks related to the FEEE, lecturers, teaching and learning process are considered and possibly improved. Other feedback related to other functional offices will be considered to improve so that students have the best conditions for learning. For receiving feedbacks, QAO annually conducts surveys for students, lecturers, alumni and enterprises. In addition, the department sends surveys to students, alumni and enterprises to receive feedback related to assessment and teaching methods, specialized knowledge and skills for improving contents, courses, syllabi for enhancement *[Exh. 3.31. Alumni and company survey results]*. In particular, syllabi in the BME programme are designed under the PDCA approach with 4 basic steps as follows:

Plan: Design CLOs, lecture contents, teaching and assessment methods.

Do: The lecture contents must match the syllabus approved by the department and FEEE.

Check: Assessment methods used in syllabi can be Q&A, quick quizzes, MCQs, online questionnaires, representation and report, essay. The assessment methods, CLOs and contents can change, update, improved in each syllabus based on student feedback or PIs measurements *[Exh. 3.32. Student survey results and PIs measurements]*.

Act: From feedback from students and lecturers, the department has the meeting with lecturers to discuss improving teaching and assessment methods *[Exh. 1.15. Group meeting reports of common courses]*.

In addition to feedback for improving English and professional knowledge *[Appendix 1.3. Feedback contents from stakeholders and survey methods]*, enterprises give feedback related to basic laws in business, entrepreneurship, building models for thesis based on the needs of enterprises and hospitals. From these feedbacks, the department adjusts ELO3 and ELO9 in the curriculum. In particular, students need to have knowledge such as IoTs, AI, Python software, to improve English and should perform real models which can implement. From these feedbacks, the department was updated the courses and knowledge related to IoTs, AI and Python software in the programme *[Exh. 3.33. IoTs model and some AI application]*.

Criterion 4. Student Assessment

4.1. A variety of assessment methods are shown to be used and are shown to be constructively aligned to achieving the expected learning outcomes and the teaching and learning objectives

According to the HCMUTE regulations, continuous assessments are mandatory for students throughout their studies. In particular, these assessments include entrance exams, formative and summative assessments of almost all courses, and progression assessments of projects, internships and graduation thesis. In addition, students have to attend co-curricular activities and community services to fulfil the curricular activity requirements.

The decision for student admission to the BME programme is based on some recruitment solutions: national high school examination; high school GPA with an average of from 7.0 each course within a specific group of courses; $1^{st}/2^{nd}/3^{rd}$ prizes of province/city/national/international levels. The national high school examination often has the five following courses related to Mathematics, Literature, Foreign Languages, Natural Sciences and Social Sciences and the admission to the BME programme is the course group related to Mathematics and Natural Sciences. Moreover, students with $1^{st}/2^{nd}/3^{rd}$ prizes of Math; Physics; Chemistry; Literature; English; Biology; Informatics or Science and Technology will be prior for recruitment It is obvious that the evaluation of the ELOs achievement in the BME programme basically depends on the quality of student intake *[Exh. 4.1. Entrance recruitment information]*.

English fluency of first-year students is evaluated through the TOEIC entrance examination results for arranging appropriate studying plans, in which students with limited English are arranged to have more time for improving their English. Moreover, their studying plan for semester courses is more proper to increase the studying quality. This means that the assessment of the English ability helps students to be more proactive during their studying semesters *[Exh. 4.2. English examination information]*.

For student assessment, all lecturers apply the HCMUTE regulations on the AAO website and the ISO procedure on the QAO website. According to the procedure, questions for formative and summative assessments must follow CLOs stated in the course syllabus and be approved by the BME department, ensuring that the BME programme's ELOs are fulfilled. Depending on the course, lecturers can use different formative assessment methods such as quick tests, online MCQs, essays, group presentations, simulation and modelling. These assessment methods are integrated in the course syllabus and posted on the UTEx system, where lecturers can easily create course works, assignments and interact with students. In addition, students are assessed through co-curricular

activities through participating in four days of social activities *[Exh. 4.3. ISO procedure for student assessments]*.

In particular, 3 PIs are measured related to ELO2, in which one of these PIs is the problem of "using systems for data acquisition from hardware and software for analysis and representation" in the course of Bio-Signal Processing, Bio-medical Sensor Technology Lab, Bio-signal Processing Lab. Many different assessment methods are used, in which the oral method is used in the course of Bio-medical Sensor Technology Lab to assess using machines and data acquisition systems for analysis and representation. For ELO6, 4 PIs are measured and one of these PIs is about "ability to explain and communicate work contents in written form". In particular, this PI is measured through the courses such as Biomedical Electronics Circuits Lab, Biomedical Instrumentation Lab, Bio-medical Image Processing Lab and others. Most Lecturers assess students based on their reports about ability to interpret and present work results in written form. With ELO7, there are 3 PI measurements, in which one of these PIs is about "ability to analyze, plan to build hardware/software for processing technical systems". This PI is related to courses such as Biomedical Instrumentation, Thesis, Internships and others. The main assessment method for this PI is that students need to represent the ability to analyze and technical solutions to build hardware engineering systems or logical software processes *[Exh. 4.4. Assessment of courses and information of PIs measurements]*.

Internships are practical courses which students study at enterprises and hospitals for enhancing practical knowledge and skills. For studying procedure, the BME department will send practical contents which students need to practice related to CLOs to the enterprises and hospitals for arranging to study accordingly on the BME department website. Enterprise representatives will instruct and assess students during studying and then send the internship results to the department and the department lecturers will assess the internship process through interviews and reports to produce the internship grade. After internship, graduation thesis is an essential course, requiring students to achieve numerous ELOs at the highest level. Students must complete the programme's courses notified on the BME department website to assign the graduation thesis. For the student's graduation thesis to meet the desired CLOs, the BME department encourages students to research the topic overview, collect relevant documents and graduate theses from the previous semesters, select practical topics from internships, applications introduced by companies or hospitals. A student's graduation thesis is assessed by a supervisor, reviewers, and a thesis committee. Rubrics for assessment issued by the department and posted on the department website. In addition, the BME department often invites employers and medical experts to attend the thesis committee for better objectivity and practicality in the assessment process. Participation of enterprises and hospitals provides helpful feedback for the student's prototypes while assessing their practical sides in reality. In addition, enterprises and hospitals give suggestions to perceive, learn and improve the practical knowledge and skills to make the products better *[Exh. 4.5. Information about internship and graduation thesis]*.

4.2. The assessment and assessment-appeal policies are shown to be explicit, communicated to students, and applied consistently.

Student assessment and assessment-appeal policies are specified in the HCMUTE regulation updated July 2021 which was posted on the AAO website. According to this regulation, with the theoretical courses, students are assessed through formative and summative assessments. The formative assessment is performed at least three times and its rate is 50% and the summative assessment is 50% of the course total grade. The course final result is calculated by the average of both the formative and summative. Moreover, the scale of each examination is 10-points and rounded to one decimal place. While courses of Labs, projects, internship and thesis are assessed during studying time of 15 weeks to produce the final result *[Exh. 4.6. HCMUTE regulations for training (7/2021)]*.

In addition, lecturers are responsible for introducing syllabi with many problems to students, in which

there are student assessments on the first day of the course. It is obvious that students well understand not only studying contents but also assessment methods and all course information is posted on lecturer UTEx page. In the summative assessment, students are informed exam problems such as exam time, courses, exam locations in the end of each semester. Moreover, exam questions and answers will be posted the department website after completing course exam *[Exh. 4.7. Exam questions and answers on BME websites]*. According to the July 2021 regulation and the ISO procedure, after students know their grades on the AAO online pages posted by lecturers, students can appeal their examination results if they are unsatisfactory. Students have seven days to apply for an appeal at the FEEE secretary office and the secretary will collect and send to the departments. After five days from receiving the appeal application, the department will assign another lecturer for remarking before announcing the appeal results to the students. In the academic year 2020-2021, FEEE has 43 assessment-appeal students, in which there are 2 students with changed scores, meaning 4.65%. In 2021-2022, assessment-appeal students are 40, students with variable scores are 6, meaning 15%. It means that the number of the assessment-appeal student rate with the changed scores is quite low *[Exh. 4.8. Information related to student assessment and assessment-appeal]*.

HCMUTE regulations have been changed in increasing the number of course assessment times, at least 3 times, for formative assessment for better reliability. Based on the regulations, online assessments are also encouraged, but are not more than 50% of the course grade proportion *[Exh. 4.9. HCMUTE regulations to formative assessment (7/2021)]*. Especially, the proportion may be higher in the case of natural disasters, epidemics, according to MOET's guidelines. In particular, in these situations, assessments of courses such as projects, internship, graduation thesis are performed online. The organization of the online assessment follows HCMUTE and MOET instructions and also must meet conditions of the committee members, transmission lines, satisfaction students and the most video clips of the operation of committees are recorded for evidence *[Exh. 4.10. Video clips of thesis committee]*.

4.3. The assessment standards and procedures for student progression and degree completion, are shown to be explicit, communicated to students, and applied consistently.

The BME programme is designed to train students in 8 semesters through courses with credits, in which one course can be from 1 to 4 credits, especially the thesis course is 7 credits. Students must complete the total 150 credits and they can complete this programme from 3 years (soon) and 8 years. In addition, students must finish physical courses and social and community activities following the HCMUTE and MOET regulations. Some courses in the curriculum are designed to be previous and prerequisite, so students need to pass these courses for studying courses in next semesters. English level with the 5.5 IELTS or equivalent is one of condition, which students must pass for completing the programme *[Exh. 4.11. Regulations on equivalent scores of different English tests]*. All problems related to the graduation condition are instructed in some channels such as handbook, AAO or department websites.

Table 4.1. Point scales exchanged between numbers and letters

10-point scale	Corresponding letter point scale	Corresponding 4-point scale	Level
9,1 – 10	A+	4,0	Pass
8,5 – 9,0	A	3,7	
8,0 – 8,4	B+	3,3	
7,5 – 7,9	B	3,0	
7,0 – 7,4	B-	2,7	
6,5 – 6,9	C+	2,3	
6,0 – 6,4	C	2,0	

5,5 – 5,9	C-	1,7	
5,0 – 5,4	D+	1,3	
4,0 – 4,9	D	1,0	
< 4,0	F	0,0	Fail

In deploying the programme, Syllabi are important, so they provide both CLOs and assessment methods based on ELOs for formative and summative assessments. With basic and concept knowledge, MCQs are often used for assessing students on the UTEx page. In particular, lecturers can announce to students the course work which is flexibly divided into smaller assignments with the ratio of in-class and online assignments while following different options such as taking the average of all assignments or the highest grade of exam times. With contents required to calculate and explain to produce results, the essay method is applied to assess students' creativity and well understanding related to mathematics and engineering. In addition, rubrics are applied to assess students in courses such as projects, internship, Labs and graduation thesis. It is obvious that using the rubrics is fair, reliable to students due to showing all contents to students for preparation. One course, which there are many lecturers to teach in one semester, needs to agree with teaching and assessment methods. Besides, students' attitudes, morals, ethics, and understandings on civic matters are assessed based on students' contributions through attendance times and extracurricular activities. The course grade of students is calculated during studying time and can be exchanged as described in **Table 4.1**. All formative and summative assessments are posted on the online pages of courses by lecturers following the AAO timetable each semester. Therefore, students are easy to know their grades through their student email addresses *[Exh. 4.12. Grade samples and course regulations]*.

Only assessment results with D-grade and above will be accumulated and published in both numerical and letter scales. Letter grades are converted to a 4-point scale to calculate term averages and cumulative GPAs. Based on the HCMUTE regulation, once students pass any courses, they can register to re-study many times to improve their better grades and then the best grade will be the final grade. In order to notify students having academic warnings, forced to drop out or considered for graduation, HCMUTE uses software to detect and monitor student learning results. Therefore, AAO will review these results before notifying students in March and September annually before graduation. In particular, AAO will notify students with academic warnings through the online academic management website, student email, and simultaneously notify the student management units, ASAO. Therefore, ASAO will announce it to parents and also send it to the counsellors for counselling *[Exh. 4.13. Studying warning information]*.

4.4. The assessments methods are shown to include rubrics, marking schemes, timelines, and regulations, and these are shown to ensure validity, reliability, and fairness in assessment.

The ISO procedure for student assessment was built based on HCMUTE and MOET regulations and posted on the HCMUTE websites *[Exh. 4.14. ISO procedure of examinations and marking]*. Therefore, all lecturers are responsible to introduce syllabi and post them on the UTEx pages, in which teaching and assessment methods are shown in detail. In addition, theoretical courses are often applied to two assessments of formative and summative parts with the rate of 50% and different assessment methods dependent on course contents. For example, in the Bio-Image Processing and Digital systems courses, 50% of the formative assessment includes 10% online quizzes on the UTEx system, 30% assessed by MCQs in class and the remaining 10% uses a presentation method. With the Bio-signal Processing course, 50% of the formative assessment consists of 20% online quizzes on the UTEx system, 25% assessed using MCQs in class, and the remaining 5% is assessed by the quick test methods. While courses such as Labs, projects, internships and thesis are often assessed during working out using rubrics *[Exh. 4.15. Assessment methods, rubrics and result samples]*.

All semester plans are established based on the HCMUTE teaching schedule. At the start of the academic year, a new schedule is published on the AAO website *[https://aao.hcmute.edu.vn/]*.

According to the schedule, students will have 15 weeks of lectures, a one-week reserve and four weeks for revision and exams. Throughout the primary lecture weeks, all lecturers are required to introduce students' learning progress including syllabi, teaching and assessment methods, assignments, coursework and others. With the summative assessment, students will attend exams following AAO's examination schedule. For project courses and graduation theses, students must regularly work on their tasks based on timetables discussed between them and their supervisors, while presenting their progress reports weekly. The BME department will organize the TDCs at the end of each semester. All these activities are always monitored and evaluated through student surveys each semester *[Exh. 4.16. Teaching information and surveys]*.

In examinations, all exam questions must be relevant to the course's CLOs/ELOs/PIs in syllabus and each question must be stated in the exam paper. All exam papers must be approved by HOD to ensure that the correct exam questions are mapped to the course's CLOs and appropriate difficulty levels and reasonable time. To ensure assessment reliability and fairness, lecturers teaching the same course often have the meeting to discuss and agree with contents and how to assess before approved by HOD. Moreover, each answer is often designed to be with a minimal grading scale of 0.5 and then the examination must be posted on the department website after the examination day for about three days. Based on the answers, students can send appeal applications by seven days to the department for remarking and sending feedback to them *[Exh. 4.17. Information related to examination]*.

In order to ensure fairness in the summative examination, each exam room must have at least two supervisors and one inspector outside the room. In addition, one course with many classes is organized at the same time so that students take the simultaneous assessment according to the arranged schedule by AAO. In addition, information related to one course is clearly shown on the exam paper, particularly such as exam time, allowed materials and devices and others *[Exh. 4.18. ISO procedure for examination monitor]*.

At the end of each semester, all lecturers receive feedback from students through the system. From these feedbacks, the department is organized a meeting so that lecturers could discuss about teaching and assessment methods, contents, CLOs, and new knowledge in their courses for adjusting, changing, and improving. These improvements and adjustments are updated in the teaching e-portfolio for teaching in the next semester and also this e-portfolio is posted on the system. According to the ISO procedure, all teaching e-portfolio, exam papers and solutions, results of formative and summative assessments are stored at FFFE and checked by QAO at the end of each semester *[Exh. 4.19. E-portfolio and lecturer feedbacks samples]*.

4.5. The assessment methods are shown to measure the achievement of the expected learning outcomes of the programme and its courses.

To assess the student's achievement for CLOs in each course and the contribution of the courses for the BME programme, since the 2019-2020 year, QAO has deployed so that 14 training programmes, which achieved AUN-QA standards from 2016 to 2019, need to perform PI measurements related to ELOs. From the 2020-2021 academic year, PI measurements have been worked out for all programmes and each programme achieved at least 50% of ELOs. FEEE has deployed to measure PIs for the programmes and the BME department assigns lecturers who are in charge of some courses to measure ELOs/CLOs/PIs related to questions during studying assessments. In addition, the lecturers will take the statistics for the measured PIs based on each student's achievement level of designated questions and the number of students fulfilling the assessment target. For instance, in a sample of 50 students, the expected target is that 70% of students achieve 6 or more per the 10-point scale of one question, this PI measurement is met. Once a PI is achieved, the department will consider raising the higher level. If the PI does not achieve, the PI level will remain the same level. In the department meeting, lecturers can discuss improving the quality of teaching and learning to achieve the desired PI. In the academic year of 2020-2021, the BME programme has measured PIs for 5 of 9 ELOs, corresponding to 17 of 29 PIs. The results show that there is the achievement of 15 of 17 PIs

as shown in Table 4.3 and all PIs of courses with the same ELOs are considered to measure their PIs corresponding to ELOs. This table shows PIs of ELOs measured and students achieved PIs related to corresponding ELOs, in which the achievement depends on the desired targets, the student numbers and assessment tools. From this statistical table, any PIs of courses (PI 1.2 and PI 6.4) not yet achieved in this measurement, they need to re-measure with changing PI targets, question levels or the student numbers *[Exh. 4.20. Plan and samples of PIs measurements]*.

Table 4.3. Results of PI measurements corresponding to 5 ELOs

ELO	PI	Assessment tools	Achieved students	Total students measured	Achieved (%)	PI targets (%)	Results
1	1.1	Brief questions	39	50	78	70	Achieved
	1.2	Rubric	45	45	100	80	Achieved
	1.3	Questions	11	14	79	70	Achieved
2	2.1	Brief questions	30	34	88	80	Achieved
	2.2	Questions	14	14	100	80	Achieved
	2.3	Questions	33	42	79	70	Achieved
3	3.1	Rubric	33	34	97	80	Achieved
	3.2	Questions	63	64	98	80	Achieved
	3.3	Rubric	43	45	96	80	Achieved
	3.4	Rubric	45	45	100	80	Achieved
4	4.1	Brief questions	63	64	98	80	Achieved
	4.2	Questions	25	50	50	70	No achieved
	4.3	Questions	44	50	88	80	Achieved
6	6.1	Brief questions	32	34	94	80	Achieved
	6.2	Rubric	39	45	87	80	Achieved
	6.3	Brief questions	50	50	100	80	Achieved
	6.4	Rubric	26	45	58	70	No achieved

4.6. Feedback of student assessment is shown to be provided in a timely manner

Throughout the teaching process, lecturers regularly give feedback on student's exam results. The feedback is provided through exercises, one-minute tests, reports, presentations following each chapter/lesson and this helps students soon to identify their mistakes for adjusting their learning activities. Simultaneously, after each chapter/lesson, lecturers also have survey questions on the UTEx system about understanding, requirements and difficulties of students during studying for adjusting. Moreover, on the UTEx system, lecturers make forums or use zalo box chat forums where students can discuss course matters and give questions to the lecturers. Lecturers can make examinations such as quizzes with multi-choice questions, submitting essays, reports and then directly send feedback on the UTEx. Before examinations, lecturers make announcements and main contents/rubrics to students before at least one week or according to the schedule set up from the beginning of the semester for preparing *[Exh. 4.21. Feedbacks samples for student]*.

For practical, experimental or laboratory courses; instructors usually assess students in small tasks, give them results and feedback after each test for looking back and adjusting learning activities. In

addition, lecturers give students main contents, duration, and forms before getting exams and they are often announced on the first day of the course and on the UTEx website. For projects and graduation thesis, students must meet lecturers weekly following the schedule planned. This will help lecturers easier to follow the working progress of students and soon to be able to send feedback/comments to them for improving to complete their products and results *[Exh. 4.22. Lecturer feedback to students on projects and thesis]*.

4.7. The student assessment and its processes are shown to be continuously reviewed and improved to ensure their relevance to the needs of industry and alignment to the expected learning outcomes

According to HCMUTE's assessment regulations, the proportion between formative and summative grades is 50%, in which the condition for the final grade is that students have to get at least 3 points per 10 of the summative exam of a course *[Exh. 4.6]*. It is obvious that this encourages students to try their best during the course. Student assessment procedures and methods are continually reviewed for improvement by HCMUTE, particularly in July 2021, they were updated to replace the 2018 regulations based on the MOET regulation of University Education in 2021. In the regulations issued in July 2021, online teaching and assessment were added to enhance the flexibility of the teaching processes to be suitable with COVID-19 pandemic. In addition, HCMUTE allowed lecturers to organize online classes on the LMS and UTEx systems as well as Google Meet/Zoom platforms *[Exh. 4.23. Teaching activity on the UTEx system]*.

For reliable results, according to the ISO procedure, online teaching is limited to less than 30% of the total lecturing hours of one training programme and online assessments are not more than 50% of the course total grade, respectively. Moreover, lecturers can create and permit students to complete their online assignments or homework outside of classroom hours using the UTEx system and this can help students to save their time for other workloads. Moreover, the types of different assessment methods can help students to achieve ELOs related to different skills. In the BME programme, these assessment methods are always improved, rubrics, which are used for student assessment studying projects, internship and thesis, are always updated from contents to points to be easier for students to achieve ELOs. Especially in Covid-19 pandemic, courses such as projects, internship and thesis are allowed to apply online assessment methods, but still guarantee the quality and achieve ELOs. In particular, in the 2nd semester of the 2020-2021 academic year, the BME department successfully organized examinations of courses with the online systems *[Exh. 4.24. Assessment information]*, *[Exh. 2.3. Rubrics samples]*.

In addition to traditional assessment methods such as oral, paper essay, online multichoice questions, the assessment method using rubrics for courses such as projects, internship, thesis, topics are always updated. In syllabi, CLOs are assigned to ELOs/PIs, so rubrics are considered to enhance the effectiveness of fair and reliable in this assessment method. Rubrics are posted on the department website and announcement to students and lecturers *[Exh. 4.25. Rubrics on the department website]*, *[Exh. 2.3]*. In order to ensure the achievement of ELOs, the department must perform PIs measurements of courses each semester. In addition to feedback from students, lecturers and stakeholders, the department can take the PIs measurements for improving teaching and assessment methods, course contents, syllabi and ELOs. With all Vietnamese training programmes, according to the MOET regulations, for the achievement of ELO related to English, students need to achieve at least 550 points of TOEIC English or equivalent *[Exh. 3.17. English outcome (TOEIC 550) of HCMUTE regulations]*.

HCMUTE regularly organizes pedagogical training courses for lecturers every year. Therefore, the lecturers can exchange effective teaching and assessment methods with experts. In addition, training courses such as pedagogy, training and Outcome-Based Education (OBE) help lecturers to improve their appropriate assessment methods for different ELOs. HCMUTE encourages lecturers to take open-book exams whenever possible better to assess CLOs with a high level of competencies. For

example, in the Digital Systems course, students are required to do logic circuit simulation besides take online quiz tests and exam papers. With graduation thesis, 2018 class students need to complete with addition of English summary in their reports and representation of English power-point slides *[Exh. 4.26. Announcement of brief courses related to education and scientific research for lecturers]*.

The significant improvement in the BME programme is the enterprise element. In particular, two courses of Topics with Enterprises, Entrepreneurship and Leadership, which are added in the programme, are to invite enterprises to talk to students about practical problems at HCMUTE or companies. In addition, enterprises are invited to participate in seminars or thesis defence committees for assessments and contribute practical ideas and feedbacks, in which students need to have knowledge about business, entrepreneurship, IoTs, AI, Python software, to improve English, building real models based on the needs of enterprises and hospitals *[Exh. 4.27. Feedbacks of enterprises and medical doctors at the thesis committee]*. Internship is a course which students can study knowledge and skills in practice and this is very important before graduation. From these feedbacks, the department can choose the suitable problems for adjusting contents of ELO3 and ELO9 in the curriculum *[Exh. 3.33. IoTs model and some AI application]*.

Criterion 5. Academic Staff

5.1. The programme to show that academic staff planning (including succession, promotion, re-deployment, termination, and retirement plans) is carried out to ensure that the quality and quantity of the academic staff fulfil the needs for education, research, and service

In long-term strategic plans of HCMUTE for the five-year period (2017-2022) - vision 2030, the quality of academic staff plays a key role in developing HCMUTE. FEEE, which is one of the largest faculties of HCMUTE, trains technology engineers of programmes such as EEE, ETET, ACE, CE, BME, ESI The development goal of FEEE is to become the leading faculty in training, scientific research and technology transfer in Vietnam's technical universities and gradually reach the international level in 2025. In order to achieve this goal, FEEE has planned to develop facilities and academic staffs. In particular, FEEE will have 107 full-time lecturers (in which 40% are PhD students and PhD holders, 20% are Assoc. Prof./Prof.); the acreage of theoretical and specialized classrooms, laboratory and practical workshop, and working room are 3,000 m^2, 4,000 m^2, and 1,000 m^2, respectively *[Exh. 5.1. HCMC and FEEE strategic plan]*.

Table 5.1. Statistics of academic staff and human resource development plan of FEEE

Years	Academic staff	Degree/Academic Rank			Retirement	Studying PhD	Leaving job
		Master Lecturer	PhD Lecturer	Prof./Assoc Prof.			
2017	96	56	16	5	1	17	1
2018	95	53	18	7	2	15	0
2019	95	47	22	9	3	14	0
2020	92	43	24	11	3	11	0
2021	89	42	25	10	0	12	0
2022	92	41	28	12	0	9	0
2023	105	47	26	15	1	16	0
2024	105	45	27	16	0	17	0
2025	107	43	29	17	0	18	0

In the recruitment of academic staff, HOD a list of required academic staff to FEEE for collecting and sending it to the GAPAO. To improve the quality of lecturers, HCMUTE offers many scholarships from various sources, including PhD and Master programme from national/international programme *[Exh. 5.2. Scholarships announcement to academic staff]*. Academic staff can apply for these scholarship programme to update their degrees. In addition, HCMUTE has the policy for supporting academic staff studying for PhD/Master programmes. HCMUTE always encourages lecturers to collect PhD degrees or Assoc. Prof./Prof. certificates *[Exh. 5.3. HCMUTE policy about learning support]*. As a result, HCMUTE's reputation has been significantly enhanced in recent years. In practice, the quantity and quality of academic staff in FEEE have performed the plan of recruiting academic staff to meet the sustainable development as shown in **Table 5.1** *[Exh. 5.4. Recruitment procedure of HCMUTE]*.

HCMUTE has attracted lecturers with Assoc./Prof., Prof. degrees by supporting policies such as high salary, benefits, promotion related to positions, scientific research and training supports. According to HCMUTE's regulations, lecturers, who are recruited to work 1 year and then receive the evaluations from colleagues, department, faculty before signed the official contracts. In addition, lecturers with years of experiment in research and training have the opportunity to become senior lecturers and Assoc. Prof/Full Prof. lecturers following the MOET regulations. Another promotion at HCMUTE is that staff's salary can be raised every 3 years if they complete workloads according to HCMUTE and MOET's regulations. Specially, they can achieve this in 2 years if their workloads are excellently completed. In particular, staff's income can relate to positions, lecturer levels, salary coefficients, scientific research and training workloads *[Exh. 5.5. Salary list of lecturers]*.

The Dean/Vice Dean/HOD at FEEE is elected from all academic staff who are required with high qualifications such as PhD/Assoc. Prof./Prof. following the MOET regulations. The responsibility of HODs is to assign courses to lecturers every semester, to ensure the quality of training programmes, scientific research workloads and always associate with FEEE's dean board for finishing FEEE workloads. HCMUTE always performs the policy of the social insurance according to government regulations for all retired lecturers. In addition, the retired lecturers with PhD/Assoc. Prof./full Prof. degrees have the opportunity to be signed contracts around 5 years for attending training and research only. Moreover, FEEE has the plan for recruiting lecturers from 2023 to 2025 or inviting visiting lecturers from good universities for replacing the retired lecturers or FEEE lecturers who will go oversea for study *[Exh. 5.6. Visiting lecturer contracts]*. With that strategy, FEEE always calculates the academic staff for both short-term and long-term development strategy *[Exh. 5.7. List and information of visiting lecturers]*.

5.2. The programme to show that staff workload is measured and monitored to improve the quality of education, research, and service.

FEEE has 92 full-time lecturers and 2 secretaries, in which there are 12 Assoc. Professors, 28 doctors and 50 masters. The lecturers have not only professional qualifications but also professional pedagogical certificates according to the MOET regulations. Staff workload is worked out following the HCMUTE and MOET and monitored based on the KPIs system *[Exh. 5.8. Recruitment requirement and KPIs system]*. **Table 5.2** shows how to calculate the staff workload at BME department, non-BME departments and visiting lecturers from other universities.

Table 5.2. Number of academic staff and their respective teaching time in end of year

Title	Male	Female	Total		Percentage of PhDs
			Headcounts	FTEs	
Associate professors	1	0	1	1x1=1	100
Full time lecturers (BME)	9	0	9	9x1=10	22.2
Part-time lecturers	6	4	10	(10x0.35)=3.5	35

(Non-BME)					
Visiting professors/lecturers	2	0	2	(2x0.7)=1.4	0
Total	**17**	**6**	**23**	**15.9**	

Table 5.3 describes the academic staff and student ratio at the BME in the last 5 years. From this table, it can be seen that the ratio is consistent with the requirement of the MOET *[Exh. 5.9. MOET regulations for academic staff]*.

Table 5.3. Academic staff and students ratio

Academic year	Total FTEs of Academic Staff	Total FTEs of Students	Staff-to-student Ratio
2016-2017	12.9	59	1/(4.57)
2017-2018	13.9	113	1/(8.20)
2018-2019	13.9	169	1/(12.37)
2019-2020	14.9	223	1/(15.57)
2020-2021	15.9	244	1/(15.60)
2021-2022	15.9	229	1/(16.01)
2022-2023	14.9	237	1/(15.90)

Academic staff workloads are calculated based on the MOET regulations for lecturer at HCMUTE *[Exh. 5.10. HCMUTE policy about workload related to training and scientific research contributions]*. In particular, these academic staff workloads, which basically include teaching, research, and service, are assigned to be different for academic staff with different positions as described in **Table 5.4**. To manage the workload information of lecturers, HCMUTE has applied the KPIs system *[http://kpis.hcmute.edu.vn/]*. Therefore, the evaluation of the staff contribution based on workloads are clear, fair and reliable. In addition, the scientific research and training workloads of lecturers are calculated annually by STO and AAO through activities such as published articles, projects, teaching hours, and other contributions *[Exh. 5.11. KPIs decision of HCMUTE]*.

Table 5.4. Representation of standard hours for academic staff for 1 academic year

No.	Title	Standard hours for academic staff			Total
		Teaching	Research	Service	
1	Senior lecturers, Professors	270	240	20	530
2	Lecturers, Assoc. Professors	270	210	30	510
3	Lecturers, PhD	270	195	60	525
4	Senior lecturers, Master	270	189	70	529
5	Lecturers, Master	270	177	80	527
6	Probationary lecturers	135	75	180	390
7	Physical lecturers	270	-	260	530

At the beginning of each year, lecturers register for teaching and research workloads on the KPIs system and also they can choose different contribution rate between teaching and scientific research, particularly if choosing 25%/50%/75%/100% for teaching, the scientific research will be 75%/50%/25%/0% *[Exh. 5.12. KPIs workload sample of lecturer]*. After registering, HOD will consider to discuss with lecturers about their suitable workloads before approving the registered workloads. In addition to teaching and research, lecturers need to contribute service activities such as introducing students to visit factories/companies, supporting students in scientific research, participating in creative competitions organized by FEEE or HCMUTE and others following HCMUTE policy and regulations.

5.3. The programme to show that the competences of the academic staff are determined,

evaluated, and communicated.

According to HCMUTE regulations, lecturers must basically complete teaching, research and service each year. In particular, the lecturers can contribute activities such as developing curriculum, improving syllabi, teaching methods, and student assessments at the end of the semester or year. Lecturers can design electronic lectures with animation to increase teaching efficiency, essay/multiple-choice questions for student assessments and then upload them to the personal LMS page and students are easy to study themselves. Teaching using the LMS page is required to all lecturers and they have effectively applied the LMS during teaching and student assessment. With teaching and studying using the LMS, the effectiveness is very high in Covid-19 pandemic due to online processing. For improvement of teaching, at the end of each semester, lecturers often receive feedbacks from students through the survey of the QAO *[Exh. 5.13. Academic staff evaluated results based on KPIs]*.

For recruiting academic staff, each lecturer candidate needs to apply a document with certificates and contributed evidences such as appropriate English, pedagogical, teaching, informatics and research ability. After passing the document round, he/she will be interviewed by FEEE and HCMUTE president boards, in which each lecturer needs to show the ability of teaching one 1-hour lesson before the FEEE training board for evaluating. With the 3rd round, the candidate will see the HCMUTE president board before signing a contract. In addition, candidates with PhD or higher degrees or oversea master graduation in native English countries are prior. The contract of a recruited lecturer will be signed for the 1st year for considering his/her contribution before signing longer contract *[Exh. 5.14. Lecturer contracts]*.

For teaching undergraduate programmes, all academic staff must be master/PhD/Assoc. Prof./Prof., in which mostly theoretical courses are taught by academic staff with PhD/Assoc. Prof./Prof. degrees. In addition, the ability to contribute scientific research of the academic staff with PhD/Assoc. Prof./Prof. degrees is very high, in which they can work out projects and publish quality international articles. It is obvious that results of the scientific research can improve contents in courses and also help students to update the latest knowledge. Furthermore, these academic staff with the high degrees can attend international conferences and seminars and it can be good for the collaboration between HCMUTE and international universities.

At the beginning of each semester, after the department assigns courses to lecturers, FEEE will send the assigned teaching plan to AAO and the lecturers will see their teaching plan schedule on the online personnel page. Therefore, the lecturers have about 2-3 weeks for preparing teaching materials and updating contents, lectures. Contents, teaching and assessment methods of each course are often updated in the lecturer e-portfolio on the HCMUTE e-portfolio system observed by AAO and QAO *[http://eportfolio.hcmute.edu.vn]*. In addition, lecturers have the ability to build and use a variety of teaching media such as chalkboards, projectors, learning tools or online teaching support platforms such as UTEx, Zoom, Meet, Kahoot from previous semesters. Actually, during the Covid-19 pandemic, lecturers are easy to complete their teaching and student assessments through online tools and the UTEx page. It is obvious that this is a strong point of HCMUTE compared to other universities in Vietnam. In addition, if one course has many lecturers for teaching in one semester, the teaching and assessment contents as well as the assessment methods are required the same for fairness. The lecturer workloads are evaluated based on KPIs with approved by HOD in the end of the academic year. Based on the workload performance, lecturers can be suggested for promotions such as increasing salary soon and suggesting for rewards from HCMUTE leaders or MOET *[Exh. 5.15. Lecturer evaluation and award lists at the end of the year]*.

Besides scientific research and teaching tasks, lecturers must perform services such as admissions consultants, academic advisors, and creating playgrounds for students. In particular, HCMUTE often organizes enrollment counseling for students in high schools every year and FEEE lecturers will register to participate this event. Moreover, lecturers organize playgrounds for students to enhance group working skills and practical activities such as organizing “Logo Design for BME programme”

or exchanging between BME students and representatives of businesses and hospitals *[Exh. 5.16. Pictures for consulting and exchanging; Organizing a logo design]*. Therefore, all service activities are registered at the beginning of each academic year and approved by HOD and then the results achieved are assessed before sending to FEEE *[Exh. 5.17. KPIs registration sample and year-end KPIs evaluation]*.

5.4. The programme to show that the duties allocated to the academic staff are appropriate to qualifications, experience, and aptitude.

According to HCMUTE and MOET regulations, positions such as Dean/Vice Dean/HOD are chosen from lecturers with PhD/Assoc. Prof./Prof. degrees, so they have experiences in teaching, scientific research and services. In addition, these positions are chosen through votes from all FEEE staff and the final decision is of HCMUTE president. The FEEE board has one dean and three vice-deans assigned different duties such as scientific research, training and equipment-student activities-business relations and the dean is responsible to the whole FEEE. While HOD will be responsible to training activities and cooperate with the FEEE members for finishing all activities, additionally deputy of the department will assist HOD to perform tasks such as assigning courses in each semester, building and upgrading programmes and others.

For teaching each semester, lecturers are assigned courses which are suitable to their expertise, experience and workloads registered on the KPIs page. In particular, lecturers with good English will be assigned courses in the English programmes, while lecturers with PhD/Assoc. Prof./Prof. degrees prior to are assigned to teach theoretical courses. Moreover, each lecturer is encouraged to teach at least 2 courses for the objective of enough workload and sharing teaching with other lecturers in common teaching courses for knowledge, teaching methods and fairness. At the same time, young lecturers are also appointed as teaching assistants to both supporting the teaching of experienced lecturers and knowledge and experience *[Exh. 5.18. Teaching course assignment to lecturers]*.

To ensure training quality, only lecturers with a master's degree or higher can instruct students to do projects, thesis and scientific research. In addition, lecturers with good research ability can register to contribute much more scientific research workload and to reduce lecture hours. For student service, FEEE has a student advisory board and lecturers with training experience can be appointed to support students during studying years. Moreover, lecturers can register to FEEE to lead students to study/visit at companies for enhancing practical learning. In addition to teaching, lecturers with good business relations can be assigned to instruct Internship or Topics with enterprises courses. In scientific research activities of students, lecturers with practical experience are encouraged to instruct students to attend competitions of robots at FEEE/HCMUTE or outside HCMUTE or to perform their projects and how to write papers *[Exh. 5.19. List of student advisory boards and scientific research information]*. In scientific research, lecturers are encouraged to perform projects different organizations and are always supported by HCMUTE. Moreover, lecturers are supported fees for publishing papers and attending domestic and international conferences and this is not only help them finish scientific research workloads, but also a lot of quality international articles and projects increase each year *[Exh. 5.20. List of projects and papers (2018-2022)]*.

HCMUTE has a strong YUSA, where students can participate in many activities related to learning, scientific research, art, sports and many other volunteer activities. Lecturers selected to be in charge of the delegation are young, talented and enthusiastic lecturers for the good development of the YUSA. In addition, the YUSA is a bridge between HCMUTE and companies to introduce internships, job positions as well as scholarships for students and sponsor equipment for HCMUTE. The YUSA organizes social activities so that lecturers can contribute or support people who have difficulties in their life *[Exh. 5.21. Activities of the YUSA]*.

5.5. The programme to show that promotion of the academic staff is based on a merit system which accounts for teaching, research, and service.

HCMUTE always has a policy to attract good academic staff to develop human resources *[Exh. 5.22. HCMUTE policy about support for paper and project]*. In particular, in order to attract the academic staff, HCMUTE has changed its policy in 2020, in which only candidates with the master/PhD degrees, who graduate from oversea universities, are more prior for accepting documents. Moreover, a lecturer, who has the PhD degree, will receive a bonus of 878 USD after signed the contract and the 150% support to HCMUTE lecturers graduated sooner. In addition to this promotion, HCMUTE lecturers studying PhD degrees are supported by reducing 50% of teaching workloads, projects related to PhD topics and other policies. Moreover, HCMUTE encourages lecturers to publish articles and register patents by supporting document fees and bonuses dependent on article quality, for example, an article published in a SCI-Q1 journal, lectures can be rewarded about 5,270 USD. In order to recognize the outstanding contributions of individuals, HCMUTE has individual awards of the year such as lecturer, manager of the year and this actually encourages them a lot. Moreover, lecturers with good achievements in scientific research, teaching and service will be considered for an early salary increase. In particular, lecturers are selected by FEEE as excellent lecturers, in which they have completed projects, many quality scientific articles and important contributions to the department, FEEE and HCMUTE *[Exh. 5.23. List of excellent lecturers and list of early salary increases]*.

Recruitment policy and human resource development at HCMUTE are always applied according to the ISO procedure. In particular, GAPAO will receive lists of recruiting staff from faculties and post them on the HCMUTE website and public magazine channels. After the 1st round of considering the document, the candidate will receive an interview invitation letter to see the FEEE board for interviewing and representing a short lesson for evaluating about teaching, research and service. The last round is that the candidate will see HCMUTE president and GAPAO for interviewing before the contract can be signed by two sides *[Exh. 5.8]*.

At HCMUTE, lecturers have many opportunities for development and contribution. In particular, during working, many lecturers have been accepted to be senior lecturers and lecturers with Assoc. professors following the MOET regulations. **Table 5.5** presents the number of the senior and Assoc. Prof. lecturers at FEEE, in which the number of the senior and Assoc. Prof. lecturers is increasing in years. Lecturers with PhD/Assoc. Prof./Prof have many contributions and experience about teaching, research and service, they have the good opportunities to promote the positions of Dean/Vice dean/HOD.

Table 5.5. Statistics on the number of academic lecturers in the period 2018-2022 at FEEE

Years	Academic Staff	Senior lecturer	Ratio (%)	Assoc. Prof. lecturer	Ratio (%)
2018	95	13	13.7	7	7.4
2019	95	17	17.9	9	9.5
2020	92	22	23.9	11	12.0
2021	89	22	24.7	10	11.2
2022	90	22	24.4	11	12.2

5.6. The programme to show that the rights and privileges, benefits, roles and relationships, and accountability of the academic staff, taking into account professional ethics and their academic freedom, are well defined and understood.

According to HCMUTE policy and regulations, academic staff have three main tasks of teaching, research and service. The policy and regulations are clearly described and posted on the HCMUTE website page. In particular, the employment contract of one lecturer shows responsibilities and benefits related to many activities at HCMUTE, in which there are the problems of salary, rewards and others. For example, lecturers are responsible for editing textbooks, lesson, syllabus; building training programmes, improvement of teaching and assessment methods based on students' feedbacks; scientific research, student support. Other policies are that lecturers will receive bonuses

and supports such as the holidays and the excellent completion of tasks, published articles, healthcare service, improving teaching, scientific research, training programmes. In addition, lecturers are rewarded for published paper articles and participating in peer review as well as other scientific activities. In addition, HCMUTE supports for participating courses related to improving English, specialized problems and pedagogy *[Exh. 5.24. HCMUTE regulation and promotion and support information]*.

The relationship between faculty members is very friendly and responsible in all activities. In particular, FEEE is responsible to receive information and workloads from functional offices and the HCMUTE leader and then deploys to all departments for performing. The departments are responsible to assign or cooperate to academic staff for finishing, in which the departments receive feedbacks and workloads from students or lecturers and then send to FEEE and the functional offices. For example, a lecturer works out a final exam for a course, he/she must be responsible to make questions related to the course contents and assessment methods based on the course syllabus and then it must be approved by HOD. Another example is that a training programme needs to be improved or updated, AAO will send decision and plan to FEEE before it is transferred to departments. Therefore, academic staff will be assigned to attend for improving syllabi or others related to their courses *[Exh. 5.25. Minutes of meeting on inspection contents]*.

In order to improve teaching quality and to share teaching experiences among colleagues, lecturers can register to attend teaching classes of the colleagues at the beginning of each semester. Therefore, lecturers can receive feedbacks from attended lecturers for improving and adjusting their teaching methods and contents. It is obvious that sharing and receiving feedbacks among colleagues for improving contents and teaching methods are very good and this is always performed at HCMUTE. Furthermore, academic staff must work in accordance with the education law and HCMUTE regulations, so it is responsible and benefit during their activities of teaching, scientific research and service *[Exh. 5.26. List of attending lecturers and reports]*.

Lecturers are encouraged to be academic freedom, in which they are allowed to choose collaborations related to scientific research or attending any seminars about training and education. In particular, HCMUTE has a KPIs system and lecturers can register the percentage between teaching and scientific research workloads *[Exh. 5.27. Percentage registration sample between teaching and scientific research]*. Moreover, HCMUTE encourages lecturers to cooperate with enterprises to perform projects or to apply documents for projects from different programmes such as the departments of Science and Technology of cities around HCMUTE, MOET, Nafosted, oversea universities. In particular, the BME department has Dr. Nguyen Manh Hung, who was invited to do postdocs in Taiwan. Assoc. Prof. Nguyen Thanh Hai had the cooperation with Hertfordshire University for registering the project of “Smart Wheelchair” in Newton Funding programme and completed the project: “Design of Digital device in the digital printing system” sponsored by the department of Science and Technology of HCM city. With more than 30 PhD and Assoc. Prof. lecturers of FEEE, the quality of teaching and scientific research always increases, particularly a lot of quality international articles and projects increase each year *[Exh. 5.28. List of projects and collaboration information (2018-2022)]*. In addition, in teaching and researching, lecturers are responsible for issues and professional ethic *[Exh. 5.29. Regulations on writing acknowledgment in articles and plagiarism]*. In particular, the academic staff must strictly adhere to issues of invention, patent and copyright and teaching lessons or using materials or editing textbooks with approving from the department and FEEE.

5.7. The programme to show that the training and developmental needs of the academic staff are systematically identified, and that appropriate training and development activities are implemented to fulfil the identified needs.

The HCMUTE/FEEE strategic plan for quality human resource development plays an important role, so it is annually performed. In particular, HCMUTE always encourages academic staff for studying

short-term and long-term training courses or programmes, in which they are the support policies such as training fee, reducing teaching workload, arranging suitable timetables and others. Moreover, HCMUTE uses about 10% of the budget for investing the human resource development and support fees in the last 5 years as described in **Table 5.6**. It means that for the high and increasing demand of advanced learning such as courses about teaching methods, how to write articles, how to build ELOs of one training programme, teaching Project-based learning and others, HCMUTE always encourages and supports all lecturers *[Exh. 5.30. Certificates of courses]*. Another support is that HCMUTE annually organizes the summer conference for lecturers with Assoc. Prof./Prof and dean/vice-dean/HOD to discuss issues related to HCMUTE development strategy. At the end of each year, HCMUTE organizes a meeting with staff to show the obtained activities and then to discuss about the activities in next year.

Table 5.6. The training fees in five years at HCMUTE (USD)

Years	2017	2018	2019	2020	2021
Training fees	50,000	65,000	86,000	93,000	104,000

Lecturers are encouraged to undergo further training in both professional and pedagogy skills, in which they can study PhD degrees or short-term training courses related to education/building programmes/scientific research. For the pedagogy skill, lecturers can participate courses about teaching, assessment methods, writing syllabus and training programmes. Therefore, GAPAO will send plans to all faculties for registering as shown in **Figure 5.1**.

Fig. 5.1. The process for development of human resources at HCMUTE.

Figure 5.1 shows the following steps: **1.** GAPAO sends a notice and plans to the faculties; **2.** GAPAO prepares the program plans based on the proposals of the faculties; **3.** courses are designed related to the mission and goals of HCMUTE; **4.** lecturers are responsible for reporting results at the end of the course according to the ISO procedure; **5.** Faculties and GAPAO summarize the results and suggest to the HCMUTE leader for improvement solutions. Thus, GAPAO will send plan to FEEE so that lecturers can register for courses that need to be opened and then consider to deploy the courses. After completion of one course, GAPAO often evaluate all course activities *[Exh. 5.31. Registration list of courses; pictures of course participation, certificates]*.

For long-term training courses, academic staff can apply for studying PhD degrees at domestic universities such as HCMUTE, IU, HCMUT or international universities in many different countries such as Korea, USA, Australia, Japan, Taiwan and other countries. In practice, FEEE has about 7 lecturers who have enrolled to study PhD programmes at domestic universities and 10 lecturers are studying PhD programmes at international universities.

With short-term courses, some programs such as educational management, quality assurance programme (HEEAP/VULII), how to write a written patent or scientific articles are often organized at HCMUTE or other universities. In addition, HCMUTE has the cooperation with oversea universities to send lecturers to participate in English courses in Philippines or India every year. Moreover, according to the 2020 scheme, HCMUTE supported lecturers to study English courses at domestic centers such as ILA, ACET for improvement. To improve skills of digital classes for lecturers, HCMUTE organizes digital teaching classes by Pearson/LMS. Regarding pedagogical training for lecturers, ensuring teaching quality, courses of the project by HEEAP/VULII/BUILD-IT, Fulbright scholars (QA – ABET, leadership) are available to be held. For scientific research skills,

courses such as writing a project proposal, copyright law, guidelines for writing and publishing international articles are organized. In terms of training and professional development, courses such as ITEC studied in India, specialized seminars on biomedical engineering are organized for lecturers. In addition, for participating domestic and international scientific conferences such as GTSD, ICSSE, HCMUTE has the policy to support travel, accommodation and publication fees *[Exh. 5.32. Statistical table of training results of the Department for the period 2017-2022]*.

5.8. The programme to show that performance management including reward and recognition is implemented to assess academic staff teaching and research quality.

HCMUTE has one regulation about lecturer workload, particularly each lecturer is responsible for 3 main tasks, including teaching, research and service. At the beginning of each academic year, lecturers will register their workloads and approved by HOD. Therefore, HCMUTE applied the KPIs system in 2016 to manage workloads including teaching, research and service to enable academic staff to register their workloads. Therefore, the working performance of all academic staff is evaluated through the registered workloads on the KPIs system by HOD at the end of each academic year. In particular, lecturers are called to complete their workloads including teaching, scientific research and service, when these workloads are not smaller than those of the registered workloads on the KPIs. Lecturers can be rewarded at different levels if their workloads are over much compared to the registered workloads. Therefore, with the excellent workloads, they can be received different reward levels from HCMUTE or MOET as shown in **table 5.7**, particularly they can be increased salary soon *[Exh. 5.33. Lists of lecturer awards and increased salary soon]*.

Table 5.7. Statistics of lecturer rewards with different levels from 2017 to 2021 at FEEE

Academic years	HCMUTE	HCM City	MOET	Total
2017-2018	37	1	1	39
2018-2019	33	1	0	34
2019-2020	30	1	1	32
2020-2021	23	2	1	26

With the achieved excellent workloads, lecturers will receive many corresponding rewards such as Certificate of Merit/Labor Medal, Emulative soldier, progressive laborer, and lecturer of the year. Moreover, lecturers receive bonuses related to scientific research about 5,270 USD, 3,293 USD, 2,197 USD and 1,537 USD for different quality papers (SCI, SCIE, ISI, and Scopus), respectively. During the annual summer conference, lecturers with the most outstanding achievements will be honored and rewarded as the lecturer of the year. Lecturers, who complete PhD programme, are rewarded with 878 USD. PhD lecturers, who get Assoc. Prof./Prof. certificates, will be rewarded by increasing salary sooner. In addition, lecturers are rewarded for successfully completing the work of the year; winning scientific research prizes, high scores of English tests, having excellent digital teaching *[Exh. 5.34. List of increasing annual salary and increasing annual salary soon and different rewards]*.

HCMUTE training programmes are enabled to use teaching assistants (TAs) to assist lecturers who have large workloads. In particular, students with outstanding studying can register to do TA and this is not only to improve student's life, but also to enhance their teaching contribution. Therefore, TAs are responsible for delivering learning activities such as helping other students to understand exercises, assignments, simulations, inserting grade lists and instructing them how to use software. Moreover, TAs can do these activities through online meetings or emails or face to face at classrooms. *[Exh. 5.35. Lists and documents of TAs and advisory board]*. In addition, at the end of each semester, Lecturers are often received feedbacks form students for teaching process and can evaluate themselves for improving teaching and contents for next semester *[Exh. 5.36. Student feedbacks at the end of each semester]*.

Criterion 6. Student support services

6.1. The student intake policy, admission criteria, and admission procedures to the programme are shown to be clearly defined, communicated, published, and up to date.

According to the MOET regulations and HCMUTE policy, HCMUTE has many recruitment methods such as using national high school graduation exam scores, directly recruiting students with prizes in national, provincial and international competitions of Math, Physics, Chemistry, English and others *[Exh. 6.1. HCMUTE 2021 admission plan and regulations]*. Recruitment information is posted on the HCMUTE website, the fanpage, the Tuoitre newspaper and transferred to high schools. Moreover, during the Covid-19 epidemic, the recruitment method is supplemented with one more recruitment method by using the high school result of 5 semesters. In addition, HCMUTE often hold the open day at HCMUTE for students of high schools to visit campus and equipment and machines at Labs *[Exh. 6.2. Plans, consultant information and Lab pictures]*. With these recruitment methods, HCMUTE often recruits quality students of biomedical engineering with the high average point of 25 compared to biomedical engineering programme of other universities.

The enrolment letters are sent to new students by HCMUTE, in which many information are listed to help them to quickly finish the admission. In addition, HCMUTE volunteer students can register to support new students at the beginning of enrolling, particularly they can pick new students up at the bus stations or HCMUTE, help to find accommodations and others. In order to improve the admission procedure during the covid-19 epidemic, HCMUTE organizes for new students to enroll online. In particular, new students can prepare documents and then register online admission information on the HCMUTE website. Moreover, after finishing the online admission, the new students start studying some online courses following instructions of the department and faculty on the first day *[Exh. 6.3. Volunteer student pictures and online admission procedure]*.

Table 6.1. Intake of first-year students

Academic year	Applicants	
	No. Offered	No. Admitted/Enrolled
2016	59	59/60
2017	55	55/60
2018	58	58/59
2019	59	59/59
2020	63	63/63
2021	45	45/45
2022	47	47/47

Table 6.2. Total number of students

Academic Year	Students					
	1st Year	2nd Year	3rd Year	4th Year	> 4th Year	Total
2016	59					59
2017	55	58				113
2018	58	55	56		-	169
2019	59	58	51	55	-	223
2020	63	58	57	51	15	244
2021	45	63	55	53	13	229
2022	47	43	63	55	29	237

When new students go to HCMUTE at the beginning of the academic year, HCMUTE often sends surveys to them to know how they like to enroll to HCMUTE with the survey results, HCMUTE will efficiently adjust information to transfer to potential students. With the student admission strategy, HCMUTE, which is one of the best southern technology universities, has a lot of recruited students with high quality and quantity. In particular, **Tables 6.1** and **Table 6.2** are statistics on the total

number of students applied, offered and enrolled within five years *[Exh. 6.4. Benchmarking and information for recruitment]*. From Table 6.1 and Table 6.2, it is obvious that after admission, most students continue to finish their study programme until graduation, in which just a little bit students could not finish their programme by different reasons such as difficult family economy or different cultures between countryside areas and the city. Moreover, with the right recruitment methods and policy, it means that the students have got the right choice of the BME programme for their future.

6.2. Both short-term and long-term planning of academic and non-academic support services are shown to be carried out to ensure sufficiency and quality of support services for teaching, research, and community service.

HCMUTE has short-term and long-term plans of academic and non-academic services for supporting students during studying time, in which the quality of support services related to teaching, scientific research and community activities is always improved. In particular, for the short-term plan, HCMUTE organizes support groups for students from far areas to register dormitories and to find accommodations. After enrolling, the faculty and department organizes an entrance day to talk to students about problems related to studying and other activities. Moreover, the youth union organize to introduce about groups of skills, sports, music, and academic activities so that students can register to participate and develop their personal skills during studying time *[Exh. 6.5. Support pictures to find hostels and clubs of youth union for activities]*. HCMUTE has a medical center to support students about testing their health at the beginning of the admission and health insurance cards. HCMUTE has the support for students with economic difficulty, particularly there is the instruction for loan procedures or scholarships for students with high GPA each semester *[Exh. 6.6. Scholarships and supporting loan applications]*.

With the long-term plan, BME students are trained basic to specialized knowledge in 8 semesters built in the BME programme and posted on the department website. New students are instructed semester plans and courses in this curriculum for choosing a suitable studying plan. At the beginning of each academic year, the faculty and department often organize the meeting for instructing studying plan, answering questions related to courses of each semester *[Exh. 6.7. Meeting at the beginning of each semester]*. In addition, HOD instructs students how to participate in scientific research and academic competitions for improving their professional knowledge. HOD introduces how to improve English skills such as participating English clubs, PowerPoint slides using English of courses, reading English books or English courses *[Exh. 6.8. English club pictures and PowerPoint slides]*.

Lecturers, who participate to support students, are evaluated through the KPIs system. At the beginning of each semester, lecturers register on the KPIs, including service tasks and the results are evaluated by HOD through the KPIs at the end of each year *[Exh. 6.9. KPIs samples]*. In addition, in order to evaluate the quality of student support services for improvement, surveys are sent to students. Moreover, FEEE often organizes the meeting with students at Large Hall and responds questions related to teaching, facilities and other services. From the student feedback, the department and FEEE can consider for improvement of contents of courses, Labs or other services to improve the studying and teaching quality *[Exh. 6.10. Meetings with students and surveys]*.

6.3. An adequate system is shown to exist for student progress, academic performance, and workload monitoring. Student progress, academic performance, and workload are shown to be systematically recorded and monitored. Feedback to students and corrective actions are made where necessary.

HCMUTE has largely invested the IT system, in which the HCMUTE official website with many functions, personal online pages for lecturers and students accessing data related to semester timetables, class information and course results. LMS pages for data upload-download, course information, exams, quizzes and others are available so that students and lecturers are easy for teaching and studying. In particular, after registering courses of each semester, students can monitor

a lot of course information such as timetables, exam schedules, formative and summative grades and other school announcements *[Exh. 6.11. Information of UTEX online pages and courses]*.

In addition, ASAO is to support students during studying years at HCMUTE with different activities. In order to support students with high studying results, the scholarship is one of the supports, in which ASAO often sends the announcement of scholarships to FEEE for sorting the list of students with high GPAs. While students with low GPAs, particularly many courses are failed in each semester, will receive warning lists. Therefore, FEEE and departments will contact these students for finding out causes, consultancy and then support them. In particular, lecturers and tutors will have extra-classes for helping students to improve their knowledge and how to study to improve better results. In addition, ASAO has other solutions to support students such as face to face consultancy, using hotline, sending the email to FEEE and HOD for consultants. Moreover, FEEE and HODs have the meeting to all FEEE students face to face for responding all questions and feedbacks at the large Hall *[Exh. 6.12. Academic warnings and support information]*.

In other studying activities, students are taught how to do research or to perform practical models related to student projects or graduation theses. In particular, advisors can instruct them how to search documents, analyse and evaluate the achievement of the practical models and use the correct citation in reports. In addition, students can suggest companies for internships after counseled by HOD or academic lecturers can introduce suitable companies for internships to students *[Exh. 6.13. Lists of companies for internships]*.

In addition to courses in the training programme, students must complete community activities such as participating “The Green Summer”, “Blood Donation”, Martial Arts, Music, Dancing, Magic, MC Pro, Social Activity Team, Examination Aid, Orphan Care. Based on the dashboard system, the Class Personnel Committee, the Youth Union - the Student Union can monitor many activities of students related to civic ethics and participation of political, social, cultural, art and sport activities *[Exh. 6.14 Pictures of social activities]*.

All training programmes at HCMUTE have been built with credits to determine studying time, in which one credit is equal to 15 class hours since 2001. The BME programme was designed to be 150 credits for eight semesters, in which from Semester-1 to Semester-6, each semester has the average of 21 credits and the last semester for thesis with 7 credits. With the BME programme, the graduated rate of students of the 2016-2020 year was more than 90%, in which there were about 20% of students waiting for English certificates. The causes of the remaining students without finishing the programme after four years often are failed some courses or financial or health problems.

FEEE has an advisory board with experienced lecturers to counsel students about many problems such as training programmes, learning methods, scientific research and others. In practice, the two main counseling channels are online and face-to-face and students can easily give questions and quickly receive answers. In particular, FEEE and the departments have a meeting with all students at the end of each semester at the large Hall and respond to all questions from students. Moreover, the members of the advisory board will respond to all questions through emails or telephones *[Exh. 6.15. Lists and documents of advisory board]*.

6.4. Co-curricular activities, student competition, and other student support services are shown to be available to improve learning experience and employability.

All activities for supporting students during academic years play an important role in one training programme. One important course for new students to start one studying programme is that Introduction to BME consists of 3 credits (2 credits for theory and 1 credit for practical activities) in the BME training programme. This course will briefly introduce BME students about the BME programme with 150-credits, in which they are introduced about syllabi, studying plan, general knowledge of the biomedical electronic engineering, what is an BME engineer? responsibility, ethics of engineers, soft skills, job opportunities and other student services. Moreover, they are taught to know how to work in a team with small topics and co-curricular activities such as visiting companies

or hospitals for practical problems *[Exh. 6.16. Curriculum of Introduction to biomedical engineering]*.

Co-curricular activities are designed to enhance practical problems for students in one training programme at HCMUTE. In particular, HCMUTE/FEEE/departments often organize these activities such as seminars with enterprises, courses of "Topics with Enterprises (2 credits)", "Entrepreneurship and Leadership (2 credits)", camps with "Green Summer", talking with alumni, festivals of robot competitions, Internship, Scientific research topics at companies/hospitals or international universities, Business open day, English clubs at HCMUTE. With these activities, students can be easier to register to attend one of events at any time which they can be *[Exh. 6.17. Co-curricular activities with specialized knowledge]*.

HCMUTE, FEEE and the departments annually organize robot competitions such as "Labyrinth robot", "LED Circuit Design", "F1 Racing", "Shooting Robot", "Robot for winning the flag", "Creative Ideas" and others so that students from all departments and faculties can attend for improving practical and design skills and studying how to work in a team related to electrical-electronic fields. Teams, who win prizes, can be chosen to attend HCMUTE festivals or national/international competitions such as Eureka, Talented Young Scientist, and others *[Exh. 6.18. Competition activities of FEEE/HCMUTE/national]*.

Table 6.3 Student support services

Support types	Activities
Student services	Self-study spaces around buildings and libraries, organizing studying soft-skills, supporting students with difficult situations, picking and supporting new students up from different places by SSC *[*https://ssc.hcmute.edu.vn*]*.
Recreation and sport	Guitar, Football, Martial Arts, Green Summer, camps *[Exh. 6.19. Pictures of sport and social activities]*
Academic	Cubs of English, research groups for competitions *[Exh. 6.20. Pictures of academic clubs activities]*
Medicare and wellness	Health insurance card, health counselling and testing *[https://hd.hcmute.edu.vn/]*
Career and employment	"Golden Week", visiting companies *[https://pr.hcmute.edu.vn/]*, *[Exh. 6.21. Pictures of enterprises activities]*
Financial and scholarship	Scholarships of HCMUTE, from enterprises and alumni *[https://sao.hcmute.edu.vn/]*, *[Exh. 6.22. List of students received scholarships]*
Mentoring and counselling	Groups of department, FEEE, HCMUTE for life skills, studying issues *[https://sao.hcmute.edu.vn/]*, *[Exh. 6.23. List of FEEE counselling group and documents]*, the FEEE counselling page.
Housing	Dormitories management, finding accommodations by SSC *[ssc.hcmute.edu.vn/]*

In addition, other student support activities as described in **Table 6.3**, in which very many different activities contribute to improve during studying years of students. In addition, HCMUTE library has the variety of material resources such as hardcopy and softcopy books, magazines and spaces for self-study and reading students *[Exh. 6.24. Library pictures]*. Moreover, HCMUTE has a lot of opening spaces around the Central Building and beautiful and comfortable canteens. With student support services, HCMUTE has the Student Service Center for helping students to find accommodations and dormitories, part-time jobs; Youth Union for supporting club activities such as sports, English, robots, scientific research, and others *[Exh. 6.25. Club activities]*. With the medical service, students, who have any health problem, can come to see doctors any time to be tested and counselled.

Career-oriented festivals such as "Golden Week" are often held each semester so that students have opportunities to be interviewed for job and internship positions or orientated their future careers. ERO will connect enterprises to organize this event, in which many companies can directly interview students and receive their applications for jobs or internship. It is obvious that this is the excellent

opportunity for students to have Vision-Thinking-Doing to real issues related to studying programme *[Exh. 6.26. Job orientation and visiting trips]*.

6.5. The competences of the support staff rendering student services are shown to be identified for recruitment and deployment. These competences are shown to be evaluated to ensure their continued relevance to stakeholders needs. Roles and relationships are shown to be well-defined to ensure smooth delivery of the services.

Support staff, who are currently large enough as shown in **Table 6.4**, play an important role related to the quality of teaching and learning at HCMUTE. In particular, the support staff will support lecturers and students about many activities and services such as healthcare, finding accommodations, students with difficult circumstances, study counseling, organizing co-curricular and others. Currently, Moreover, HCMUTE has the KPIs procedure to evaluate the contribution of support staff, in which they can register their workloads and heads of functional offices will consider and discuss with them before approving these workloads. QAO annually sends surveys to students and lecturers for receiving feedbacks about supporting services for improving *[Exh. 6.27. HCMUTE and MOET regulations about workloads]*.

Table 6.4. Number of Support Staff

No.	Support Units	Highest Education Attainment						
		Assoc. Prof.	Doctoral	Master	Bachelor	College	Professional High School	Total
1	QAO	1	0	3	2	0	0	**6**
2	AAO	0	0	5	7	0	0	**12**
3	FPO	0	0	3	9	1	0	**13**
4	STIAO	2	2	3	4	0	0	**11**
5	ERO	0	0	3	5	0	0	**8**
6	EMO	0	0	3	2	1	1	**7**
7	AIO	0	0	3	2	0	0	**5**
8	FMO	0	1	2	5	0	5	**13**
9	GAPAO	0	1	6	9	0	25	**41**
10	PMO	0	0	3	5	0	0	**8**
11	ASAO	0	1	4	6	1	0	**12**
12	Library	0	0	5	5	2	0	**12**
13	HCO	0	0	0	0	1	1	**2**
14	STC	0	0	1	3	0	0	**4**
15	DLC	0	0	3	1	0	0	**4**
16	SSC	0	0	3	5	0	0	**8**
17	CPEND	1	0	9	7	0	0	**17**
18	FLC	0	0	1	1	0	0	**2**
19	IEC	0	0	4	1	0	0	**5**
20	ITC	0	1	0	4	1	0	**6**
Total		**4**	**6**	**64**	**83**	**7**	**32**	**196**

For evaluating the support quality, HCMUTE has apply the KPIs system which the support staff register their workloads on and approved by their office head each academic year. Thus, after each academic year, the support staff, who have not yet completed their workloads, receive feedbacks from colleagues for improving. In addition, QAO often performs surveys about student satisfaction related to HCMUTE service and support quality. The feedbacks are directly transferred all office heads for considering and they can discuss with their support staff for improving. If feedbacks related to

improvement of equipment, infrastructure and facility TVs for studying, wifi system, self-study spaces, library books, Labs and others, they would suggest HCMUTE. In addition to the QAO surveys, faculties or HCMUTE board can directly receive feedbacks from students through the face to face meetings at the end of each semester. From these feedbacks, the HCMUTE board and EMO can make plans to invest and renew them *[Exh. 6.28. Satisfaction surveys and feedbacks (2021)]*.

According to HCMUTE procedure, GAPAO annually sends the announcement for recruiting quality support staff to functional offices and then receive lists for making recruitment plans. Therefore, the recruitment information is publicly announced on the HCMUTE website and simultaneously published on newspapers such as “Lao Dong”, “Tuoi tre”, “Giao duc and Thoi Dai”. In the recruitment procedure, each candidate must meet suitable qualifications, experience, foreign language, basic informatics and enthusiasm. After recruited, the support staff will be signed the one-year contracts and then they are considered to evaluate their workloads after one year before the long-term contracts are officially signed *[Exh. 6.29. Human resources recruitment Procedure and announcement]*.

In types of staff positions, Deans/Vice-Deans/HOD are very important positions in one faculty, because they are not only excellent academic staff, but also directly support students in training, scientific research and relative services. Moreover, these staff are chosen based on qualifications, working, training and scientific research experiences. In addition to these criteria, the appointment of these positions is always performed according to HCMUTE regulations, particularly they are voted by all faculty staff. Faculty secretaries will support faculty Dean and students, particularly they can organize summative exams, check score lists, answer student questions or student counseling and also support lecturers to finish faculty problems *[Exh. 6.30. Decisions on FEEE and department boards]*.

From the KPIs system *[https://kpis.hcmute.edu.vn/],* workloads of support staff such as working processing, planning, English, basic informatics, and time management are considered. In particular, their competencies depend on different job positions and each faculty/office/center has different criteria for evaluating their workloads. At the end of each academic year, all faculties/offices/centers will consider workloads, feedbacks of all support staff, particularly, they organize meetings to evaluate the achievement of different workload levels. Thus, support staff with excellent workload achievement results will be suggested for HCMUTE/MOET prizes. While support staff with weak results are encouraged to improve their weak points in next years. For the enhancement of knowledge and skills, GAPAO often organizes short-term courses with different fields and requires support staff to attend every year. After the courses, they must send their reports for efficient evaluation. Furthermore, support staff could recommend to enroll for courses to improve their fields organized outside HCMUTE *[Exh. 6.31. Courses for support staff]*.

6.6. Student support services are shown to be subjected to evaluation, benchmarking, and enhancement.

Each semester, HCMUTE conducts dialogue meetings between HCMUTE/faculties/departments leaders with students to collect feedbacks and improve the quality and support service activities. QAO annually conducts a survey on the satisfaction of students and alumni about the capacity and service attitude of support staff through the website *[https://danhgia.hcmute.edu.vn/]*. From the survey results, HCMUTE will have meetings with the functional departments for considering to improve. The survey on student satisfaction about service quality from 2018 to 2022 is shown in **Table 6.5**, in which the quality of internet and wifi, dormitory, studying equipment, tools, and sport places gets a light increase.

The increase means that HCMUTE has invested to renew offices and also built more new offices with modern facilities such as resting areas with air-conditioners, compassion corner, football fields, the domed multi-purpose sports hall, a mini dormitory named "Happy House" with 30 free accommodations for female students with difficult circumstances. Moreover, the digitization of hostel data through the Online Hostel Map has been deployed. In addition, the quality of medical care, self-

study space and incentive scholarships for students are all good levels, averaging around 80%. For better student support services, HCMUTE always plans short-term courses or seminars so that support staff can attend for improving knowledge and skills in their fields such as English, communication skills, advanced informatics and specialization problems *[Exh. 6.32. Workshops, short-term training activities of teachers and staffs]*. Therefore, the average satisfaction level of nearly 82% for support staff is evaluated by learners *[Exh. 6.33. Report on the results of the student survey on the quality of service and student support of HMCUTE 2018-2022]*.

Table 6.5. Satisfaction level with service quality of HCMUTE (in % unit)

Item	2018	2019	2020	2021	2022
Internet, wifi	59.77	59.82	62.86	61.95	63.17
Library	77.34	78.86	76.04	79.89	77.74
Service attitude and capacity of support staff	79.52	82.13	83.01	83.85	80.25
Medical care service	75.96	78.96	77.91	79.2	77.16
Support for internships, job search	78.14	80.32	79.95	82.1	77.73
Scholarships	79.7	81.26	82.23	82.27	77.07
Dormitory service	75.7	77.98	79.69	80.31	71.76
Self-study space for learning	Not included	Not included	84.97	83.00	79.78
Sports facilities	77.54	79.56	80.67	85.58	78.43
Overall service quality	78.6	81.14	86.87	85.64	77.87

With HCMUTE educational philosophy and taking learners as the center, activities to serve and support learners as well as the student monitoring system are widely deployed to faculties and departments. In addition, these activities are published on websites and on social networks. To deploy these activities, HCMUTE has established and assigned tasks for a team of counselors to approach and timely support students on issues such as training regulations, study methods, social skills, school services and psychological counseling *[Exh. 6.34. Decision on appointment of consultant team 2017-2022]*. The student monitoring and counseling system is always reviewed annually, in which there is statistics and evaluation *[Exh. 6.35. List of FEEE consultant team]*.

In the academic year 2021-2022, to meet the management and service work of students to the Covid-19 epidemic situation, HCMUTE has deployed the student management system software, called UIS software *[Exh. 6.36. Plan for updating management software in training management]*, and the website system for student information *[https://online.hcmute.edu.vn]* to timely support and solve administrative procedures for new students, graduation and others. In addition, in order to promptly support students in answering questions during the Covid-19 epidemic, HCMUTE has implemented student support activities through many online counseling channels such as the fanpage, , using telephones and consulting page *[http://tuvansinhvien.hcmute.edu.vn]*. With co-curricular activities, HCMUTE deploys a system to manage and allows student to register *[https://youth.hcmute.edu.vn/] [Exh. 6.37. Announcement of counseling activities for regular students in 2021-2022]*.

The service quality of Library is always maintained and continuously improved each year. Therefore, student satisfaction with the library is from 76.04% to 79.89% in 5 years (2018 to 2022). In order to better serve readers, Library has upgraded the management software with high mobile technology applications. In particular, readers can look up documents and register to borrow them online or at HCMUTE Library. In addition, the database of loan and check-out information is updated daily, so readers can easily look up the borrowed and returned rooms. In addition, Library can guide readers on how to find and use digital documents quickly. Library's online services have been enhanced to

provide new book catalogs on Library's website and fanpage, information on demand, and information consulting services *[http://thuvienso.hcmute.edu.vn/]*.

The BME department also deploys visiting companies for the 1st and 2nd year students to help students have the motivation for studying as well as to approach the real needs. Moreover, the department organizes exchanges between BME students of all courses with alumni and enterprises to create the connection and share their experiences to students *[Exh. 6.38. Pictures of visiting and exchanging between students, alumni and enterprises]*.

ERO has deployed the Job Search and Recruitment page - HCMUTE *[careerhub.hcmute.edu.vn]*. In particular, this page is to support students in finding internships and jobs. It is obvious that with this activity, HCMUTE students have satisfied with high rate of nearly 80%. In summary, the quality of HCMUTE's facilities and student support services has improved year over year in the period 2018 - 2022, with 78.6% in 2018 and taking a peak of 2020 with 86.87%. This shows that HCMUTE always invests for improvement of many policies and active activities to best support for learners.

Criterion 7. Facilities and Infrastructure

7.1. The physical resources to deliver the curriculum, including equipment, material, and information technology, are shown to be sufficient.

HCMUTE, which is one of the largest universities with the campus in Vietnam, has an area of 174,247 m² with spacious space and many trees. Currently, HCMUTE has 2 campuses, 98 workshops, 58 Labs, 2 libraries, 176 classrooms, 176 multimedia rooms, 138 functional rooms. In addition, there are self-study areas and group studying rooms at many places such as the libraries, Labs and around buildings. Theoretical classrooms can accommodate from 30 to 100 students, in which large class rooms, which can contain more than 100 students, are used to teach common basic courses for several programmes. Class rooms for specialized courses can contain about 30 to 50 students. In addition, one day has 3 sessions which are divided into from 7:00 AM to 11:30 AM, from 12:30 PM to 5:50 PM, and from 6:00 PM to 8:40 PM. For staff, there are smaller spaces in faculties and departments for advising students related to studying problems as well as instructing projects *[Exh. 7.1. Public announcement of HCMUTE facilities]*.

In addition, HCMUTE has the traditional library in Block-A and the high-quality library in the basement of the Central building, which serve readers from Monday to Friday, from 7:00 AM to 11:30 AM, from 1:00 PM to 5:00 PM. Library's materials include Vietnamese books, foreign language books, textbooks, dictionaries, technical standard handbooks, scientific research reports, and thesis reports, proceedings related to all fields. In particular, there are 374,695 textbooks; 122,129 copies of Vietnamese literature books; 10,158 copies of foreign language books; 7,801 undergraduate thesis reports; 7,205 master and PhD thesis reports; scientific research reports; and over 35 newspapers and magazines. According to the HCMUTE library regulation, each reader is just borrowed to bring home with 2 types of materials, quantities and time as described in **Table 7.1** *[Exh. 7.2. Library facilities and pictures]*.

Table 7.1. Description of objects, the quantity, time and documents borrowed

Reader	Textbooks		Reference Books	
	Quantity	Time	Quantity	Time
Student	15	5 months	10	3 weeks
Master/PhD	5	8 weeks	5	4 weeks
Lecturer	5	1 year	10	1 year

With the sustainable development orientation, in the medium-term strategic plan for 2017 to 2022 and a long-term vision to 2030, HCMUTE has invested to build and to renew classrooms, student shops, Labs, and modern equipment to better serve for meetings, studying, teaching and scientific

research. In addition, a large amount of the IT facilities has been invested, in which they consist of about 2,451 personal computers for all Labs and functional offices, about 258 projectors and LCD displays for classrooms. In addition to these computers, FEEE is equipped with 249 computers for lecturers, staff and students at FEEE working offices and Labs. To enhance practical teaching and studying, HCMUTE annually plans to invest additional equipment for Labs or renewing class rooms, spaces for other activities about 270,000 USD per year, about 520,000 USD is for equipment, equipment and retail and consumables devices are nearly 260,000 USD for each semester *[Exh. 7.3. Investment information of devices and equipment from 2016-2021]*. Moreover, HCMUTE has a Digital Learning Center with modern equipment supported by co-funding Intel in Vietnam for serving group learning courses and E-Learning and LMS online training systems. Furthermore, HCMUTE has the UTEx system to help students to be more active in their learning activities, such as downloading documents, previewing lecturers' video lectures, and doing lecturers' tests. Students can use their laptops or smartphones to preview lessons, take exams, and update test results. In this system, students can exchange studying together and with lecturers through the forum *[Exh. 3.9. UTEx page samples]; [Exh. 7.4. Information of Digital Learning Center]*.

Since 2015, HCMUTE has worked out surveys of staff about the working environment and of students on the quality of services. From the survey results, HCMUTE will consider sending functional offices for performing improvement. In particular, according to the survey report in 2021, about 80% of students were satisfied with facilities such as computer rooms, Labs, student shops, and equipment for sports, stadium, classrooms, self-study spaces, libraries, public areas such as pathways, halls, corridors, stairs, yards. In addition, about 88.7% of lecturers are satisfied with their working environment such as faculty and department offices, Lab spaces and offices for scientific research *[Exh. 7.5. Survey samples and results on service quality and working environment]*.

7.2. The laboratories and equipment are shown to be up-to-date, readily available, and effectively deployed.

In the period from 2016 to 2021, HCMUTE invested more than 1 million USD for modern equipment, biomedical electronic KITs and machines at these Labs. BME's LABs are often invested around 9,000 USD for purchasing new equipment and around 13,000 USD for purchasing devices to replace and repair every academic year *[Exh. 7.3.]*. In particular, these Labs include 3D ultrasound machines, portable X-ray machines, EEG devices, spirometers, computers, biomedical electronics KITs and other specialized machines as described in **Table 7.2.** Students in the BME programme can study in 10 Labs, which are managed by the department. In addition to Labs, FEEE has the D102 room for meetings and seminars and a secretary room for serving students at Block-D *[Exh. 7.6. Procurement of equipment for Biomedical Engineering Labs]*.

Table 7.2. Description of LABs

No.	Location	LABs	Typical equipment
1	C206A	Biomedical electronic circuit	Device Model Simulating Electrocardiogram Signals and Noise
2	C206A	Biomedical image processing	Model of image acquisition and processing
3	C306A	Biomedical signal processing	Electrocardiogram Model Connected to Computer, Electroencephalogram Device (14 Channels)
4	C306B	Medical Devices	4D Diagnostic Ultrasound Machine, Multi-parameter Patient Monitor, Portable X-Ray Machine, Electrocardiogram Machine
5	C305A	Biomedical Sensor	Biomedical Sensors for NI ELVIS II Data Collection Kit, Bronchoscopy & Lung Model, Spirometry

6	C305B	Biomedical Embedded Systems	Raspberry Pi Compute Module
7	C405	Digital processing and artificial intelligence	Practical models such as movement robot, automatic drug production, virtual reality, remote diagnostic system, intelligent house/hospital
8	D501	Microprocessor	Microprocessor programming KITs
9	D503	Microprocessor	Microprocessor programming KITs
10	D403	Digital System	Digital circuits testing KITs
11	D402	Digital circuits	Digital circuits testing KITs
12	D401	Image processing and Microprocessor	Raspberry Pi Compute Module, HD Camera, Depth Camera, Microprocessor programming KIT

In addition, lecturers with practical experience are assigned to manage Labs to ensure better support, particularly they can prepare materials and machines for teaching Lab tasks or testing and repairing small errors of equipment and machines. In case of complex damaged equipment or machines, they will report to EMO for maintenance plans. In each semester, HCMUTE supports electronics and electrical devices for changing during studying Labs of students, in which Lab lecturers are responsible to make lists of these devices approved by HOD before sending them to EMO for support. In practice, from 2016 to 2021, 6 Labs have been invested at Block C, including C206A - Biomedical Electronic Circuit LAB, C206B - Biomedical Image Processing LAB, C306A - Medical Device Lab, C306B - Biomedical Signal Processing Lab, C305A – Biomedical Sensor Lab and C305B - Biomedical Embedded System Lab *[Exh. 7.7. Equipment maintenance and repair procedure], [Exh. 7.8. Annual financial report of HCMUTE], [Exh. 7.9. The decision to assign the LAB manager].*

In the BME programme, from the 3rd semester, students start studying at LABs, in which each Lab can contain from 15 to 24 students. In addition to using devices for studying at Labs, students can still borrow devices for doing scientific research or thesis projects under the supervision of Lab lecturers. From the end of the 1st semester, all students are introduced to visit hospitals or medical equipment companies at the end of the week. According to the BME curriculum, students will study for internships at hospitals or companies in the 7th semester for at least 8 weeks. However, the department will allow students to register to study in the summer of the 6th semester so that they have more time for their studying as well as thinking about their thesis topic for the final semester. Especially, HCMUTE has signed many MOUs with hospitals and companies for internships and scientific research cooperation from 2016 until now *[Exh. 7.10. Information and MOUs].*

7.3. A digital library is shown to be set-up, in keeping with progress in information and communication technology.

Since 2012, libraries have established an electronic portal to provide information and electronic documents for readers. With the BME programme oriented to biomedical electronic engineering, there are about 2,450 books related to Biomedical Electrical - Electronics major in the HCMUTE library, in which Biomedical Engineering is about 69 textbooks and 17 specialized references. In addition, HCMUTE provides lecturers with a source of data at the library website for searching materials and databases from different resources such as SpringerLink, National Science and Technology Journal, Vietnamese eBooks, Derwent Innovation, IG Publishing, IEEE Xplore Digital Library. Moreover, to enhance cooperation and exchange of information resources, Library has actively participated in professional organizations and associations such as the Vietnam Library Association, Library Union of Universities and Colleges in the South, Union of Libraries of Technical Universities STE, Union of Libraries of Multidisciplinary Universities.

In addition, FEEE has the D102 room with specialized books and journals, and graduation thesis reports for reading at Building-D. Students can access to Labs of C305, C306, D401 for doing their projects and theses, in which they can borrow devices and equipment. In the HCMUTE library, one

large room with 63 computers and 30 tables equipped with internet lines is available for self-studying and looking up documents and there are 4 reading rooms with 2100 seats. In addition, Library has an organized self-study space, where lecturers and students can register for group working. According to the policy of updating documents, Library often sends an announcement to FEEE each semester for making a list of new documents which lecturers and students need to use related to courses of the programme. Therefore, Library's resources are always invested so that contents of courses in the BME curriculum are always updated *[Exh. 7.11. Library activities and information]*.

In 2015, Library upgraded Library management software with a higher technology platform for applying mobile technology. In particular, readers can look up documents and register for borrowing through the online channel or at the Library of HCMUTE. The database information of borrowing and returning will be updated daily and readers can easily look up and borrow rooms. In addition, the Library can guide readers how to quickly search and use digital documents, in which the librarians are available to promptly support and answer questions during the use of the Library. Library's online services have also been enhanced, especially there are the services of providing lists of new books on Library's website and fan page, information on demand, and Information Consulting Services.

To attract a lot of students coming to the Library, Library regularly updates a variety of documents to serve different programmes and also enhances communication through multimedia to students. In addition, Library has activities such as introducing ‘ODILO - Solutions for Libraries 4.0’; organizing a competition to introduce books with video clips following the theme of ”Books - Change My Creative and Entrepreneurship Mindset"; reviewing contest with the theme of “The book I love”; doing workshop on exploiting digital resources in libraries to be Situation - Technology - Solutions; Thematic discussion; Business Book Association; Donating books to Central Vietnam; book discounts *[Exh. 7.12. Pictures and video clips]*.

With the objective of comprehensive quality assurance and continuous improvement, the Library often receives feedback from readers through surveys and direct comments at dialogue sessions of HCMUTE's leaders and students. The survey contents, which include readers' satisfaction about the products, services, and service attitudes of staff, are sent to students through Google form or PSC system every year. The results show that the majority of students are satisfied with the quality of facilities, reference materials, information technology systems, attitude, and support of the librarians. It is obvious that feedback and comments from readers will help Library to continuously improve the service quality of Library *[Exh. 7.13. Library surveys and feedback]*.

7.4. The information technology systems are shown to be set up to meet the needs of staff and students.

Software Technology Center (STC) has been invested to develop different software for training and the management of Library, human resource, websites for faculties and functional offices and LMS pages for lecturers uploading materials and students downloading documents for studying by the online links. In addition, HCMUTE has invested the PSC system to provide all staff and students email accounts for exchanging information or accessing to online pages of offices and centers of HCMUTE, as well as doing surveys of lecturers, staff, and students. Lecturers can log in to UTE Portable to view the timetable, list of classes they are in charge of, enter scores of exams and others. Students can register for courses, view their exam scores, exam schedules, academic information. In addition, students can pay tuition fees through the website of the financial department. In order to easily find and perform works, all faculties, functional offices, and centers at HCMUTE have websites. Thus, students and lecturers can access the FEEE website to find information about departments, training programmes, scientific research announcement, information of staff and other information.

HCMUTE's dashboard system allows to continuously update and monitor important training metrics such as the total number of learners, lecturers, staff, training disciplines, and facilities *[Exh. 7.14. Dashboard pictures]*. In addition, the system provides statistics on scientific research information

such as the number of projects and articles. In addition, the important functions of the system are statistics of students enrolled each academic year, the number of graduates, community service activities, and feedback from students and stakeholders. With the obtained information, HCMUTE can have an overview of each training programme and then perform plans for improvement.

In 2015, HCMUTE established a Digital Learning room, equipped with the latest technology for video conference and teaching courses of PBL *[Exh. 7.15. Information of PBL and pictures for activities]*. This room allows HCMUTE to connect with ASU and other education institutions around the world for interaction between faculties and students. This global interaction aims to enhance important skills and knowledge such as teamwork, problem-solving, planning, presentation skills, and English.

HCMUTE encourages lecturers to participate in teaching courses of Blended learning, E/M learning. In particular, lecturers can register their courses with one of 3 levels of digital teaching and studying at the beginning of every semester and they will be evaluated at the end of that semester. A UTEx online system at HCMUTE was officially applied on April 22, 2019 and supports many activities for teaching and studying through an internet system. Lecturers can post textbooks, references, video clips and work out formative and summative examinations and students can directly study on this system, as well as complete their testing tasks. It is obvious that the UTEx online system is one of useful investments of HCMUTE due to being evaluable and suitable to Covid-19 pandemic. In particular, with the Covid-19 of the academic year, all staff and students of HCMUTE must work at home through the UTEx online system *[Exh. 7.4.]*.

Students of the BME programme are often studied with specialised software followed by medical devices such as EmotivBCI for EEG devices, Winspiro PRO for SpO2, heart rate measuring and analysis machines. In addition, students use Matlab and Python softwares for simulating and analyzing biomedical signals and images. Some different softwares are Proteus is to simulate digital electronic circuits and Labview is for collecting and processing data from biomedical sensors or Solid Work is used to design 3D models.

7.5. The university is shown to provide a highly accessible computer and network infrastructure that enables the campus community to fully exploit information technology for teaching, research, service, and administration.

All faculties, offices, and centers of HCMUTE are equipped with computers with the internet connections and there are about 1,512 computers serving all students. Moreover, INC has been invested to renovate the wifi system with higher speed and upgrade the internet bandwidth with the username of WIFI-UTE for meeting, studying and teaching. In addition to this, Saigon Post and Telecommunications (SPT) company has installed a Free S-wifi system at areas around Blocks A, B, C, D for accessing information and the HCMUTE websites. INC will continue to renovate and upgrade equipment and the internet bandwidth with a total number of 134 Cambium Access Point devices and the internet bandwidth of 500 Mbps domestically, 5 Mbps for the international transmission *[Exh. 7.1.], [Exh. 7.16. Report on public wifi system in HCMUTE]*.

The wifi system at the campus can cover some areas such as the whole central building, the high-tech building, some outdoor learning, and SSC. In addition, some faculties have been installed with the wifi systems at their areas for enhancing teaching and studying. With a lot of the different wifi systems installed will support many lecturers, staff, and students during teaching, working and studying for increasing the effectiveness of activities.

7.6. The environmental, health, and safety standards and access for people with special needs are shown to be defined and implemented.

In 2019, HCMUTE deployed general regulations about the management of safety, health, and working environment, in which HCMUTE has committed to preventing accidents or illnesses arising in activities and working environments. To perform these, HCMUTE requires functional units to

continuously improve regulations with applying standards and management systems following directions of MOET and Vietnam government. In particular, GAPAO, QAO, EMO, FMO, HCO and related units will be responsible for applying these regulations and directions *[Exh. 7.17. Regulations on management of safety, health and working environment]*.

To build a green, clean and beautiful environment, HCMUTE annually deploys units for planting green trees and putting stone tables and chairs by calling for support from alumni and enterprises. For the green environment and healthy safety, HCMUTE has deployed “Smoking Ban" signs on walls of offices and classrooms since 2000. Especially, corridors to enter studying halls or blocks or restrooms are specially designed for people with disabilities and also marked with color signs for easy identification and movement *[Exh. 7.18. Pictures of corridors]*. Moreover, the energy-saving policy is one of HCMUTE's annual quality goals and the security guards always work out with regularly checking and monitoring the use of electricity and water at offices and classrooms. In addition, wastewater, toxic chemicals, and solid waste need to be safely treated according to the HCMUTE regulations and HCO periodically organizes disinfecting and insecticidal sprays on all blocks to prevent dangerous diseases *[Exh. 7.19. Information and pictures for activities]*.

For the prevention of the COVID 19 epidemic, HCO has organized disinfection spraying the whole HCMUTE campus and dormitories and also distributed masks to staff and students, hand wash basins and hand sanitizers located many places around HCMUTE. Moreover, HCMUTE's leaders require all units to strongly propagate with videos, photos, and information on the prevention of the Covid-19 epidemic on HCMUTE website and facebook, student forums, and banner systems. A committee for the COVID-19 prevention, including HCMUTE’s leaders, ASAO and GAPAO was established to control and support staff and students *[Exh. 7.20. Activities during the COVID-19 epidemic]*.

HCMUTE supports the health and accident insurance and HCO annually sends lists so that staff, lecturers and students can choose options and register hospitals for testing. In addition, all new students are supported to test their health before enrolling. GAPAO and the HCO coordinate with the hospitals to organize this periodical physical examination and then all medical records are sent to HCO for feedback and advice from doctors. Students are often informed about disease prevention from HCO and monitored and supported for preventing seasonal epidemics. In addition, SSC and HCO are in charge of psychological and health counseling for students and staff, as well as supporting them for disease prevention and treatment through many information channels such as email notifications or face-to-face consultation. For food safety, HCO periodically organizes testing the quality of food and meals at canteens and two dormitories *[Exh. 7.21. HCO announcement]*.

For student safety in workshops and Labs, rules on occupational safety, dangerous warning signs and medical cabinets are mounted on the walls inside of Labs and around HCMUTE areas. In addition, the workshops and Labs are equipped with small fire extinguishers for fire safety. On the first day of studying at Labs, students are instructed about Lab safety and how to use the fire extinguishers and medical cabinets as well as performing electrical safety by wearing Lab shoes and uniforms and using practical devices. During teaching, lecturers often supervise and monitor the actions of students to promptly remind them for safety *[Exh. 7.22. Announcement of fire prevention and training pictures]*.

For the safety of students, staff and their belongings on campus, HCMUTE has a security team who always monitors areas around the campus for protecting HCMUTE property and the belongings from theft. Moreover, the security team is always required to participate in professional training courses for theft detection skills. FMO periodically organizes to inspect fire alarm systems and extinguishers to ensure still working and to train staff for the use of these systems. In addition, FMO organizes fire prevention and fighting drills on the HCMUTE campus every year. The existing instructions and the security hotline number for emergency calls are also notified to students and staff *[Exh. 7.23. Guide to escape in case of fire]*.

7.7. The university is shown to provide a physical, social, and psychological environment that is conducive for education, research, and personal wellbeing.

HCMUTE has a large area with many green trees, in which HCMUTE is a green, clean, beautiful, smoke-free environment and modern facilities, including a large 1,000-seat auditorium; the central building built at the end of 2012. HCMUTE has many quality classrooms; 16 computer rooms with the total area of 1,164 m²; 58 Labs, and 98 practice workshops with the total area of 30,433 m²; 02 Libraries with the 4,496 m² area; 02 dormitories with the total capacity of 2,416 students; one stadium and one dome for sport and competition activities. In addition, the campus has many self-study areas, small parks, benches, coffee shops, beautiful canteens, and convenience stores for serving students and staff *[Exh. 7.1.]*.

ASAO and the Youth Union often organizes seminars, music and movie shows, entertainment events for students at the large Hall, in which gifted and English clubs and social working teams are established and can operate on the HCMUTE campus. In addition, HCMUTE annually organizes a variety of activities and competitions of talents, sports and camps for students to increase solidarity. Alumni associations are always connected to share experience and support students, in which the FEEE alumni association annually has the meeting at Block-D by Teacher's day (20th Nov). In 2019, the BME department organized an exchange between BME students and enterprises, hospitals, and former students related to working experience, skills and specialized knowledge. Furthermore, BME students actively participate in volunteer activities such as blood donation, visiting places of orphans and heroic Vietnamese mothers, volunteering spring, green summer *[Exh. 6.14. Pictures of social activities]*, *[Exh. 6.25. Club activities]*.

HCO always takes care of the health of staff and students such as guiding the purchase of health insurance, sending lists for registering annual health testing to all staff at hospitals. In addition, HCO doctors and staff will promptly diagnose and basically treat diseases for staff and students, when their health has the large problem advised to go to hospital. SSC has psychological counseling programmes for students to ensure that their health and spirit are always good during studying *[http://ssc.hcmute.edu.vn/]*. Moreover, the HCMUTE security is ready to respond 24/7 for safety *[Exh. 7.17.]*.

7.8. The competences of the support staff rendering services related to facilities are shown to be identified and evaluated to ensure that their skills remain relevant to stakeholder needs.

In HCMUTE's development strategy, service quality plays an important role due to the quality of teaching and studying. In particular, the contribution of support staff should be identified and evaluated through surveys of students and lecturers. Support staff, who are in charge of facilities, must have the competencies *[Appendix 7.1. Job description of support staff]*, in which their common competencies include document editing, planning, English skill, basic informatics, time management. For recruitment, candidates need to meet the requirements of these competencies and then the recruited candidates will be evaluated after a working year by the head of the unit through workloads before signing the long-term contracts. Every year, staff will be required to attend professional courses for improving skills and training new equipment *[Exh. 5.4. Recruitment procedure of HCMUTE]*.

HCMUTE has a KPIs system for evaluating staff workloads such as assigned work, the satisfaction of students and lecturers, on time, community activities related to increasing salary and rewards following HCMUTE and MOET regulations. In addition, using KPIs not only evaluates completion of staff workloads, but also addresses their weak points for improving the contributions in next year. For evaluating staff contributions related to deciding rewards and increasing salary soon at the end of the academic year, leaders of FEEE and HCMUTE sit down to consider workloads based on KPIs performance indicators and make decisions following the HCMUTE regulations. It is obvious that using KPIs is very clear, fair, and effective to all staff *[Exh. 5.11. KPIs decision of HCMUTE]*, *[Exh.5.12. KPIs workload sample of lecturer]*.

7.9. The quality of the facilities (library, laboratory, IT, and student services) are shown

to be subjected to evaluation and enhancement.

Every year, QAO annually organizes surveys and collects feedback from students and lecturers about the quality of facilities, in which they can choose answers or write their comments for satisfaction. The results were that the majority of lecturers were satisfied with the equipment installed in classrooms and also suggested improving the sound quality at some classrooms last year. In another aspect of satisfaction about Lab equipment, basically managers of Labs are satisfied with Lab facilities. Regarding the conditions for supporting teaching and scientific research, the satisfaction level of lecturers with the conditions of Library's support is the average of 84.93%. While the level of supporting the common infrastructure for online teaching, studying and scientific research is about the 70% average satisfaction. In the low satisfaction, lecturers suggested that the IT system (wifi system) needs to improve better for serving the needs of teaching and scientific research *[Exh. 7.5.]*.

For evaluating the quality of HCMUTE's service, QAO sends students the online surveys every academic year. The survey results of the students show that the learning materials provided by the Library are good and suitable, while some modern equipment in some Labs should be updated. **Table 7.3** shows that the level of student satisfaction on the 2 items increased gradually from 2018 to 2022, in which the satisfaction level reached the highest level in 2021 with 86.06% and 79.89% respectively and a little bit reduced due to Covid-19. In addition, for objectively improving, alumni surveys after 1 year of graduation are often sent to collect feedback for satisfaction about facilities which they used. In addition to student surveys, HCMUTE often organizes dialogue sessions between FEEE/HCMUTE leaders and students at the end of every semester and feedback will be sent to functional offices for improvement plans. These offices will analyze the causes and then propose improvement solutions to HCMUTE leaders for next semester or year *[Exh. 7.24. Graduates and alumni survey held by QAO], [Exh. 7.25. Improvement report of ASAO]*.

Table 7.3. Satisfaction level with service quality of HCMUTE (in % unit)

Item	2018	2019	2020	2021	2022
Learning materials	81.64	83.28	85.22	86.06	79.99
Lab equipment	77.34	78.86	76.04	79.89%	77.74

Criterion 8. Output and Outcomes

8.1. The pass rate, dropout rate, and average time to graduate are shown to be established, monitored, and benchmarked for improvement.

According to the HCMUTE regulation, the management and comparison of training indicators are applied to all training programmes. The indicators could be categorized into three groups including learning outcome, research ability, and employability. To efficiently monitor the indicators, HCMUTE has used a dashboard system since 2014, in which relative offices such as AAO, ASAO, STIAO, QAO, ERO are required to update the data regularly. Training programmes are required to (1) Establish these indicators at the beginning of the academic year and (2) report the achieved results at the ending of the academic year. The reports must be analyzed the results and then they need to propose solutions for continuously improving these outcomes *[Exh. 8.1. Monitor- Benchmark-Improvement Regulation]*.

The pass rate, dropout rate, and the average-time-to-graduate are learning-outcome indicators. In the BME programme, these indicators are established at the beginning of each academic year. In the academic year 2016-2020, this is the first year that we implement the programme; therefore, the average indicators of FEEE is used to assigned for our programme. In later year, therefore, our programme established the indicators slightly higher than the average indicators of FEEE. **Table 8.1** shows the established and actual on-time graduation rate, dropout rate, average time to graduate and **Table 8.2** describes the pass rate and dropout rate over years in detail. The average graduation time of the BME programme is 4.05 years; the dropout rate of the 2016 intake is 8 students per 59,

corresponding to the rate of 13.55%. The results show that the drop-out rate was reduced significantly. Especially, the drop rate from the fourth year is very small. It means students had been consulted well. After the first year, if students would like to follow the programme, they have more possibility to complete it *[Exh. 8.2. BME teaching and training report]*.

Table 8.1. Description of the average time, be stablished, the pass rate and dropout rate

Academic Year	2016-2020		2017-2021		2018-2022	
	Established	Actual	Established	Actual	Established	Actual
On-time graduation rate (%)	40	54.9	40	60	45	52.1
Dropout rate (%)	13.46	13.56	10	9.09	8	6.6
Average time to graduate (year)	4.8	4.19	4.8	4.09	4.8	4.2

Table 8.2. Detail information about the pass rate and dropout rate

Academic year	Cohort Size	Completed first degree in (Unit in %)			Drop-out during (Unit in %)			
		<4	4	>4	1st	2nd	3rd	>4th
2016-2020	59	-	54.90	31.54	1.69	3.39	1.69	6.78
2017-2021	55	-	60	30.91	0	7.27	0	1.82
2018-2022	58	-	52.1	-	0	6.6	0	-
2019-2023	59	-	-	-	1.69	5.08	-	-
2020-2024	63	-	-	-	0	-	-	-
2021-2025	45	-	-	-	4.44	-	-	-

Table 8.3 shows the comparison of the on-time graduation rate between the BME programme and two other programmes (ACET and MET). The results show that the indicator of the BME programme is very close to highest score that is gained by the ACET programme. The on-time graduation rate is 54.90% compared to 56.25% of the Automation and Control Engineering Technology (ACET) programme and 49.15% of Mechatronics Engineering Technology (MET) programme. To enhance the on-time graduate rate and reduce the dropout rate, several solutions have been applied. In particular, FEEE often has the meeting with HODs to find causes, in which there are many students with difficult families, failing courses or healthy problems *[Exh. 8.3. Drop out list and corresponding reason]*. Therefore, solutions are that HODs can contact with student's family for understanding and also discuss with the department lecturers for improving exam questions, teaching and assessment methods *[Appendix 8.1. Solutions for improvement]*.

Table 8.3. Benchmarking result on the on-time graduation rate indicator

Academic year	Dropout rate of BME programme (%)	On-time graduation rate (%)				
		BME	ACET	MET	VEE	TET
2016-2020	13.56	54.9	56.25	49.15	46.72	42.31
2017-2021	9.09	60.0	38.01	43.85	42.57	50
2018-2022	6.6	52.1	-	-	-	-

8.2. Employability as well as self-employment, entrepreneurship, and advancement to further studies, are shown to be established, monitored, and benchmarked for

improvement.

In the academic year 2019-2020, FEEE expects 80% of the students to get a job after 3 months of graduation. To measure employability, we conduct the measurement twice a year. In particular, the first time is in the graduation ceremony and each student will fill in a survey form about identifying how many students can find a job within three months. The second is that an annual activity is conducted by QAO in October. This survey aims to measure how many students can find a job within 6 months or 1 year. In addition, the BME programme uses the BME email address to send the Google form survey to students through their student email addresses after one year of graduation. The employability results are shown in **Table 8.4**, in which the result of the BME survey is higher than that of QAO. The reason is that QAO just sends the survey to the student email addresses, while the BME department not only sends the survey through the student email addresses, but also informs on the BME group facebook. This is obvious that the BME survey activity ensures more alumni to be able to reach the information for survey *[Exh. 8.4. FEEE teaching and training report], [Exh. 2.5], [Exh. 2.6], [Exh. 2.7].*

Table 8.4. Employability result from 2020-2022 academic years

Survey content	Graduated year (%)		Establish
	2020	2021	
Get a job before graduation	39.1	44.50	-
Get a job one month from graduation	39.1	22.25	-
Get a job three months from graduation	13	22.25	-
Total	**91.2**	**89**	**80**
Get a job six months from graduation	4.3	6.6	-
Learning to a higher degree	0	0.0	-
Have another plan	0	4.3	-
Looking for a job/ work in an unrelated field.	4.3	11	-

Table 8.5 presents the employability comparison between three programmes: BME, MET, and ACET and the results show that the employability of the BME programme is comparable to well-known programmes. In addition, the alumni survey given by the BME department points out that 18% of alumni agree that the BME programmes fits very well with their jobs. It means the content of the BME programmes can cover well 18% of jobs in the labor market. In addition, 72% of alumni agree that the BME programmes can help them in their jobs *[Exh 2.8. Meetings with students and lecturers, survey samples and feedbacks from stakeholders]*.

Table 8.5. Employability benchmarking among three programmes

Jobs within three months	Graduated year (%)				
	2017	2018	2019	2020	2021
BME Programme	-	-	-	91.2	89.12
MET Programme	68.73	69.09	69.91	70.75	70.15
ACET Programme	84.13	67.21	70.13	70.23	70.28
VEE Programme	41.45	60.2	52.5	62.72	33.33
TET Programme	84.6	75	82.3	70.37	68.75

To continuously support students, several activities have been held in recent years. The performance of the supporting activities was measured by feedbacks from enterprises and alumni. Following the feedbacks, 15% of alumni said that they found their jobs through the HCMUTE channel and lecturers and HOD *[Exh. 6.26. Job orientation and visiting trips], [Exh. 7.24. Graduates and alumni survey held by QAO], [Appendix 8.1.].*

8.3. Research and creative work output and activities carried out by the academic staff and students, are shown to be established, monitored, and benchmarked for improvement.

Scientific research plays an important role in improving the learning and teaching of the programme. In HCMUTE regulations, workloads for lecturers is to have the number of hours of scientific research per year, so most of the lecturers have to do research. Besides, some lecturers of FEEE have projects and products with high quality. Thus, these studies and products can help them adapt their curriculum or add exercises, experimental models, or simulations. In addition, some research students have a good opportunity to work with academic faculty to enhance their research experience and skills *[Exh. 3.25.]*.

At the beginning of the semester, all lecturers register their research workloads on the KPIs system *[https://kpis.hcmute.edu.vn/]*. HOD often discuss with lecturers before approving their workloads to ensure that they are matched with faculty plans to increase workload performance. The actual results of scientific papers are described in **Table 8.6** *[Exh. 5.12. KPIs workload sample of lecturer]*.

Table 8.6. Actual research results over years and the target for next academic year in FEEE

Academic Year	Types of Publication			Total	No. of Publication per Academic Staff
	National	International conference	International journal		
2016	28	15	24	67	0.63
2017	57	32	20	109	1.04
2018	25	32	28	85	0.89
2019	29	31	54	114	1.2
2020	22	28	47	97	1.05
2021	33	33	38	104	1.17

The benchmarking in **Table 8.7** shows that the FEEE has the best results in both research papers and projects. This means that HCMUTE has focused on developing high quality human resources in recent years. In addition, many young lecturers have gone overseas to gain their PhD degrees and many outstanding lecturers from other universities have joined us for collaboration. Lecturers not only graduated PhD degrees from HCMUTE but also domestic and international universities where help them to develop about scientific research. It is obvious that with the diversity and highly qualified human resources, the number of publications has significantly increased over recent years. However, the number of papers per academic staff is still small, because the remaining academic staff with master degrees mainly focus on teaching and basic research. This is the main reason for the number of papers per academic staff to be low.

Table 8.7. Benchmarking of research outcomes

Academic year	Number of papers (No. of paper per academic staff)				Number of projects (No. of project per academic staff)			
	FEEE	FME	FVEE	FCFT	FEEE	FME	FVEE	FCFT
2016	0.63	1.04	0.56	0.71	0.42	0.52	0.71	0.07
2017	1.04	0.9	1.09	0.6	0.27	0.33	0.44	0.19
2018	0.89	0.81	0.79	1.21	0.38	0.38	0.47	0.17
2019	1.2	1.01	0.65	0.45	0.53	0.6	0.82	0.31
2020	1.05	0.77	0.91	1.57	0.46	0.32	0.35	0.12

Table 8.8. The results of scientific research students from 2015-2020 in FEEE

Academic year	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020
Student research/ award	25	28	22	26	11
Competition	3	3	5	4	5

In addition to the staff research, student scientific research is a critical point in HCMUTE. Therefore, HCMUTE has the ISO procedure for supporting these scientific research activities of students, particularly FEEE and HCMUTE often organize robot competitions and they are encouraged and supported to register projects to perform under the instruction of experience lecturers. In **Table 8.8,** the student scientific research activities increase from 2015 to 2020, especially, there were two BME students who won the 2nd and 3rd scientific research rewards held by MOET, in which one of the BME students, Le Ngoc Phu, was honored as one of the best students in the national prize in 2020 *[Exh. 8.5. Student research certificate]*. In particular, his research topic, "Research and Application of EEG Signals to Control Assistant Arm Exoskeleton" is the most outstanding of seventy projects. In addition, his advisor, Mr. Ngo Ba Viet, is a lecturer in the BME department of HCMUTE. To keep enhancing the student research quality, some activities have been deployed such as registering projects, attending robot competitions and developing small projects from courses *[Exh. 8.6. ISO procedure to student research] [Exh. 6.18. Competition activities of FEEE/HCMUTE/national] [Appendix 8.1]*. To enhance the scientific research quality, HCMUTE encourages student projects with paper products and this requires a group with many students to perform together. This can be the main reason for less projects from 2019 until now *[Exh. 8.7. Student projects and papers]*.

8.4. Data are provided to directly show the achievement of the programme outcomes, which are established and monitored.

The BME programme includes 9 ELOs, in which each ELO is measured and evaluated by several PIs. In total, there are 29 PIs corresponding to 9 ELOs, and many PIs have been measured since the academic years of 2019-2021. At the beginning of a semester, several courses will be selected for PI measurement. For each PI, we establish an expectation that is the student ratio will pass the PI. In each course, our lecturers will set up a measurement plan that clearly points out the relationships between course assignments and measured PIs. During the semester, lecturers follow the plan to collect students' responses aligned to the assignments. If a student's score is higher than an expected score, the student will pass the PI. We compute the ratio of students who pass the PI and compare it with the expected ratio. The results in **Table 8.9** show that the actual score is higher than our expectation in almost PIs. However, the PI4.2 and PI6.4 are lower than our expectations for 2020-2021. Hence, we continuously measure more PIs for 2021-2022 and plan for improvements in next semesters *[Exh. 8.8. PIs measurement]*. Besides, the number of PIs related to ELOs measured during time which students study at enterprises is shown in **Table 1.4**.

Table 8.9. A summarization of Expected (%)/Actual (%) PI measurements of ELOs

Expected Learning Outcomes	2019-2020	2020-2021	2021-2022
ELO1: Ability to apply, formulate and solve principles, theorems, concepts of engineering, science, and mathematics in the field of biomedical engineering.	-	PI1.1=70/78 PI1.2=80/100 PI1.3=70/79	PI1.1=70/83 PI1.2=70/75 PI1.3=70/74
ELO2: Ability to develop, conduct, and operate appropriate experiments and devices on boards, machines, and data obtained to interpret and produce results.	-	PI2.1=70/88 PI2.2=70/100 PI2.3=70/79	PI2.1=70/91 PI2.2=70/70 PI2.3=70/98
ELO3: Ability to recognize professional and ethical responsibilities associated with biomedical	PI3.1=70/83 PI3.2=60/98	PI3.1=80/97 PI3.2=80/98	PI3.1=70/91 PI3.2=70/90

engineering issues that affect the social, environmental, economic, and global contexts.	PI3.3=60/91	PI3.3=80/96 PI3.4=80/100	PI3.3=70/95 PI3.4=70/85
ELO4: Ability to effectively apply knowledge in appropriate and long-term learning strategies in biomedical engineering field	-	PI4.1=80/98 PI4.2=70/50 PI4.3=80/88	PI4.1=70/100 PI4.2=70/100 PI4.3=70/60
ELO5: Ability to effectively apply knowledge to teamwork and provide entrepreneurship and leadership to achieve objectives	-	-	PI5.1=70/96 PI5.2=70/98 PI5.3=70/97
ELO6: Ability to explain, demonstrate, and communicate technical issues to people in the BME field and even in English.	-	PI6.1=80/94 PI6.2=80/97 PI6.3=80/100 PI6.4=70/58	PI6.1=70/96 PI6.2=70/90 PI6.3=70/79 PI6.4=70/97
ELO7: Ability to analyze and interpret data obtained from the experiments to apply appropriate circuits and systems	-	-	PI7.1=70/100 PI7.2=70/84 PI7.3=70/100
ELO8: Ability to effectively evaluate issues, systems and applications in biomedical field that can impact on social, economic, environmental and global contexts to have conclusions	-	-	PI8.1=70/83 PI8.2=70/100 PI8.3=70/84
ELO9: Ability to create biomedical engineering systems using new knowledge and skills	-	-	PI9.1=70/100 PI9.2=70/100 PI9.3=70/90

8.5. Satisfaction levels of the various stakeholders are shown to be established, monitored, and benchmarked for improvement.

To improve satisfaction levels, HCMUTE always receives feedbacks from stakeholders including staff, students, alumni, enterprises and hospitals. For each stakeholder, different processes are applied to monitor the satisfaction level and propose an action plan for improvement. From 2015, QAO annually holds online surveys to collect feedbacks and then the survey results are analyzed to points out issues that could be improved.

In particular, QAO and Library annually send surveys to students for service and facility quality. While the Library service is highly evaluated, the internet service is required to be improved. In addition, students can evaluate the teaching quality of each course on the lecturer personal page before they can receive the final grade at the end of each semester *[https://online.hcmute.edu.vn/]*. In particular, each course with three metrics including teaching method, course content, and lecturer attitude will be evaluated and a higher average score means that the course quality is higher *[Exh. 8.9. Surveys on service, and library quality]*. **Table 8.10** shows the results which students evaluated FEEE lecturers in last years and basically, they are good. In addition, FEEE and HCMUTE leaders have meetings with students face to face every semester and questions are responded, respectively. From these questions, the FEEE and HCMUTE will transfer to functional offices and lecturers for supports and improvement *[Exh. 8.10. Teaching quality evaluation]*.

Table 8.10. Survey result for the average teaching quality from 2016-2019 (%)

Academic year	Teaching method	Course content	Lecturer attitude
2015-2016	84.1	84.3	85.1
2016-2017	85.7	86.1	86.3
2017-2018	87.3	87.6	88.1

2018-2019	88.6	88.2	88.9

For evaluating the working environment, the staff meeting is often held at the beginning of an academic year and staff can discuss current issues and next plans. In addition to the staff meeting, QAO annually sends the survey to staff in October and the survey result will be analyzed to produce statistic reports about satisfaction criterion. With the satisfaction measurements, the reports show that if the satisfaction level is less than 65%, the criterion needs to be improved immediately. If it is greater than 80%, that criterion is pretty good.

Table 8.11. Alumni actions from 2015-2020

Year	2015	2016	2017	2018	2019	2020
Member in the alumni club (in person)	467	575	615	679	716	765
Alumni in the offline events (in person)	104	150	121	146	111	114
Funding in the alumni club (in USD)	4,712	4,052	4,448	5,858	6,562	8,588
Sponsored projects (in USD)	-	-	-	61,660	101,300	233,430

For feedbacks from alumni, FEEE has an alumni club and they often have the meeting at the large Hall in November. During the meeting, FEEE and the department receive a lot of feedbacks related to the BME training programme. In addition, alumni come back HCMUTE to not only meet old classmates, but also share practical knowledge which they have got from practical works as well as give feedbacks for improving problems related to the training programme. Hence, from these feedbacks, we can evaluate their satisfaction. Moreover, in the event, alumni will donate some fundings to support for students with difficulty having the excellent GPAs of FEEE. Some alumni, who have the good positions at their companies, are ready to support students in internships, to do projects or to get jobs. **Table 8.11** shows that FEEE alumni always keep in touch with FEEE during long time and also arrange time for attend this annual event. Besides the alumni club, the satisfaction level of FEEE programmes could be measured based on questions for alumni and their feedbacks. According to the survey for the BME programme, the positive feedbacks are up to 80% *[Exh 2.8. Meetings with students and lecturers, survey samples and feedbacks from stakeholders]*.

With the stakeholder is enterprises and hospitals, the BME department can collect feedbacks from a seminar or at a graduation TDC and also send a Google survey form. The survey contents cover not only necessary skills on the market but also the quality of graduation students. The survey results point out that soft-skills and English ability are major issues that should be improved, while technical skills are acceptable. To evaluate the satisfaction level from enterprises or hospitals, the questionnaires are that companies are willing to accept BME students when they have the suitable positions *[Appendix 1.3. Feedback contents from stakeholders and survey methods], [Exh. 8.11. Enterprise meeting by FEEE]*. The survey results point out that 95.2% of companies agree that they are willing the BME students when the company has a new position. In addition, a benchmarking of the percentage of students who can find a job in a trained field is presented in **Table 8.12**. As a programme in FEEE, our students can work in any field relative to electrical and electronic fields. Moreover, these students can work in hospitals and medical companies. therefore, our metric is higher than other programmes and slightly better than the average metric of FEEE *[Exh. 2.3 Meetings with students and lecturers, survey samples and feedbacks from stakeholders], [Appendix 8.1]*.

Table 8.12 The ratio of working in the trained/ relatived field (in % unit)

Year	2017	2018	2019	2020	2021
FEEE average	79.21	84.99	95.93	93.36	92.85

UTE Average	81.99	87.68	93.69	94.45	95.64
ATC	79.25	88.88	94.45	90.63	64.66
MET	84.21	61.24	58.70	-	-
BME	-	-	-	93.75	95.12

PART III: STRENGTHS AND WEAKNESS ANALYSIS

Criterion 1 - Expected Learning Outcomes

Strengths

1. 9 ELOs were designed based on Bloom's taxonomy, in which there are 29 Performance Indicators (PIs) distributed for all ELOs. Especially, 29 PIs were designed to follow CLOs and ELOs in all syllabi for measurements for evaluating, enhancing and improving contents, questions, methods and ELOs.
2. 9 ELOs in the BME programme includes knowledge and skills related to humanity, society, science, education, practice, application, technology, business and leader. In addition, a lot of courses for co-curricular activities related to enterprises making good translation to meet stakeholders' needs. It means that students commit themselves to life-long learning and daily learning practices.

Weakness

1. The relationships between HCMUTE and enterprises are the majority of the domestic companies and hospitals and this is common of Vietnamese universities. Therefore, the BME programme was built and start recruiting for 2016, so the relationship with enterprises need to be improved, in which the international components need to be improved.

Plans for improvement

1. Enlarge connections between the BME programme and international enterprises and hospitals through MOUs to put actions together such as visiting, training, seminars, internships.

Criterion 2 - Programme Structure and Content

Strengths

1. Content and structure of the programme apply the concept of interdisciplinarity to equip students with the necessary knowledge, attitude and skills so that they may work at the interface between electronics, biomedical engineering and technology.
2. The project courses help students facilitate the implementation of the project-based learning process and MOOCs are designed by experience lecturers and posted the UTEx page. Therefore, students can self-study with online materials which are edited with the high quality and thus this helps students save time for moving to classrooms and enhance their self-studying. It means that online teaching and studying are suitable by Covid-19 pandemics.
3. All major changes in the curriculum are noted in the programme based on satisfactions' feedbacks to follow up and to prevent stepping back and plans for changing and updating are followed by the ISO procedure.

Weakness

1. We need to attract top-notch lecturers who have great visions and high expectations to be able to teach students.
2. English is a problem to some students for completing the studying programme.

Plans for improvement

1. The department will coordinate with FEEE to come up with good policies to attract foreign graduates with excellent academic and scientific research qualification and suggest to HCMUTE leaders.
2. We will enhance English for students by introducing English clubs, making exams with English questions, using English power-point slides and student representation in English for graduation theses.

Criterion 3 - Teaching and Learning Approach

Strengths

1. Courses of Labs, projects, internship are accompanied by individual efforts as well as team works and it is reflected their practical ability.
2. In addition to traditional teaching and learning approaches at classrooms, MOOCs have been added in this programme to enhance self-study and students can save time and fee of each course.
3. Besides, Labs and Internship, courses of "Topics with Enterprises" and "Entrepreneurship-Leadership" are designed in the BME programme to enhance actual knowledge and skills which students need to know and to prepare for future works.

Weakness

1. This BME programme has one student from Laos who got the admission in 2019. Therefore, she has not yet failed some courses for last semesters.

Plans for improvement

2. FEEE and the department need to improve teaching and learning approaches to international students, particularly HCMUTE allows to use TAs to take care directly to each international student during studying years. Moreover, the BME programme needs to improve to be suitable to international students.

Criterion 4 - Student Assessment

Strengths

1. In addition to traditional assessment approaches, student assessments using rubrics are always improved to be suitable to the change of syllabus contents. In addition, rubrics, which are always improved to enhance outcome achievement, are encouraged to apply in curses of Labs, projects, internship and thesis and always for reliability and fairness.
2. The assessment method using rubrics can apply at classrooms or on the online LMS page of each lecturer, the most used in the Covid-19 epidemic.
3. The assessment methods followed by CLOs/ELOs/PIs and the exam questions are assigned points for PI measurements for improving the assessment methods and ELOs.

Weakness

1. Some assessment methods such as oral testing, doing topics are difficult to apply for courses with the large student size.

Plans for improvement

1. The department receives feedbacks from exam results of courses and will have meetings with lecturers to choose some suitable assessment methods for these courses.

Criterion 5: Academic Staff

Strengths

1. Most lecturers of the department have practical experience in teaching students at Labs and instructing them to execute practical models.

2. A majority of lecturers are young and enthusiastic and graduated from developed countries such as Australia, Korea, England and Taiwan. They are passion in scientific research with projects and have published publications on national and international journals with the high quality. In addition, they are enthusiastic to instruct students to make real models or robots in participating competitions at FEEE/HCMUTE or outside of HCMUTE

Weakness

1. Only one lecturer in the department holds the Assoc. Professor title and two third lecturers with master degrees are lack research experience at high level.

Plans for improvement

1. Encourage younger lecturers with master degrees to study PhD degree and the department will arrange workloads so that they can are easier during study years.

Criterion 6 - Student Support Services

Strengths

1. Many student support services are made during studying years, in which there are social, sport, art activities such as Sports Championship, Blood Donation, “heroes’ Mother” and Green Summer organized by the Youth Union and Student Association.
2. Scientific research activities are often competitions such as LED Circuit Design Contest and Maze Robot Competition, Dancing Robot, Puppetry Robot, IoTs Startup organized by FEEE and STIAO.
3. Specialized Labs of the BME programme are equipped with modern machines and equipment and also have private spaces for research students.

Weakness

1. With the development of technology in using equipment and machines for teaching, the HCMUTE internet system is a problem.

Plans for improvement

1. FEEE will suggests HCMUTE for improving this problem and a private system can be designed at Building C and D belong to FEEE in the short term.

Criterion 7 – Facilities and Infrastructure

Strengths

1. Labs with quality machines and KITs for the BME programme are appropriately equipped and always maintained each semester.
2. The modern digital teaching room was investigated to be the international standard for teaching, learning groups and seminars.
3. Labs are designed to have a small space for students doing projects or theses.
4. Library has invested to digitally manage the large number of books, e-books, e-journal papers which are annually increased. Especially, Library has the anti-plagiarism software (Turnitin).
5. With the large area of HCMUTE, a lot of self-study spaces with computers in Library and stone tables and chairs around campus are put for self-study.

Weakness

1. Motorcycle parking is not optimal and students still have to wait a long time to park their Motorcycles.
2. The FEEE Labs need to increase the number of TAs.

Plans for improvement

1. FEEE will suggest HCMUTE for building more Motorcycle parking spaces.
2. The department will suggest FEEE and HCMUTE for recruitment of TAs, particularly students, who are the end years, can serve at the BME Labs.

Criterion 8 – Output and Outcomes

Strengths

1. The statistics regarding student's profiles have been carefully designed. It allows the department and FEEE to keep track of the effectiveness of the recruitment campaign and the impact of the BME programme.
2. HCMUTE has the ISO management procedure for monitoring teaching and learning process. This procedure especially supports the improvement of quality of students' studying process and helps adequate graduation rate of students on time; early graduation from requirements; reduction of late graduation and drop out.
3. Many courses such as topics of theory courses, projects, thesis, internships and Labs have been applied rubrics for student assessment to enhance reliability and fairness. Moreover, rubrics are always updated and improved to be suitable each particular courses.
4. 29 PIs designed in 9 ELOs of the BME programme are measured for studying improvement of students.

Weakness

1. The number of student projects is less.
2. The graduation rate of students still is low and the majority of students do not achieve the output English on time.

Plans for improvements

1. The department will investigate the reason of registering student projects and then discuss with FEEE for improving this problem.
2. The department will plan to improve graduation rate of students on time based on feedbacks from students and suggest FEEE and HCMUTE to have a particular plan for improving this.

List of evidences

No.	Exh.	Title of Exhibition	Category
	Criterion 1: Expected Learning Outcomes		
1	1.1	The mission and vision of HCMUTE and FEEE	
	1.1a	The missions and vision of HCMUTE	Document
	1.1b	The missions and vision of FEEE	Document
2	1.2	Curriculums for potential students and enterprises	
	1.2a	Curriculum for potential students	Document
	1.2b	Curriculums for enterprises	Document
2	1.3	HCMUTE and MOET regulations	
	1.3a	MOET regulation for building programme	Document
	1.3b	HCMUTE regulation for building programme	Document
4	1.4	Syllabus sample with the relationship of ELOs/PIs and CLOs	Document
5	1.5	The ISO procedure for designing programmes	Document
6	1.6	Interdisciplinary courses and MOOC list	
	1.6a	Interdisciplinary courses	Document
	1.6b	MOOC list and department meeting report	Document
7	1.7	MOOC pictures and regulation for studying MOOCs	Picture
	1.7a	MOOC pictures	Picture
	1.7b	Regulation for studying MOOCs	Document
8	1.8	Regulation for 2 courses	Document
9	1.9	Pictures of course with enterprises	Picture
10	1.10	BME curriculum	Document
11	1.11	Information of reviewing the BME curriculum, surveys and feedbacks	
	1.1a	Expert Feedbacks for reviewing the BME curriculum	Document
	1.1b	Survey and feedback samples of BME department	Document
	1.1c	Survey and feedback samples of QAO	Document
12	1.12	Department meetings about student assessment	Document
13	1.13	50% (2020-2021) and 100% (2021-2022) of PIs measured	
	1.3a	50% (2020-2021) of PIs measured	Document
	1.3b	100% (2021-2022) of PIs measured	Document
14	1.14	Student assessment samples	
	1.14a	Student assessment sample of Lab	Document
	1.14b	Student assessment sample of project	Document
	1.14c	Student assessment sample of theory	Document
15	1.15	Group meeting reports of common courses	
16	1.16	Plan for measuring PIs of courses and measured samples	
	1.16a	Plan for measuring PIs of courses	Document
	1.16b	Measured samples	Document
17	1.17	FEEE quality objectives of academic years	Document

No.	Exh.	Title of Exhibition	Category
	Criterion 2: Programme Structure and Content		
1	2.1	Programme specialisations for enterprises and potential students	

	2.1a	Programme specialisation for enterprises	Document
	2.1b	Programme specialisation for potential students	Document
2	2.2	Syllabus sample with PIs	
	2.2a	Syllabus of Digital systems	Document
	2.2b	Syllabus of Bio-image processing Lab	Document
	2.2c	Syllabus of thesis	Document
3	2.3	Rubrics samples	
	2.3a	Rubric for Microprocessor project	Document
	2.3b	Rubric for Capstone project	Document
	2.3c	Rubric for graduation thesis	Document
4	2.4	Process for design of one curriculum	Document
5	2.5	Survey forms and enterprise and hospital feedbacks	
	2.5a	Survey forms	Document
	2.5b	Feedbacks of enterprises and hospitals	Document
6	2.6	Survey forms and alumni feedbacks	
	2.6a	Survey forms of the department	Document
	2.6c	Feedbacks of alumni	Document
7	2.7	Survey forms and student feedbacks	
	2.7a	Survey forms of the department	Document
	2.7b	Survey forms of QAO	Document
	2.7c	Feedbacks of students	Document
	2.7d	Meetings with students at the large Hall	Picture
8	2.8	Feedbacks of educational experts	Document
	2.9	Department meetings and updated contents in syllabus, projects	
9	2.9a	Department meetings	Document
	2.9b	Meetings with the department lecturers	Document
	2.9c	Updated contents in syllabus	Document
	2.9d	Updated contents in projects	Document
	2.9e	New syllabus of Thesis Topics	Document
10	2.10	FEEE scientific and academic committee, department meetings and updated problems in the BME programme	
	2.10a	Department meetings for changing problems	Document
	2.10b	Updated BME programme	Document
	2.10c	Decision of FEEE scientific and academic committee for updating	Document
11	2.11	Decision, Department plan and results of PI measurements	
	2.11a	Decision for performing PIs	Document
	2.11b	Department plan	Document
	2.11c	PI measurement of Digital Systems course with ELO	Document
	2.11d	PI measurement of Internship course with ELO	Document
	2.11e	PI measurement of Bio-Signal Processing Lab with ELO	Document
12	2.12	Exams and projects related to updated and integrated knowledge and skills	
	2.12a	Exams related to updated and integrated knowledge and skills	Document
	2.12b	Projects related to updated and integrated knowledge and skills	Document
13	2.13	Thesis slide sample and pictures with enterprise activities	
	2.13a	Thesis slide sample	Slide

	2.13b	Thesis defence committee list	Picture Document
	2.13c	Visiting enterprise/hospitals	Picture
	2.13d	Studying with enterprise	Picture
14	2.14	Information for counseling students	
	2.14a	List of FEEE counselors	Document
	2.14b	Counselor information and FEEE counselor page	Picture
	2.14c	Announcements on the department website for registering	Document
15	2.15	Information of other programmes	
	2.15a	BME prorgamme of IU, VNU	Document
	2.15b	BME prorgamme of HCMUT, VNU	Document
	2.15c	BME prorgamme of HUST	Document
	2.15d	Biomedical Engineering of ASU	Document
16	2.16	Visiting Enterprises and Hospitals	
	2.16a	Visiting Enterprises	Picture
	2.16b	Visiting Hospitals	Picture
17	2.17	Syllabus of Introduction to BME course	Document
18	2.18	Pictures of social activities	Picture
19	2.19	Teaching plan of the BME programme	Document
20	2.20	ISO procedure for updating programme and reviewing information	
	2.20a	ISO procedure for updating the programme	Document
	2.20b	Feedbacks from reviewers of the BME programme	Document
	2.20c	Feedbacks from reviewers of the BME programme syllabi	Document
21	2.21	Plan and decision for the BME programme of years 2016, 2018, 2020	
	2.21a	BME curriculums with 150 credits, year 2016	Document
	2.21b	BME curriculums with 150 credits, year 2018	Document
	2.21c	BME curriculums with 150 credits, year 2020	Document
22	2.22	Information related to TPP and the 4th Industrial Revolution	
	2.22a	Information related to TPP	Document
	2.22b	Information related to the 4th Industrial Revolution	Document
23	2.23	HCMUTE decision for online teaching and assessments and syllabus, online exams	
	2.23a	HCMUTE decision for online teaching	Document
	2.23b	Online teaching and studying pictures	Document
	2.23c	Online syllabus and Online exams	Document
24	2.24	Online projects, grade lists, online pages	
	2.24a	Online projects	Document
	2.24b	Online grade lists	Document
	2.24c	Online pages	Document

No.	Exh.	Title of Exhibition	Category
	Criterion 3. Teaching and Learning Approach		
1	3.1	HCMUTE educational philosophy	Picture
2	3.2	Channels for receiving feedbacks from students and support campaigns	

	3.2a	Channels for receiving feedback from students	Document
	3.2b	Sharing corner and sharing Tet	Picture
	3.2c	Supporting students' necessities due to covid-19	Picture
3	3.3	Students participate in competitions and awards	
	3.3a	Logo design contest	Document
	3.3b	Maze Solving Robot contest	Picture
	3.3c	Scientific Research Student Award by the MOET	Picture
4	3.4	Foreign training and internship courses	
	3.4a	Notice of training planning	Document
	3.4b	List of registrations for training	Document
	3.4c	Certificates	Picture
	3.4d	Internship courses of students	Document
5	3.5	Syllabus sample with CLOs	
	3.5a	Digital systems syllabus	Document
	3.5b	Biosignal processing syllabus	Document
	3.5c	Health Information systems syllabus	Document
6	3.6	Exams of Digital systems and its Lab	
	3.6a	Digital systems teaching profile (Attendance lists, Exercises on UTEx, Student reports, Forum on UTEx)	Picture
	3.6b	Digital systems Lab teaching profile (Attendance lists, Exercises on UTEx, Student reports, Forum on UTEx)	Picture
7	3.7	Surveys and feedbacks for students from the lecturers	
	3.7a	Surveys	Document
	3.7b	Feedbacks for students from the lecturers	Document
8	3.8	Thesis teaching profiles and reports	Document
9	3.9	UTEx page samples	Picture
10	3.10	Exercises and Quizzes on UTEx	Document
11	3.11	Lab samples and assessments	
	3.11a	Sample practice manual	Document
	3.11b	Lab reports of student	Document
	3.11c	Sample of Lab assessment	Document
	3.11d	Lab products of students	Picture
12	3.12	Project samples and rubrics	Document
13	3.13	Information of studying with enterprises and rubric samples	
	3.13a	Information of studying with enterprises	Document
	3.13b	Rubric samples	Document
14	3.14	Oversea internship information	Document
	3.14a	Decide to recognize courses at external universities	Document
	3.14b	Student evaluation sheet of Chung Yuan Christian University	Document
15	3.15	Lists of students participating in scientific research and seminars	Document
16	3.16	English clubs and sample teaching slides in English	
	3.16a	English club fan-pages	Document
	3.16b	English club activities pictures	Picture
	3.16c	Teaching slide of Biomedical Imaging Processing subject	Document
	3.16d	Teaching slide of Microprocessor subject	Document
	3.16e	Teaching slide of Digital systems subject	Document

17	3.17	English outcome (TOEIC 550) of HCMUTE regulations	Document
18	3.18	Syllabus of Introduction to Biomedical Engineering and guide to finding information of the library	
	3.18a	Syllabus of Introduction to Biomedical Engineering	Document
	3.18b	Guide to finding information of the library	Document
19	3.19	Syllabus and project reports of students	
	3.19a	Syllabus projects and capstone	Document
	3.19b	Sample project reports of student	Document
20	3.20	Sample essay reports of students	
	3.20a	Essay report in digital systems	Document
	3.20b	Essay report in embedded systems in biomedical engineering	Document
	3.20c	Essay report in Biomedical Sensors Technology	Document
21	3.21	Support donation lists	
	3.21a	List of donations to support students in need	Document
	3.21b	List of donations to support people affected by natural disasters	Document
22	3.22	Photos of students participating in competitions	Picture
23	3.23	Social activities	
	3.23a	Plans for activities	Document
	3.23b	Activities	Picture
24	3.24	Thesis report sample and product video clips	Picture
	3.24a	Thesis report samples	Document
	3.24b	Product video clips of students	Video
25	3.25	Student project working with lecturer and paper	Document
26	3.26	Pictures of BME LABs and student activities	Picture
27	3.27	Tables of estimated costs in student's graduation thesis	Document
28	3.28	Department meetings for teaching and learning	Document
29	3.29	ISO procedures of AAO	
	3.29a	ISO procedure for planning and implementing instruction	Document
	3.29b	ISO procedure for exam questions, security and duplication of written exams, delivery of test papers and test scores	Document
30	3.30	Meetings pictures, student feedbacks	
	3.30a	Meetings pictures	Picture
	3.30b	The meeting minute for rubrics assessment	Document
	3.30c	The meeting minute for assessment methods	Document
	3.30d	Meeting minutes the Faculty’s student dialogue	Document
31	3.31	Alumni and company survey results	Document
32	3.32	Student survey results and PIs measurements	
	3.32a	Student survey results	Document
	3.32b	PI measurement results	Document
33	3.33	IoTs model and some AI application	Document

No.	Exh.	Title of Exhibition	Category
	Criterion 4. Student Assessment		
1	4.1	Entrance recruitment information	Document
2	4.2	English examination information	
	4.2a	English testing regulations	Document
	4.2b	English testing information	Document

3	4.3	ISO procedure for student assessments	
	4.3a	ISO procedure for course assessment and confidentiality of examination tasks	Document
	4.3b	ISO procedure for examination monitor	Document
	4.3c	Sample questions with CLOs	Document
4	4.4	Assessment of courses and information of PIs measurements	
	4.4a	Information of PIs measurements for ELO2	Document
	4.4b	Information of PIs measurements for ELO6	Document
	4.4c	Information of PIs measurements for ELO7	Document
5	4.5	Information about internship and graduation thesis	
	4.5a	Requirement to perform thesis	Document
	4.5b	Thesis rubric table	Document
	4.5c	Graduation thesis grading committee (council) lists	Document
	4.5d	Assessment of internship	Document
	4.5e	Thesis and internship reports	Document
6	4.6	HCMUTE regulations for training (7/2021)	Document
7	4.7	Exam questions and answers on BME websites	Picture
8	4.8	Information related to student assessment and assessment-appeal	
	4.8a	Course assessment and assessment types published on UTEx page	Document
	4.8b	Testing on the UTEx page	Document
	4.8c	Formative and summative questions	Document
	4.8d	Sample assessment results	Document
9	4.9	HCMUTE regulations to formative assessment (7/2021)	Document
10	4.10	Video clips of thesis committee	Video
11	4.11	Regulations on equivalent scores of different English tests	Document
12	4.12	Grade samples and course regulations	
	4.12a	Digital systems subjects	Document
	4.12b	Biomedical Imaging Technology subjects	Document
	4.12c	Microprocessor Lab	Document
13	4.13	Studying warning information	Document
14	4.14	ISO procedure of examining and marking	
15	4.15	Assessment methods, rubrics and result samples	
	4.15a	Assessment methods on UTEx	Document
	4.15b	Rubric types and assessment results using rubrics	Document
	4.15c	Essay and Quiz answers of students	Document
	4.15d	Student reports for subjects	Document
16	4.16	Teaching information and surveys	
	4.16a	Plan on teaching and learning timetable	Document
	4.16b	Student evaluations for the courses	Document
17	4.17	Information related to examination	
	4.17a	Sample exam questions and answers	Document
	4.17b	Answer papers	Document
	4.17c	Sample lists of grade	Document
18	4.18	ISO procedure for examination monitor	Document
19	4.19	Eportfolio and feedback samples	
	4.19a	The eportfolio of “Biosignal processing”	Document

	4.19b	The eportfolio of “Biomedical Electronic Circuit Design”	Document
	4.19c	The eportfolio of “Biomedical Sensors Technology”	Document
	4.19d	Feedback samples	
20	4.20	Plan and samples of PIs measurements	
	4.20a	Plan of PIs measurements	Document
	4.20b	Samples of PIs measurements	Document
21	4.21	Feedbacks samples for student	Document
22	4.22	Lecturer feedbacks to student on projects and thesis	
	4.22a	Schedule for doing projects	Document
	4.22b	Lecturer’s comments on student projects	Document
	4.22c	Thesis comments by instructors and reviewers	Document
23	4.23	Teaching activity on the UTEx system	Document
24	4.24	Assessment information	
	4.24a	Formative answer papers	Document
	4.24b	Summative answer papers	Document
25	4.25	Rubrics on the department website	Document
26	4.26	Announcement of brief courses related to education and scientific research for lecturers	Document
27	4.27	Feedbacks of enterprises and medical doctors at the thesis committee	Video

No.	Exh.	Title of Exhibition	Category
	Criterion 5: Academic Staff		
1	5.1	HCMC and FEEE strategic plan	
	5.1a	HCMC strategic plan	Document
	5.1b	FEEE strategic plan	Document
2	5.2	Scholarships announcement to academic staff	Document
3	5.3	HCMUTE policy about learning support	Document
4	5.4	Recruitment procedure of HCMUTE	
	5.4a	Notice on the planning of human recruitment	Document
	5.4b	Recruitment announcement from GAPAO	Document
5	5.5	Salary list of lecturers	
	5.5a	The salary coefficients of lecturers	Document
	5.5b	List of annual salary increase before the due date from 2019-2021	Document
6	5.6	Visiting lecturer contracts	Document
7	5.7	List and information of visiting lecturers	Document
8	5.8	Recruitment requirement and KPIs system	Document
	5.8a	Recruitment requirement	Document
	5.8b	KPIs system	Document
9	5.9	MOET regulations for academic staff	Document
10	5.10	HCMUTE policy about workload related to training and scientific research contributions	Document
11	5.11	KPIs decision of HCMUTE	Document
12	5.12	KPIs workload sample of lecturer	Document
13	5.13	Academic staff evaluated results based on KPIs	
	5.13a	Academic staff evaluated rubric	Document

	5.13b	Academic staff evaluated results	Document
14	5.14	Lecturer contracts	Document
	5.14a	Probationary labor contract	Document
	5.14b	Definite-term labor contract	Document
15	5.15	Lecturer evaluation and award lists at the end of the year	
	5.15a	Lecturer evaluation	Document
	5.15b	Lecturer award lists	Document
16	5.16	Pictures for consulting and exchanging; Organizing a logo design	
	5.16a	Pictures for consulting and exchanging	Pictures
	5.16b	Organizing a logo design	Pictures
17	5.17	KPIs registration sample and year-end KPIs evaluation	
	5.17a	KPIs registration sample	Document
	5.17b	Year-end KPIs evaluation	Document
18	5.18	Teaching course assignment to lecturers	Document
19	5.19	List of student advisory boards and scientific research information	
	5.19a	List of student advisory boards	Document
	5.19b	Scientific research information	Document
20	5.20	List of projects and papers (2018-2022)	
	5.20a	List of projects (2018-2022)	Document
	5.20b	List of papers (2018-2022)	Document
21	5.21	Activities of the YUSA	
	5.21a	Spring volunteer campaign	Images
	5.21b	Competitions organized by YUSA	Document
22	5.22	HCMUTE policy about support for paper and project	
	5.22a	HCMUTE policy about support for paper	Document
	5.22b	HCMUTE policy about support for project	Document
23	5.23	List of excellent lecturers and list of early salary increases	
	5.23a	List of excellent lecturers	Document
	5.23b	List early salary increases	Document
24	5.24	HCMUTE regulation and promotion and support information	Document
25	5.25	Minutes of meeting on inspection contents	Document
26	5.26	List of attending lecturers	Document
27	5.27	Percentage registration sample between teaching and scientific research	Document
28	5.28	List of projects and collaboration information (2018-2022)	
	5.28a	List of projects (2018-2022)	Document
	5.28b	Collaboration information (2018-2022)	Document
29	5.29	Regulations on writing acknowledgment in articles and plagiarism	Document
30	5.30	Certificates of courses	Document
31	5.31	Registration list of courses; pictures of course participation, certificates	
	5.31a	Registration list of courses	Document
	5.31b	Pictures of course participation, certificates	Pictures

32	5.32	Statistical table of training results of the Department for the period 2017-2022	Document
	5.32a	Notice of training planning	Document
	5.32b	List of registrations for training	Document
	5.32c	Certificates	Pictures
33	5.33	Lists of lecturer awards and increased salary soon	Document
34	5.34	List of increasing annual salary and increasing annual salary soon and different rewards	Document
35	5.35	Lists and documents of TAs and advisory board	Document
36	5.36	Student feedbacks at the end of each semester	Document

No.	Exh.	Title of Exhibition	Category
	Criterion 6: Student support services		
1	6.1	HCMUTE 2021 admission plan and regulations	
	6.1a	HCMUTE 2021 admission plan	Document
	6.1b	HCMUTE regulation for recruiting	Document
2	6.2	Plans, consultant information and Lab pictures	
	6.2a	Consultant plans	Document
	6.2b	Consultant on the UTX-TV	Picture
	6.2c	Online consultant	Document
	6.2d	Open day information	Picture
3	6.3	Volunteer student pictures and online admission procedure	Picture
4	6.4	Benchmarking and information for recruitment	
	6.4a	Benchmarking	Document
	6.4b	Information for recruitment	Document
5	6.5	Support pictures to find hostels and clubs of youth union for activities	Picture
6	6.6	Scholarships and supporting loan applications	Document
7	6.7	Meeting at the beginning of each semester	Document
8	6.8	English club pictures and PowerPoint slides	Picture
9	6.9	KPIs samples	Document
10	6.10	Meetings with students and surveys	Document
11	6.11	Information of UTEX online pages and courses	
	6.11a	Lecturer online page	Picture
	6.11b	Course information	Document
	6.11c	Semester online results of Digital Systems course	Document
12	6.12	Academic warnings and support information	
	6.12a	Academic warnings of students with low GPA	Document
	6.12b	Scholarship announcement	Document
13	6.13	Lists of companies for internships	
14	6.14	Pictures of Social activities	
15	6.15	Lists and documents of advisory board	
16	6.16	Curriculum of Introduction to biomedical engineering	
	6.16a	Syllabus of Introduction to biomedical engineering	Document
	6.16b	Related activities of this course	Picture
17	6.17	Co-curricular activities with specialized knowledge	
	6.17a	Internships	Picture

	6.17b	Talking with alumni	Picture
	6.17c	Talking with enterprises/hospitals	Picture
18	6.18	Competition activities of FEEE/HCMUTE/national	
	6.18a	MOET rewards	Document
	6.18b	FEEE robot	Picture
	6.18c	HCMUTE robot	Picture
19	6.19	Pictures of sport and social activities	Picture
20	6.20	Pictures of academic clubs activities	Picture
21	6.21	Pictures of enterprises activities	Picture
22	6.22	List of students received scholarships	Document
23	6.23	List of FEEE counselling group and documents	Document
24	6.24	Library pictures	Picture
25	6.25	Club activities	
	6.25a	English club	Picture
	6.25b	Sport club	Picture
	6.25c	Scientific research club	Picture
26	6.26	Job orientation and visiting trips	
	6.26a	Job orientation	Picture
	6.26b	Visiting trips to enterprises/hospitals	Picture
	6.26c	Announcement and enterprise list	Document
27	6.27	HCMUTE and MOET regulations about workloads	
	6.27a	MOET regulation about workloads	Document
	6.27b	HCMUTE regulation about workloads	Document
	6.27c	KPIs Workload samples of academic staff	Document
	6.27d	KPIs Workload samples of support staff	Document
28	6.28	Satisfaction surveys and feedbacks (2021)	
	6.28a	Survey sample	Document
	6.28b	Satisfaction feedbacks of students	Document
	6.28c	Satisfaction feedbacks of lecturers	Document
29	6.29	Human resources recruitment Procedure and announcement	
	6.29a	HCMUTE recruitment procedure	Document
	6.29b	Announcement sent to units	Document
	6.29c	Recruitment information on the GAPAO website	Document
30	6.30	Decisions on FEEE and department boards	
	6.30a	Dean/Vice-Dean decision	Document
	6.30b	FEEE secretary decision	Document
	6.30c	HOD Decisions	Document
31	6.31	Courses for support staff	
32	6.32	Workshops, short-term training activities of teachers and staffs	Picture
33	6.33	Report on the results of the student survey on the quality of service and student support of HMCUTE 2018-2022	Document
34	6.34	Decision on appointment of consultant team 2017-2022	Document
35	6.35	List of FEEE consultant team	Document
36	6.36	Plan for updating management software in training management	Document
37	6.37	Announcement of counseling activities for regular students in 2021-2022	Document

38	6.38	Pictures of visiting and exchanging between students, alumni and enterprises	Picture

No.	Exh.	Title of Exhibition	Category
	Criterion 7: Facilities and Infrastructure		
1	7.1	Public announcement of HCMUTE facilities	
	7.1a	Public announcement of HCMUTE's facilities in 2020-2021	Document
	7.1b	Photos of campus and service facilities	Picture
2	7.2	Library facilities and pictures	
	7.2a	Photos of library	Picture
	7.2b	List of books and documents	Document
3	7.3	Investment information of devices and equipment from 2016-2021	
	7.3a	Plan to purchase equipment for the project	Document
	7.3b	Plan to purchase laboratory supplies	Document
	7.3c	Plan for the implementation of quality goals	Document
	7.3d	FEEE PC statistics	Document
4	7.4	Information of Digital Learning Center	
	7.4a	Digital teaching room establishment decision	Document
	7.4b	Regulations on implementation of digital teaching activities	Document
	7.4c	Notice of organization of online course acceptance test	Document
	7.4d	Results of acceptance of digital teaching classes	Document
	7.4e	Photos of digital teaching activities	Picture
5	7.5	Survey samples and results on service quality and working environment	
	7.5a	Student survey on service quality of HCMUTE, No. 09 /BC-DBCL March 18, 2021	Document
	7.5b	Student survey on service quality form	Document
	7.5c	Staff survey on working environment of HCMUTE, No.14/BC-ĐBCL April 9, 2021	Document
	7.5d	Staff survey on working environment form	Document
6	7.6	Procurement of equipment for Biomedical Engineering Labs	
	7.6a	Information of investment in HCMUTE's BME LABs	Document
	7.6b	List of devices	Document
7	7.7	Equipment maintenance and repair procedure	
	7.7a	Equipment maintenance and repair plan	Document
	7.7b	Equipment maintenance and repair activities	Picture
8	7.8	Annual financial report of HCMUTE	Document
9	7.9	The decision to assign the LAB manager	Document
10	7.10	Information and pictures about MOUs	
	7.10a	MOU between HCMUTE and hospitals	Document
	7.10b	MOU between HCMUTE and enterprise	Document
	7.10c	MOU between HCMUTE and Emotiv	Document
	7.10d	Pictures about MOUs	Picture
11	7.11	Library activities and information	

	7.11a	Announcement on the use and exploitation of online databases	Document
	7.11b	Recommended for information to Register to compile textbooks and study materials	Document
	7.11c	Registration form for writing textbooks and references	Document
	7.11d	Procedures For Supplement Of References	Document
12	7.12	Pictures and video clips	Picture
13	7.13	Library surveys and feedback	
14	7.14	Dashboard pictures	Picture
15	7.15	Information of PBL and pictures for activities	
	7.15a	Key tasks for the academic year 2019-2020	Document
	7.15b	The plan on implementing the scientific research task "Project-based Learning" in 2020	Document
	7.15c	Pictures of activities	Picture
16	7.16	Report on public wifi system in HCMUTE	Document
17	7.17	Regulations on management of safety, health and working environment	
	7.17a	Decision on promulgating regulations on management of safety, health and working environment	Document
	7.17b	Regulations on types of violations and discipline for students	Document
	7.17c	Hotline phone number	Document
18	7.18	Pictures of corridors	Picture
19	7.19	Information and pictures for activities	Picture
20	7.20	Activities during the COVID-19 epidemic	
	7.20a	Announcement about the continuation of the epidemic prevention of Covid19	Document
	7.20b	Pictures of food support for students	Picture
	7.20c	List of donations	Document
	7.20d	Information for processing teaching and studying in COVID-19 epidemic	Document
21	7.21	HCO announcement	
	7.21a	Announcement of Physical Examination for Freshmen	Document
	7.21b	Guidelines for preventing insect diseases in the rainy season	Document
	7.21c	Announcement of environmental disinfection spray	Document
	7.21d	Announcement of Physical Examination for employees of HCMUTE	Document
22	7.22	Announcement of fire prevention and training pictures	
	7.22a	Announcement fire drills	Document
	7.22b	Announcement of fire protection equipment	Document
	7.22c	Fire prevention and training photos	Picture
23	7.23	Guide to escape in case of fire	
	7.23a	Escape map	Document
	7.23b	Plan to coordinate in organizing propaganda activities on crime prevention, fire prevention, and traffic safety for HCMUTE students	Document
24	7.24	Graduates and alumni survey held by QAO	
	7.24a	Graduates survey report	Document
	7.24b	Graduates survey form	Document

	7.24c	Alumni survey report	Document
	7.24d	Alumni Survey form	Document
25	7.25	Improvement report of ASAO	Document

No.	Exh.	Title of Exhibition	Category
	Criterion 8: Output and Outcomes		
1	8.1	Monitor- Benchmark- Improvement Regulation	
	8.1a	Monitor- Benchmark- Improvement Regulation	Document
	8.1b	Appendix of the Regulation	Document
2	8.2	BME Teaching and Training report	
	8.2a	The report in 2020-2021	Document
	8.2b	The report in 2021-2022	Document
3	8.3	Drop out list and corresponding reasons	
	8.3a	Report in 2019-2020	Document
	8.3b	Report in 2020-2021	Document
4	8.4	FEEE teaching and training report	
	8.4a	The report in 2019-2020	Document
	8.4b	The report in 2020-2021	Document
5	8.5	Student research certificate	Document
6	8.6	ISO process to Student research	Document
7	8.7	Student research project and paper	Document
	8.7a	Student based research projects	Document
	8.7b	Student based research paper	Document
8	8.8	PIs measurement	
	8.8a	PIs measurement (2019-2020)	Document
	8.8b	PIs measurement (2020-2021)	Document
	8.8c	PIs measurement (2021-2022)	Document
9	8.9	Surveys on service, and library quality	
	8.9a	Service survey in 2016-2017	Document
	8.9b	Service survey in 2017-2018	Document
	8.9c	Service survey in 2018-2019	Document
	8.9d	Service survey in 2019-2020	Document
	8.9e	Service survey in 2020-2021	Document
	8.9f	Library survey in 2017-2018	Document
	8.9g	Library survey in 2018-2019	Document
	8.9h	Library survey in 2019-2020	Document
10	8.10	Teaching quality evaluation	
	8.10a	Evaluation Form	Website
	8.10b	Report in 2020-2021	Document
11	8.11	Enterprise meeting by FEEE	
	8.11a	Invitation letter	Document
	8.11b	Image	Picture

PART IV: APPENDICES

A. Self-rating for AUN-QA Assessment at Programme Level

Criteria		1	2	3	4	5	6	7
1	**Expected Learning Outcomes**							
1.1	The programme to show that the expected learning outcomes are appropriately formulated in accordance with an established learning taxonomy, are aligned to the vision and mission of the university, and are known to all stakeholders						X	
1.2	The programme to show that the expected learning outcomes for all courses are appropriately formulated and are aligned to the expected learning outcomes of the programme.						X	
1.3	The programme to show that the expected learning outcomes consist of both generic outcomes (related to written and oral communication, problem-solving, information technology, teambuilding skills, etc.) and subject specific outcomes (related to knowledge and skills of the study discipline)						X	
1.4	The programme to show that the requirements of the stakeholders, especially the external stakeholders, are gathered, and that these are reflected in the expected learning outcomes					X		
1.5	The programme to show that the expected learning outcomes are achieved by the students by the time they graduate					X		
	Overall Opinion	**6.0**						
2	**Programme Structure and Content**							
2.1	The specifications of the programme and all its courses are shown to be comprehensive, up-todate, and made available and communicated to all stakeholders.						X	
2.2	The design of the curriculum is shown to be constructively aligned with achieving the expected learning outcomes.						X	
2.3	The design of the curriculum is shown to include feedback from stakeholders, especially external stakeholders.					X		
2.4	The contribution made by each course in achieving the expected learning outcomes is shown to be clear.						X	
2.5	The curriculum to show that all its courses are logically structured, properly sequenced (progression from basic to intermediate to specialised courses), and are integrated.						X	
2.6	The curriculum to have option(s) for students to pursue major and/or minor specialisations.					X		
2.7	The programme to show that its curriculum is reviewed periodically following an established procedure and that it remains up-to-date and relevant to industry.						X	

	Overall Opinion	**6.0**						
3	**Teaching and Learning Approach**							
3.1	The educational philosophy is shown to be articulated and communicated to all stakeholders. It is also shown to be reflected in the teaching and learning activities.						X	
3.2	The teaching and learning activities are shown to allow students to participate responsibly in the learning process.						X	
3.3	The teaching and learning activities are shown to involve active learning by the students.					X		
3.4	The teaching and learning activities are shown to promote learning, learning how to learn, and instilling in students a commitment for life-long learning (e.g., commitment to critical inquiry, information-processing skills, and a willingness to experiment with new ideas and practices).						X	
3.5	The teaching and learning activities are shown to inculcate in students, new ideas, creative thought, innovation, and an entrepreneurial mindset.					X		
3.6	The teaching and learning processes are shown to be continuously improved to ensure their relevance to the needs of industry and are aligned to the expected learning outcomes.						X	
	Overall Opinion	**6.0**						
4	**Student Assessment**							
4.1	A variety of assessment methods are shown to be used and are shown to be constructively aligned to achieving the expected learning outcomes and the teaching and learning objectives.						X	
4.2	The assessment and assessment-appeal policies are shown to be explicit, communicated to students, and applied consistently.						X	
4.3	The assessment standards and procedures for student progression and degree completion, are shown to be explicit, communicated to students, and applied consistently.						X	
4.4	The assessments methods are shown to include rubrics, marking schemes, timelines, and regulations, and these are shown to ensure validity, reliability, and fairness in assessment.						X	
4.5	The assessment methods are shown to measure the achievement of the expected learning outcomes of the programme and its courses.						X	
4.6	Feedback of student assessment is shown to be provided in a timely manner.						X	
4.7	The student assessment and its processes are shown to be continuously reviewed and improved to ensure their relevance to the needs of industry and alignment to the expected learning outcomes.					X		
	Overall Opinion	**6.0**						
5	**Academic Staff**							

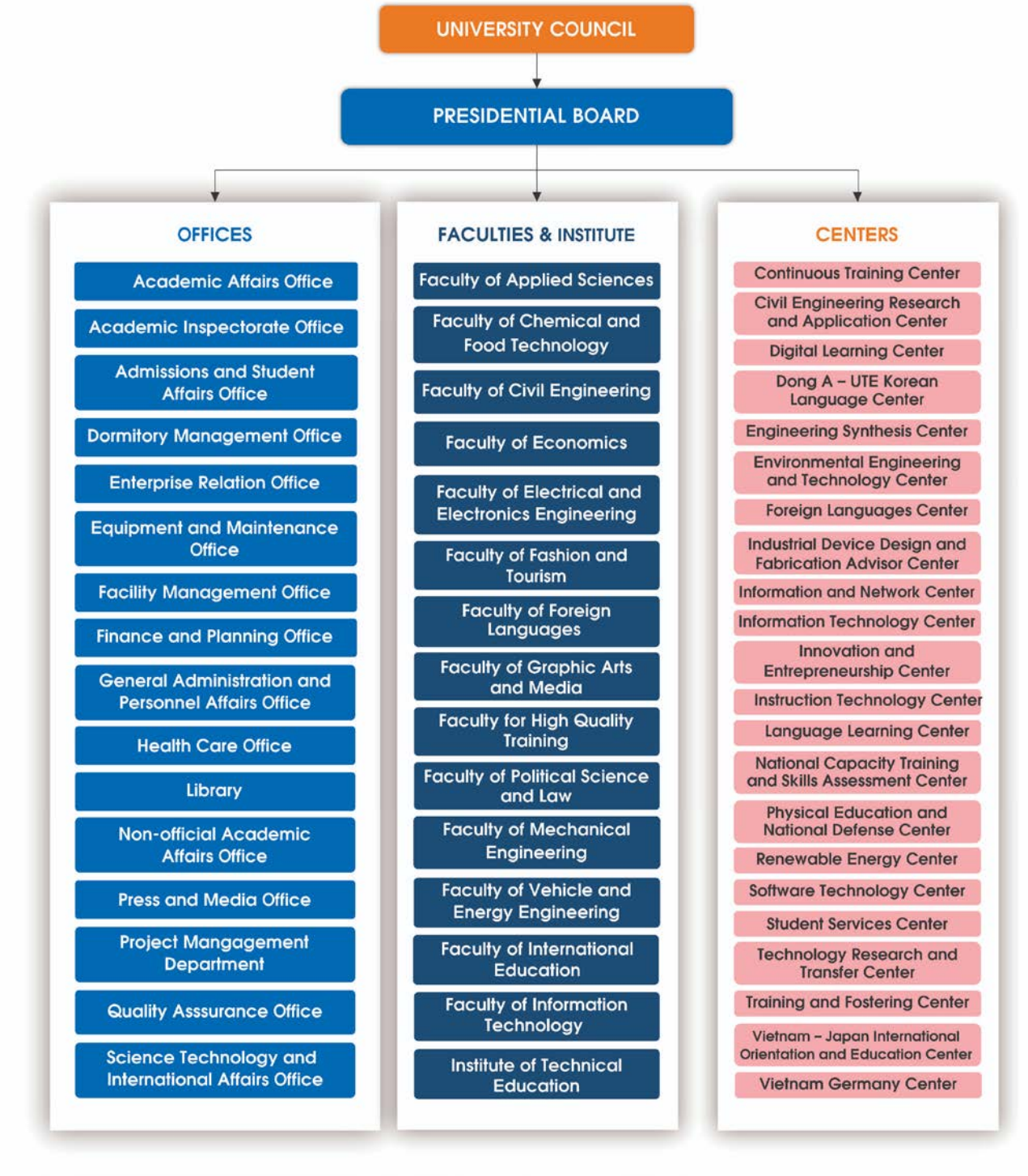
5.1	The programme to show that academic staff planning (including succession, promotion, redeployment, termination, and retirement plans) is carried out to ensure that the quality and quantity of the academic staff fulfil the needs for education, research, and service.						X	
5.2	The programme to show that staff workload is measured and monitored to improve the quality of education, research, and service.						X	
5.3	The programme to show that the competences of the academic staff are determined, evaluated, and communicated.						X	
5.4	The programme to show that the duties allocated to the academic staff are appropriate to qualifications, experience, and aptitude.					X		
5.5	The programme to show that promotion of the academic staff is based on a merit system which accounts for teaching, research, and service.						X	
5.6	The programme to show that the rights and privileges, benefits, roles and relationships, and accountability of the academic staff, taking into account professional ethics and their academic freedom, are well defined and understood.					X		
5.7	The programme to show that the training and developmental needs of the academic staff are systematically identified, and that appropriate training and development activities are implemented to fulfil the identified needs.					X		
5.8	The programme to show that performance management including reward and recognition is implemented to assess academic staff teaching and research quality.					X		
	Overall Opinion	**5.5**						
6	**Student Support Services**							
6.1	The student intake policy, admission criteria, and admission procedures to the programme are shown to be clearly defined, communicated, published, and up-to-date.						X	
6.2	Both short-term and long-term planning of academic and non-academic support services are shown to be carried out to ensure sufficiency and quality of support services for teaching, research, and community service.					X		
6.3	An adequate system is shown to exist for student progress, academic performance, and workload monitoring. Student progress, academic performance, and workload are shown to be systematically recorded and monitored. Feedback to students and corrective actions are made where necessary.						X	
6.4	Co-curricular activities, student competition, and other student support services are shown to be available to improve learning experience and employability.					X		
6.5	The competences of the support staff rendering student services are shown to be identified for recruitment and deployment. These competences are shown to be evaluated to ensure their continued					X		

	relevance to stakeholders needs. Roles and relationships are shown to be well defined to ensure smooth delivery of the services.							
6.6	Student support services are shown to be subjected to evaluation, benchmarking, and enhancement.				X			
	Overall Opinion	**5.5**						
7	**Facilities and Infrastructure**							
7.1	The physical resources to deliver the curriculum, including equipment, material, and information technology, are shown to be sufficient.					X		
7.2	The laboratories and equipment are shown to be up-to-date, readily available, and effectively deployed.						X	
7.3	A digital library is shown to be set-up, in keeping with progress in information and communication technology.					X		
7.4	The information technology systems are shown to be set up to meet the needs of staff and students.					X		
7.5	The university is shown to provide a highly accessible computer and network infrastructure that enables the campus community to fully exploit information technology for teaching, research, service, and administration.					X		
7.6	The environmental, health, and safety standards and access for people with special needs are shown to be defined and implemented.				X			
7.7	The university is shown to provide a physical, social, and psychological environment that is conducive for education, research, and personal well-being.					X		
7.8	The competences of the support staff rendering services related to facilities are shown to be identified and evaluated to ensure that their skills remain relevant to stakeholder needs.				X			
7.9	The quality of the facilities (library, laboratory, IT, and student services) are shown to be subjected to evaluation and enhancement.				X			
	Overall Opinion	**5.0**						
8	**Output and Outcomes**							
8.1	The pass rate, dropout rate, and average time to graduate are shown to be established, monitored, and benchmarked for improvement.					X		
8.2	Employability as well as self-employment, entrepreneurship, and advancement to further studies, are shown to be established, monitored, and benchmarked for improvement.					X		
8.3	Research and creative work output and activities carried out by the academic staff and students, are shown to be established, monitored, and benchmarked for improvement.					X		
8.4	Data are provided to show directly the achievement of the programme outcomes, which are established and monitored.						X	

8.5	Satisfaction level of the various stakeholders are shown to be established, monitored, and benchmarked for improvement.						X	
	Overall Opinion	**5.5**						
	Final Opinion	**5.5**						

B. Tables and Figures related to Introduction and 8 criteria
Introduction

Appendix 0.1. Description of the organization structure of HCMUTE



Appendix 0.2. Report on the Assessment and Accreditation of HCMUTE from 2016 - 2019

Assessment level	Institution/Programme	Assessment organization	Assessment date	Result	Approval certificate	
					Approval Date	expiry Date

Institution	HCMC University of Technology and Education		CEA VNU-HCM	11/2016	Approved	03/05/2017	03/05/2022
Programmes	1	Electrical and Electronics Engineering Technology	**AUN-QA**	03/2016	Approved	17/04/2016	16/04/2020
	2	Mechatronics Engineering Technology		03/2016	Approved	17/04/2016	16/04/2020
	3	Automotive Engineering Technology		03/2016	Approved	17/04/2016	16/04/2020
	4	Construction Engineering Technology		12/2016	Approved	04/04/2017	03/04/2022
	5	Electronics Communication Engineering Technology		11/2017	Approved	09/12/2017	08/12/2022
	6	Machine Manufacturing Technology		11/2017	Approved	09/12/2017	08/12/2022
	7	Thermal Engineering Technology		11/2017	Approved	09/12/2017	08/12/2022
	8	Environmental Engineering Technology		11/2017	Approved	09/12/2017	08/12/2022
	9	Mechanical Engineering Technology		12/2018	Approved	12/01/2019	11/01/2024
	10	Automation and Control Engineering Technology		12/2018	Approved	12/01/2019	11/01/2024
	11	Industrial Management		12/2018	Approved	12/01/2019	11/01/2024
	12	Printing Engineering Technology		11/2019	Approved	14/12/2019	13/12/2024
	13	Garment Technology		11/2019	Approved	14/12/2019	13/12/2024
	14	Information Technology		11/2019	Approved	14/12/2019	13/12/2024

Abbreviation:

- *CEA (VNU-HCM): Centre of Educational Assessment (Vietnam National University-HCMC).*
- *AUN-QA: ASEAN University Network Quality Assuranc.*

Criterion 1. Expected Learning Outcomes

Appendix 1.1. Correlation between POs and ELOs

Expected Learning Outcomes	**PO1.** Apply, formulate and solve scientific, technical and technological problems in biomedical engineering	**PO2.** Identify, develop, conduct experiments for analysis, and apply new knowledge with professional responsibility	**PO3.** Recognize and apply effectively when working in teams, and communicate effectively to people and	**PO4.** Operate, apply, analyze, evaluate, design and manage health and medical systems in

	field with social benefit	and ethics in biomedical engineering field	even in English	term of considering economic, social and human factors
ELO-1. Ability to apply, formulate and solve principles, theorems, concepts of engineering, science and mathematics in the field of biomedical engineering	X			
ELO-2. Ability to develop, conduct, and operate appropriate experiments and devices on boards, machines, and data obtained to interpret and produce results		X		
ELO-3. Ability to recognize professional and ethical responsibilities associated with biomedical engineering issues that affect the social, environmental, economic, and global contexts		X		
ELO-4. Ability to recognize and apply knowledge in appropriate and long-term learning strategies			X	
ELO-5. Ability to effectively apply knowledge to teamwork, to provide Entrepreneurship and leadership to achieve objectives			X	
ELO-6. Ability to explain, demonstrate, and communicate technical issues to people in the BME field and even in English			X	

ELO-7. Ability to analyze and interpret data obtained from the experiments to apply appropriate circuits and systems				X
ELO-8. Ability to effectively evaluate issues, systems and applications in biomedical field that can impact on social, economic, environmental and global contexts to have conclusions.				X
ELO-9. Ability to create biomedical engineering systems using new knowledge and skills.				X

Criterion 1. Expected Learning Outcomes

Appendix 1.2. The relationship between POs-ELOs-PIs-CLOs of Courses

Courses\ELOs	POs								
	PO1	PO2			PO3		PO4		
	ELO1	ELO2	ELO3	ELO4	ELO5	ELO6	ELO7	ELO8	ELO9
1st semester									
CPRL130064-Program-C Language	PI1.1/ PI1.2/ PI1.3	PI2.2		PI4.3					
MATH130101-Calculus 1	PI1.1/ PI1.2/	PI2.2							
LLCT130105 - Principles of Marxist-Leninism			PI3.2		PI5.1				
INBE130165-Introduction to Biomedical Engineering	PI1.2	PI2.3	PI3.2	PI4.1/I 4.2	PI5.1		PI7.3		
2nd semester									

MATH130201 - Calculus 2	PI1.1/ PI1.2/ PI1.3	PI2.2							
PHYS130102 - Physics 1	PI7.3	PI2.2							
MATH130401 - Applied Probability –Statistics	PI1.2/ PI1.3	PI2.2		PI4.2		PI6.1	PI7.3		
AMEE341944 - Applied Mathematics for Electrical Engineers	PI1.1/ PI1.2/ PI1.3	2			PI5.1		PI7.3		
ELCI140144 - Electric Circuit	PI1.1/ PI1.3			PI4.1	PI5.1				
3rd semester									
PHYS120202 - Physics 2	PI1.1/	PI2.2							
MATH130301 - Calculus 3	PI1.2/ PI1.3	PI2.2					PI7.3		
GCHE130603 - General Chemistry	PI1.1/ PI1.3	PI2.2							
DIGI330163 - Digital Systems	PI1.1/ PI1.2/ PI1.3	PI2.3				PI6.4	PI7.2		
BAEL340662 - Basic Electronics	PI1.1/ PI1.2/ PI1.3	PI2.2		PI4.1		PI6.1			
PHYS110302 - Physics Lab-1	PI1.2	PI2.1		PI4.1	PI5.2				
HUAN330265 - Human and animal physiology and anatomy	PI1.2/ PI1.3					PI6.3/ PI6.4	PI7.3		
4th semester									
BISI340665 - Bio-signal processing	PI1.2/ PI1.3	PI2.2				PI6.1			
MICR330363 – Microprocessor	PI1.2	PI2.3		PI4.1		PI6.4	PI7.2		
MEDE430465 - Biomedical	PI1.2	PI2.2		PI4.2			PI7.2	1	

Electronic Circuit Design									
PRDI310263 - Digital Systems Lab	PI1.2	PI2.1				PI6.4	PI7.2		
TESO330765 - Biomedical sensor technology	PI1.1			PI4.2	PI5.2	PI6.4	PI1.2/ PI1.3		
ELPR320762 - Basic Electronics Lab	PI1.2	PI2.1			PI5.2	PI6.4	PI7.2		
PHYS111302 - Physics Lab-2	PI1.2	PI2.1		PI4.2	PI5.2				
Biomedical and Electronics Core (01 elective course)	PI1.2/ PI1.3	PI2.2		PI4.2			PI7.3		
5th semester									
BIIM330965- Biomedical image processing	PI1.1/ PI1.2/ PI1.3	PI2.3			PI5.2		PI7.2		
BIPR311665 - Bio-signal signal processing Lab	PI1.1	PI2.2	PI3.2	PI4.2	PI5.2				
DEMD330565 - Biomedical Instrumentation	PI1.1/ PI1.2			PI4.3		PI6.3/ PI6.4	PI7.2		
RMI320463 - Microprocessor Lab	PI1.2	PI2.3	PI3.1	PI4.2	PI5.2	PI6.1	PI7.3		
MCPR311765 - Biomedical Electronic Circuit Lab	PI1.1/ PI1.2/ PI1.3	PI2.1/ PI2.2	PI3.1			PI6.1/ PI6.4	PI7.3		
PRCD312663- Digital Electronic Circuit Design Lab	PI1.2	PI2.3	PI3.1	2	2	PI6.1	PI7.3		
ELPR311065 - Digital-Electronics Project	PI1.2	PI2.3	PI3.3/ PI3.4	PI4.2		PI6.4	PI7.2		
MESY335565 - Embedded Systems in Biomedical Engineering	PI1.1/ PI1.3	PI2.2/ PI2.3					PI7.2		

TSEP311965 - Biomedical Sensors Technology Lab	PI1.3	PI2.2		PI4.1	PI5.2	PI6.4	PI7.1/ PI7.2/ PI7.3		
Humanities-Social Sciences (01 elective course)	PI1.1		PI3.3	PI4.2	PI5.1		PI7.1		
Humanities-Social Sciences (01 elective course)	PI1.1		PI3.3	PI4.2			PI7.1		
6th semester									
MIPR311165 - Microprocessor Project	PI1.2	PI2.3	PI3.3/ PI3.4	PI4.2	PI5.2	PI6.2/ PI6.4	PI7.2	PI8.3	
HSBE330865 - Health and Safety in Biomedical Engineering	PI1.1/ PI1.3		PI3.2/ PI3.3	PI4.1/ PI4.2	PI5.1	PI6.4			
BIMP311865 - Biomedical Image Processing Lab	PI1.1/ PI1.2/ PI1.3					PI1.2/ PI1.3	PI1.2/ PI1.3		
BIME331965 - Computer Aided Design	PI1.1/ PI1.2/ PI1.3	PI2.2			PI5.3	PI1.2/	PI1.3		
MEPR321565 - Biomedical Instrumentation Lab	PI1.3	PI2.1/ PI2.3			PI5.2	PI6.1/ PI6.4	PI7.1		
MEPR316165 - Biomedical Embedded Systems Engineering Lab	PI1.2/ PI1.3	PI2.2				PI6.1	PI7.3		
MSY332065 - Healthcare information system	PI1.1	PI2.2	PI3.2/ PI3.3		PI5.3				
Biomedical and Electronics Advanced Core/relative programmes (01 elective course)	PI1.2	PI2.1			PI5.1	PI6.3			
Biomedical and Electronics Advanced Core/relative	PI1.2	PI2.1		PI4.1/ PI4.2	PI5.1				

programmes (01 elective course)									
7th semester									
BSPR411965 - Healthcare Information Systems Lab	PI1.2/ PI1.3					PI6.4	PI7.2		
CAPR411265 - Capstone Project	PI1.2					PI6.4	PI7.2/ PI7.2	PI8.1	
BUCO121465- Topics with Enterprises	PI1.3				PI5.1	PI6.4	PI7.1		
THEM426265 - Thesis Topics	PI1.2/ PI1.3	PI2.2/ PI2.3	PI3.3/ PI3.4	PI4.2	PI5.2	PI6.2/ PI6.4	PI7.3	PI8.2	PI9.2
GRPR442065 – Internship	PI1.2			PI4.2	PI5.2	PI6.3/ PI6.4	PI7.2	PI8.2	
LEBU320026 - Leadership and Entrepreneurship in Engineering	PI1.2		PI3.2	PI4.1	PI5.2		PI7.1	PI8.3	
8th semester									
GRAD462165 - Graduation Thesis	PI1.2	PI2.3	PI3.2/ PI3.3/ PI3.4	PI4.2	PI5.2	PI6.2/ PI6.3/ PI6.4	PI7.2	PI8.3	PI9.3

ELOs	**ELO1**	**ELO2**	**ELO3**	**ELO4**	**ELO5**	**ELO6**	**ELO7**	**ELO8**	**ELO9**
Competence level	I: Introduction			R: Reinforce			M: Mastery		

Appendix 1.3. Feedback Contents from Stakeholders and Survey Methods

Stakeholders	**Method of data collection**	**Time**		**Times/ year**	**Summary of Requirement**
Employers (enterprises/hospitals)	- Online -Google forms - Workshop - Seminar - Paper sheets	- July & Jan. (extra time) - FEEE and enterprise committee		2	- Improve English - Improve soft-skills - Update new software - Update IoTs and AI - Cooperation with enterprises for

	- After thesis committees - Online (PSC)				producing commercial models - Equipment quality process
Alumni	- Online -Google form - Online (PSC) - Alumni meeting	20th Nov. annually		2 1 1	- Update new software - Improve English
Graduated students (3 to 12 months)	- Online-Google form - Online (PSC)	July & Jan.		2	- Update new software - Business and leadership
Lecturers	- Online-Google form - Online (PSC) - Department meetings	June & Jan.		1 1 2	- Improve facilities and internet - Update new software - Change and update new subjects
Students	- Online-Google form - Online (PSC) - face to face with HCMUTE board - Meetings at the beginning of each academic year	- July & Jan. - Dec. & May - Nov. & May - Aug.		2 2 2 1	- Improve assessment methods - Improve scientific research support - Improve facilities and internet

Appendix 1.4. Measurement of ELOs achievement through PIs related to courses and other activities (A: achieve; SA: Students achieved; TAS: Total assessment students)

ELOs	Name of courses support the ELOs	Teaching and learning activities	Co-curricular activities	Measurement of ELOs' achievement (5W+1H)

ELO-1. Ability to apply, formulate and solve principles, theorems, concepts of engineering, science and mathematics in the field of biomedical engineering	Digital Systems; Biomedical Image Processing Lab; Internship; Biomedical Embedded System Lab	At Theory classrooms/ Labs	Scientific research with enterprises	- A=77% (SA/TAS=385/ 497) - PI1.1=83% - PI1.2=75% - PI1.3=74%
ELO-2. Ability to develop, conduct, and operate appropriate experiments and devices on boards, machines, and data obtained to interpret and produce results	Labs of Biomedical Electronics Circuits; Biomedical Embedded System; Digital Systems; Microprocess or Lab	At Labs	Scientific research with enterprises	- A=85% (SA/TAS=180/ 211) - PI2.1=91% - PI2.2=70% - PI2.3=98%
ELO-3. Ability to recognize professional and ethical responsibilities associated with biomedical engineering issues that affect the social, environmental, economic, and global contexts	Biomedical Electronics Circuits Lab; Systems; Microprocess or Lab; Thesis	Theory classrooms/ Labs	Scientific research with enterprises	- A=90% (SA/TAS=138/ 153) - PI3.1=91% - PI3.2=90% - PI3.3=95% - PI3.4=85%
ELO-4. Ability to recognize and apply knowledge in appropriate and long-term learning strategies	Introduction to BME; Thesis; Biomedical Instruments	Theory classrooms/ Labs	Social activities	- A=87% (SA/TAS=136/ 157) - PI4.1=100% - PI4.2=100% - PI4.3=60%
ELO-5. Ability to effectively apply knowledge to teamwork, to provide Entrepreneurship and leadership to achieve objectives	Thesis Topics; Internship; Project 1,2; Thesis; some theory courses	Theory classrooms/ Labs/Comp anies	Companies/Ho spitals	- A=97% (SA/TAS=179/ 184) - PI5.1=96% - PI5.2=98% - PI5.3=97%

ELO-6. Ability to explain, demonstrate, and communicate technical issues to people in the BME field and even in English	Biomedical Electronics Circuits Lab; Thesis; Biomedical Instruments Lab; Internship; Business topics	Theory classrooms/ Labs/Companies	Companies/Hospitals	- A=92% (SA/TAS=335/365) - PI6.1=96% - PI6.2=90% - PI6.3=79% - PI6.4=97%
ELO-7. Ability to analyze and interpret data obtained from the experiments to apply appropriate circuits and systems	Internship; Project 1,2; Thesis; Biomedical Sensors Instrumentation Lab; some theory courses	Theory classrooms/ Labs/Companies	Companies/Hospitals	- A=88% (SA/TAS=262/299) - PI7.1=100% - PI7.2=84% - PI7.3=100%
ELO-8. Ability to effectively evaluate issues, systems and applications in biomedical field that can impact on social, economic, environmental and global contexts to have conclusions.	Internship; Project 1,2; Thesis	Labs/Companies	Companies/Hospitals	- A=91% (SA/TAS=98/108) - PI8.1=83% - PI8.2=100% - PI8.3=84%
ELO-9. Ability to create biomedical engineering systems using new knowledge and skills.	Internship; Thesis	Labs/Companies	Companies/Hospitals	- A=96% (SA/TAS=86/90) - PI9.1=100% - PI9.2=100% - PI9.3=90%

Criterion 2. Programme Structure and Content

Appendix 2.1 BME Training Programme specifications

THE MINISTRY OF EDUCATION AND TRAINING

HCMC UNIVERSITY OF TECHNOLOGY AND EDUCATION

FACULTY OF ELECTRICAL AND ELECTRONICS ENGINEERING

UNDERGRADUATE PROGRAM

ENGINEER OF

BIOMEDICAL ENGINEERING

(7520212)

July - 2022

THE MINISTRY OF EDUCATION AND TRAINING

HO CHI MINH CITY UNIVERSITY OF TECHNOLOGY AND EDUCATION

Faculty of electrical and electronics engineering

UNDERGRADUATE PROGRAMME

(Full-time Curriculum)

Programme: Biomedical Engineering

Level: Undergraduate

Major: Biomedical Electronics Engineering

Programme duration: 4 years

(Decision No……date… on……)

1- Enrollment, Grading System, Curriculum and Graduation Requirements

- *Enrollment***:** High-school Graduates
- *Grading system*: 10
- *Curriculum and Graduation Requirements*: Based on regulations of Decision No 43/2007/BGDDT

2- The Goals, Objectives, and Expected Learning Outcomes

Goals

The programme is designed to prepare graduates to assume engineering and technology positions in the biomedical electronics field. Graduates of Biomedical Engineering (BME) programme have an ability to demonstrate expertise and career advancement in the biomedical electronics field through the application of fundamental knowledge, skills, and engineering technology tools. In addition, they have the ability to contribute significantly to the achievement of their organization's goals as an effective member and an ability to take part in life-long learning by being engaged with biomedical institutions, educational organizations, hospitals and professional societies.

Programme Objectives

PO-01	Apply, formulate and solve scientific, technical and technological problems in biomedical engineering field with social benefit
PO-02	Identify, develop, conduct experiments for analysis, and apply new knowledge with professional responsibility and ethics in biomedical engineering field
PO-03	Recognize and apply effectively when working in teams, and communicate effectively to people and even in English
PO-04	Operate, apply, analyze, evaluate, design and manage health and medical systems in term of considering economic, social and human factors

Expected Learning Outcomes

ELO-01	Ability to apply, formulate and solve principles, theorems, concepts of engineering, science and mathematics in the field of biomedical engineering
ELO-02	Ability to develop, conduct, and operate appropriate experiments and devices on boards, machines, and data obtained to interpret and produce results
ELO-03	Ability to recognize professional and ethical responsibilities associated with biomedical engineering issues that affect the social, environmental, economic, and global contexts
ELO-04	Ability to recognize and apply knowledge in appropriate and long-term learning strategies
ELO-05	Ability to effectively apply knowledge to teamwork and provide entrepreneurship and leadership to achieve objectives
ELO-06	Ability to explain, demonstrate, and communicate technical issues to people in the BME field and even in English
ELO-07	Ability to analyze and interpret data obtained from the experiments to apply appropriate circuits and systems
ELO-08	Ability to effectively evaluate issues, systems and applications in biomedical field that can impact on social, economic, environmental and global contexts to have conclusions
ELO-09	Ability to create biomedical engineering systems using new knowledge and skills

3- Blocks of knowledge in the whole programme:150 credits (without Physical Education and National Defense Education knowledge)

4- Blocks of knowledge

Name	**Credits**		
	Total	**Compulsion**	**Elective**
General knowledge	**62**	**58**	**04**
Political Education and General Laws	13	13	0
Humanities and Social Science	04	0	04
English	12	12	0
Mathematics and Natural Sciences	27	23	0
Informatics	03	03	0
Introduction to BME	03	03	0
Professional knowledge	**88**	**79**	**09**
Biomedical and Electronics Core	30	27	3
Biomedical and Electronics Advanced Core	9	9	0
Biomedical Electronics Specialization	17	11	6

Laboratories and Practices	21	21	0
Internship and Graduation Thesis	11	11	0

5- Programme Contents

1	**General knowledge: 62 Credits**			
No.	**Course Prefix and Number**	**Course Title**	**Cr.**	**Note**
A1	**Political Education and General Laws**		**12**	
1	LLCT130105	Principles of Marxist-Leninism	3	
2	LLCT120205	Political Economics of Marxism and Leninism	2	
3	LLCT120405	Science socialism	2	
4	LLCT120314	Ho Chi Minh's Ideology	2	
5	LLCT220514	History of Vietnamese communist party	2	
6	GELA220405	General Laws	2	
A2	**Informatics**		**3**	
1	CPRL130064	Program-C Language	3	
A3	**Introduction to BME**		**3**	
1	INBE130165	Introduction to BME	3	
A4	**Foreign Language**		**12**	
1	ENGL130137	English 1	3	
2	ENGL230237	English 2	3	
3	ENGL330337	English 3	3	
4	ENGL430437	English 4	3	
A5	**Humanities and Social Science (Select 02 of free elective courses)**		**4**	
1	GEEC220105	General Economics	2	
2	QMAN331606	Quality Management	2	
3	INMA220305	Introduction to Management	2	
4	INLO220405	Introduction to Logic	2	
5	IVNC320905	Vietnamese Culture	2	
6	INSO321005	Introduction to Sociology	2	
7	ENPS220591	Engineer Psychology	2	
8	SYTH220491	Systematic thinking	2	
9	LESK120190	Learning Skills	2	
10	PLSK120290	Planning Skill	2	

11	WOPS120390	Workplace Skills	2	
12	SRME530126	Scientific Research Methodology	2	
A6	**Mathematics and Natural Sciences**		**23**	
1	MATH132401	Calculus 1	3	
2	MATH132501	Calculus 2	3	
3	MATH132601	Calculus 3	3	
4	AMEE341944	Applied Mathematics for Electrical Engineers	4	
5	MATH131901	Mathematical statistics for engineers	3	
6	PHYS130902	Physics 1	3	
7	PHYS131002	Physics 2	2+1	
8	GCHE130603	General Chemistry	3	
A7	**Physical Education**		**5**	
1	PHED110513	Physical Education 1	1	
2	PHED110613	Physical Education 2	1	
3	PHED130715	Physical Education 3	3	
A8	**National Defense Education**		**165**	

B	**Professional knowledge: 88 credits**			
No.	**Course Prefix and Number**	**Course Title**	**Cr.**	**Note**
B1	**Biomedical and Electronics Core**		**27**	
1	ELCI140144	Electric Circuits	4	
2	BAEL340662	Basic Electronics	4	
3	DIGI330163	Digital Systems	3	
4	MICR330363	Microprocessor	3	
5	SISY330164	Signals and Systems	3	
6	HUAN330265	Human and animal physiology and anatomy	3	
7	BISI340665	Biosignal processing	4	
8	HSBE330865	Biomedical Engineering Safety	3	
B2	**Elective Biomedical and Electronics Core (Select 01 course)**		**3**	
1	ELFI230344	Electromagnetic Field	3	
2	ITFA336064	Internet of Things: Foundations and Applications	3	

3	AIFA436864	Fundamentals and applications of AI	3	
4	APCA331363	Android programming in control applications	3	
5	BIME332265	Computer-Aided Design	3	
B3	**Biomedical and Electronics Advanced Core**		**9**	
1	MEDE330465	Biomedical Electronic Circuit Design	3	
2	DEMD330565	Biomedical Instrumentation	3	
3	TESO330765	Biomedical Sensor Technology	3	
B4	**Biomedical and Electronics Specialisation**		**11**	
1	IMSY332065	Healthcare Information system	3	
2	BIIM330965	Bio-medical Image Processing	3	
3	**MESY335565**	Embedded Systems in Biomedical Engineering	3	
4	BUCO121465	Topics with Enterprises	2	
5	LEBU320026	Leadership and Entrepreneurship in Engineering		
B5	**Elective Biomedical and Electronics Advanced Core (Select 02 courses)**		**6**	
1	APME332365	Data Acquisition and Control Using Computer	3	
2	WITE332465	Wireless Technologies	3	
3	SPSU332565	Special Topic in Biomedical Engineering	3	
4	ECME332665	Engineering Challenges in Medicine	3	
5	MALE331063	Machine Learning	3	
6	BIMA332765	Biomaterials	3	
7	BITE332865	Biomedical Imaging Technology	3	
8	BIAP332965	Application of ultrasound and magnetism in biomedicine	3	
B6	**Elective Biomedical and Electronics Advanced Core from relative programmes (Select 02 courses)**			
1	INSK331663	Industrial skills	3	
2	PLCS330846	Programmable Logic Controller	3	
3	INRO331129	Industrial Robot	3	
4	SCDA430946	SCADA Systems	3	

5	ROTE430946	Robotics Engineering	3	
6	HCIN431979	Human-Computer Interaction	3	
7	APEN331329	Applied Programming in Engineering	3	
B5	**Massive Open Online Courses (MOOCs): Select courses for replacing the courses taught at classroom**			
1	LLCT220514	History of Vietnamese communist party		
2	GELA220405	General Laws		
3	LLCT130105	Principles of Marxist-Leninism		
4	INSO321005	Introduction to Sociology		
5	PRSK320705	Representation Skills		
6	MATH132401	Calculus 1		
7	MATH132501	Calculus 2		
8	MATH132601	Calculus 3		
9	CPRL130064	Program-C Language		
10	ELCI140144	Electric Circuits		
11	BAEL340662	Basic Electronics		
12	DIGI330163	Digital Systems		
13	SISY330164	Signals and Systems		
14	MATH132901	Applied Probability-Statistic		
B8	**Laboratories and Practices**		**21**	
1	ELPR320762	Basic Electronics Lab	2	
2	PRDI310263	Digital Systems Lab	1	
3	PRMI320463	Microprocessor Lab	2	
4	PRCD312663	Digital Electronic Circuit Design Lab	1	
5	MEPR321565	Biomedical Instrumentation Lab	2	
6	MEPR316165	Biomedical Embedded Systems Engineering Lab	1	
7	BIPR311665	Biosignal Signal Processing Lab	1	
8	TSEP321765	Biomedical Electronic Circuit Lab	2	
9	BIMP311865	Biomedical Image Processing Lab	1	

10	TSEP311965	Biomedical Sensors Technology Lab	1	
11	BSPR411965	Biomedical Information Systems Lab	1	
12	ELPR311065	Digital Electronics Project	1	
13	MIPR311165	Microprocessor Project	1	
14	CAPR411265	Capstone Project	1	
15	THEM426265	Thesis Topics	3	
B9	**Internship and Thesis**		**11**	
1	GRPR442065	Internship	4	
2	GRAD462165	Graduation Thesis	7	

C Teaching plan

The general courses arranged by GAPAO each semester				
No.	**Course Prefix and Number**	**Course Title**	**Cr.**	**Note**
1	ENGL130137	English 1	3	
2	ENGL230237	English 2	3	
3	ENGL330337	English 3	3	
4	ENGL430437	English 4	3	
5	LLCT120205	Principles of Marxist-Leninism	2	
6	LLCT120405	Science socialism	2	
7	LLCT220514	History of Vietnamese communist party	2	
8	LLCT120314	Ho Chi Minh's Ideology	2	
9	GELA220405	General Laws	2	
10	PHED110513	Physical Education 1	1	
11	PHED130715	Physical Education 3	3	
12	**Total**		**22**	
1st Semester				
No.	**Course Prefix and Number**	**Course Title**	**Cr.**	**Pre-requisite**
1	LLCT130105	Principles of Marxist-Leninism	3	
2	CPRL130064	Program-C Language	3	
3	MATH132401	Calculus 1	3	

4	INBE130165	Introduction to BME	3	
5	PHED110513	Physical Education 2	1	
	Total		**12**	
2nd Semester				
No.	**Course Prefix and Number**	**Course Title**	**Cr.**	**Pre-requisite**
1	MATH132501	Calculus 2	3	MATH130101
2	PHYS130902	Physics 1	3	
3	AMEE341944	Applied Mathematics for Electrical Engineers	4	MATH130201
4	MATH131901	Mathematical statistics for engineers	3	
5	ELCI140144	Electric Circuits	4	MATH130101
	Total		**21**	
3rd Semester				
No.	**Course Prefix and Number**	**Course Title**	**Cr.**	**Pre-requisite**
1	PHYS131002	Physics 2	3	PHYS130102
2	MATH132601	Calculus 3	3	MATH130201
5	BAEL340662	Basic Electronics	4	
4	GCHE130603	General Chemistry	3	
5	DIGI330163	Digital Systems	3	BAEL340662
6	HUAN330265	Human and animal physiology and anatomy	3	
7	PHYS111202	Physics Laboratory 1	1	
	Total		**18**	
4th Semester				
No.	**Course Prefix and Number**	**Course Title**	**Cr.**	**Pre-requisite**
1	BISI340665	Bio-signal processing	4	SISY330164
2	MICR330363	Microprocessor	3	DIGI330163
3	MEDE330465	Biomedical Electronic Circuit Design	3	BAEL340662
4	PRDI310263	Digital Systems Lab	1	DIGI330163

5	TESO330765	Biomedical sensor technology	3	
6	ELPR320762	Basic Electronics Lab	2	BAEL340662
7	PHYS111302	Physics Laboratory 2	1	
8		**Elective Biomedical and Electronics Core (Select 01 course)**	3	
	Total		**21**	
5th Semester				
No.	**Course Prefix and Number**	**Course Title**	**Cr.**	**Pre-requisite**
1	BIIM330965	Biomedical image processing	3	BISI340665
2	BIPR311665	Bio-signal signal processing Lab	1	BISI340665
3	DEMD330565	Biomedical Instrumentation	3	
4	PRMI320463	Microprocessor Lab	2	MICR330363
5	PRCD312663	Digital Electronic Circuit Design Lab	1	DIGI330163
7	TSEP321765	Biomedical Electronic Circuit Lab	2	MEDE330565
8	ELPR311065	Digital- Electronics Project	1	BAEL340662 DIGI330163
9	MESY335565	Embedded Systems in Biomedical Engineering	3	MICR330363
10	TSEP311965	Biomedical Sensors Instrumentation Lab	1	MESY335565
11		Humanities-Social Sciences (Select 02 of free elective courses)	4	
	Total		**20**	
6th Semester				
No.	**Course Prefix and Number**	**Course Title**	**Cr.**	**Pre-requisite**
1	MIPR311165	Microprocessor Project	1	PRMI320463
2	HSBE330865	Health and Safety in Biomedical Engineering	3	
3	BIMP311865	Biomedical Image Processing Lab	1	BISI340665
4	MEPR321565	Biomedical Instrumentation Lab	2	DEMD330565
6	MEPR316165	Biomedical Embedded Systems Engineering Lab	1	MESY335565
7	IMSY332065	Healthcare information system	3	INBE130165

8		Specialised knowledge (Select 02 of free elective courses)	6	
	Total		**17**	
7th Semester				
No.	**Course Prefix and Number**	**Course Title**	**Cr.**	**Pre-requisite**
1	CAPR411265	Capstone Project	1	
2	BSPR411965	Healthcare Information Systems Lab	1	IMSY332065
3	GRPR442065	Internship	4	MIPR311165
4	BUCO121465	Topics with Enterprises	2	
5	LEBU320026	Leadership and Entrepreneurship in Engineering	2	
6	THEM426265	Thesis Topics	3	
	Total		**17**	
8th Semester				
No.	**Course Prefix and Number**	**Course Title**	**Cr.**	**Pre-requisite**
1	GRAD462165	Graduation Thesis	7	
	Total		**7**	

A. Brief Course Description

A.1. Applied Mathematics for Electrical Engineers

Credit: 4 credits (4:0:8) (4 lecture periods, 0 lab period, 8 self-study periods per week)
Prerequisite course(s): None
Previous course(s): Advanced Mathematic 1

Course Description

The course on Applied Mathematics of Electrical Enginers provides learners knowledge related to matrices, complex numbers and functions, ordinary differential equations and laplace transforms, fourier series and optimization. They can use knowledge to analyze circuit, signal processing and automation system

A.2. Electric Circuits

Credits: 4 (4:0:8) (4 for theory, 0 for practice/experiment)
Prerequisite course(s): None
Previous course(s): Advanced Mathematics1,2,3

Course description

This course aims to supply learners with knowledge to solve problems related to electric circuit analysis. Learners will learn laws, principles and Math such as Ohm's, Faraday's and Kirchhoff's laws to solve problems related to electrical and electronics circuits. Moreover, learners will learn how to analyse circuits with mutual inductance, Op-Amp, three phase systems, two-ports networks, linear and nonlinear circuits in time domain and frequency domain using Laplace transform, Fourier transform and bode plot with their applications in the real world.

A.3. Fundamentals and applications of AI

Credits: 3 (3:0:6) (3 lecture periods, 0 lab period, 6 self-study periods per week)
Prerequisite course(s): None
Previous course(s): Program-C Language

Course Description:

The AI Foundations and Applications course provides students the foundational knowledge of artificial intelligence and applications. The course is designed to include the foundational knowledge of applied math, probability theory, artificial neural networks and deep learning. In addition, the course equips skills in programming artificial intelligence applications using Python language and building recognition applications.

A.4. Android programming in control applications

Credits: 3 credits (3:0:6) (3 lecture periods, 0 lab period, 6 self-study periods per week)
Prerequisite course(s): Microprocessor
Previous course(s):

Course Description:

The course equips students with fundamental knowledge of the Android operating system and control applications. In detail, Android development tools and essential components of a control application are introduced. The user interface, the operator on an Android application are described. Moreover, the course introduces methods for event handling, completing, and packaging in an application. Modern technologies such as SMS, Bluetooth, Wifi, NFC, voice recognition, accelerometer are also introduced in this course ... Fundamental knowledge on microcontrollers and electronic devices are integrated to develop a comprehensive application.

A.5. Basic Electronics

Credits: 4 (4:0:8) (4 lecture periods, 0 lab period, 8 self-study periods per week)
Prerequisite course(s): None
Previous course(s): Electrical circuits

Course Description:

The course on Basic Electronics provides leaners with basic knowledge about materials for electronic components such as structures, characteristics and applications of basic electronic components (Diode, Transistor, SCR, TRIAC, DIAC, OP-AMP and 4-layer semiconductor devices, optoelectronic components). Methods of analyze, calculate parameters and design basic electronic circuits are included in this course, such as rectifier, clipper, DC power, small signal amplifier, power amplifier, oscillator, control circuits using SCR, TRAC, DIAC, photoresistor, op-to and electronic circuits applied in practice.

A.6. Biomaterials

Credits: 3 (3:0:6) (3 lecture periods, 0 lab period, 6 self-study periods per week)
Prerequisite course(s): None
Previous course(s): Advanced Mathematics

Course Description:

This course aims to provide learners the basic knowledge of material science and its application properties in biomedical field. The course includes the knowledge such as structure, mechanical properties, and biocompatibility. Students can learn the methods of analysis, testing and evaluation of material standards. Finally, there are practical applications in the biomedical field, the prospects and challenges of biomedical materials in medicine.

A.7. Topics with Enterprises

Credits: 2 (2:0:4) (2 lecture periods, 0 lab period, 4 self-study periods per week)
Prerequisite course(s): None
Previous course(s): None

Course Description:

This subject provides students knowledge of situations that often occur in the industrial environment and how to approach and solve problems that can occur in practice. Therefore, students can study knoledge and skills to quickly integrate in the industrial environment after graduation. In addition, the course will teach students about the way and engineer career, how to analyse failure and success, process data and experiences during working.

A.8. Capstone Project

Credits: 1 (1:0:2) (1 lecture periods, 0 lab period, 2 self-study periods per week)
Prerequisite course(s): None
Previous course(s): Digital Electronic project; Biomedical Instrumentation Lab

Course Description:

After completing this subject, students will be able to form ideas for implementing graduation thesis. In addition, this subject aims to help students implement these ideas to work out the graduation thesis, to work in a team with members and defense it in a thesis committee. Students must submit reports with chapters, in which there are calculation, design, choice of components and then send to lecturers.

A.9. C programming language

Credits: 3 (3:0:8) (3 lecture periods, 0 lab period, 6 self-study periods per week)
Prerequisite course(s): None
Previous course(s): None

Course Description:

The course covers the fundamental concepts of programming language: definition, classification, and purpose of different languages. The course specifically focuses on C programming language, demonstrates data structures and control structures in the C language. The course help students to get knowledge and ability of designing and writing C language applications.

A.10. Electromagnetic Field

Credits: 3 (3:0:6) (3 lecture periods, 0 lab period, 6 self-study periods per week)
Prerequisite course(s): None
Previous course(s): Advanced Mathematics, General Physics

Course Description:

This course provides learners fundamental knowledge related to electromagnetic field, laws and equations for describing electromagnetic field. In addition, the course also equips with the

knowledge of the static electromagnetic field, steady electromagnetic field, time-varying electromagnetic field, electromagnetic waves, electromagnetic radiation; calculate the characteristic parameters of electric field, magnetic field and electromagnetic waves.

9.11. Engineering Challenges in Medicine

Credits: 3 (3:0:6) (3 lecture periods, 0 lab period, 6 self-study periods per week)
Prerequisite course(s): None
Previous course(s): Human and Animal Physiology and Anatomy

Course Description:

This course is designed for students to study advanced techniques in biomedical engineering. Lecturers with medical and engineering majors and experiences in multidisciplinary research, will teach the subject. The course includes topics about the central nervous system, muscles and bones, lungs and heart. In the course, important biosignals, measurement methods, necessary equipment along with sicientific research topics will be discussed.

A.12. Electronics Lab

Credits: 2 (0/2/4) (0 lecture periods, 2 lab period, 4 self-study periods per week)
Prerequisite course(s): Basic Electronics
Previous course(s): Electrical Circuit

Course Description:

The course on Electronics Lab guides learners to practice on basic electronic circuits such as rectifier, clipper, DC supply power, small signal amplifier, power amplifier, switching circuit using transistor, sine and square waveform oscillator circuits, control circuit using SCR, TRIAC, DIAC, photoresistor, OPTO and practical electronic circuits.

A.13. Thesis

Credits: 3 (7:0:14) (7 lecture periods, 0 lab period, 14 self-study periods per week)
Prerequisite course(s): All courses
Previous course(s): None

Course Description:

This thesis course requires learner to carry out a practical research project that can be a real model applied new knowledge and the learned knowledge to calculate, design, construct and estimate it. In addition, this course helps students to complete the synthesis of documents, to represent a complete report and the real model and the thesis committee will assess contribution to working group, skills of designing, writing report and other contributions related to scientific research skills and creativity.

A.14. Internship

Credits: 4 (0:4:8) (0 lecture periods, 4 lab period, 8 self-study periods per week)
Prerequisite course(s): None
Previous course(s): Courses of projects and Labs

Course Description:

The course trains students to have the qualities of a biomedical engineering engineer. Students are introduced to practise at domestic and foreign companies, health care units, hospitals, and medical centers in order to consolidate studied knowledge and practise good manners under the instruction of the company or hospital for internship.

A.15. Industrial Skills

Credits: 3 (3:0:6) (3 lecture periods, 0 lab period, 6 self-study periods per week)
Prerequisite course(s): None
Previous course(s): None

Course Description:

This subject provides students with knowledge of situations that often occur in the industrial environment and how to approach and solve problems. Therefore, students should form skills to quickly integrate in the industrial environment after graduation. In particular, the course will teach students about the way and career of an engineer, analysis in failure and success, as well as ways to handle data and working experiences.

A.16. Internet of Things: Foundations and Applications

Credits: 3 (3:0:8) (3 lecture periods, 0 lab period, 6 self-study periods per week)
Prerequisite course(s): None
Previous course(s): Embedded Systems

Course Description:

The main aim of this course is to introduce the fundamental concepts of the Internet of Things and its applications and architecture models; the technologies and mechanisms for sensing, actuation, processing and cyber-physical data communication; Discussing semantic technologies, service oriented solutions and networking technologies that enable the integration of IoTs data and services into the cyber world.

A.17. Machine learning

Credits: 3 (3:0:6) (3 lecture periods, 0 lab period, 6 self-study periods per week)
Prerequisite course(s): C Programming Language
Previous course(s): Probability and Applied Statistic

Course Description:

This course on Machine Learning is intended to provide learners with the fundamental knowledge of machine learning algorithms and practical applications in the Python language. The algorithms include supervised learning, unsupervised learning, and recommendation systems. In addition, techniques for model evaluation and model selection are also presented. Sklearn library and Python language are introduced to implement these machine-learning algorithms.

A.18. Biomedical Electronic Circuit Design

Credits: 3 (3:0:6) (3 lecture periods, 0 lab period, 6 self-study periods per week)
Prerequisite course(s): None
Previous course(s): Basic Electronics, Digital Systems

Course Description:

The course on biomedical electronic circuit design provides learners with knowledge related to the design of electronic circuits based on the knowledge of electronic circuits used in biomedical engineering systems. In particular, biomedical signal amplification circuits using Op-Amp circuits, biomedical signal filtering circuits (low-pass, high-pass, band-pass, blocking-pass filter circuits), measuring circuits connected to biomedical sensors such as electrocardiogram, electroencephalogram, electromyogram.

A.19. Microprocessor

Credits: 3 (3:0:8) (3 lecture periods, 0 lab period, 6 self-study periods per week)
Prerequisite course(s): Digital Systems, Basic Electronics
Previous course(s): Digital Systems

Course Description:

This course equips learners with the functional knowledge of microprocessors and their history. In detail, the course covers the infrastructure and operating principles of an 8-bit microcontroller. Peripheral devices such as timer/counter, analog-to-digital conversion, interrupts, pulse width modulation, UART data transmission are also introduced. Assembly language and C language are used to implement microcontrollers-based applications. The co-design between hardware and software is introduced.

A.20. Microprocessor Project

Credits: 1 (0:1:1) (0 lecture periods, 1 lab period, 2 self-study periods per week)
Prerequisite course(s): Digital-Electronics Project
Previous course(s): Microprocessor; Microprocessor Lab

Course Description:

Students will investigate previuos research works using knowelege of electronics, digital, and microprocessors to calculate, design and impletment of biomedical circuits and systems. In addition, students must prepare reports which show contents of calculation and component selection, design, and results from simulation to real model. Students must also show presenting skills and contribution in group.

A.21. Programmable Logic Controller

Credits: 3 (3:0:6) (3 lecture periods, 0 lab period, 6 self-study periods per week)
Prerequisite course(s): None
Previous course(s): Electrical Machines; Digital Systems

Course Description:

The course on Programmable Logic Controller provides learners knowledge related to sensors, actuators, hardware architecture and programmable logic controller (PLC) operation. In addition, the course also introduces programming languages along with PLC instruction and control diagram design methods. Finally, students are equipped with practical skills and knowledge to design hardware and programming industrial control systems.

A.22. Electronics-Digital Project

Credits: 1 (0:1:1) (0 lecture periods, 1 lab period, 2 self-study periods per week)
Prerequisite course(s): None
Previous course(s): Basic Electronics Lab; Digital Systems Lab

Course Description:

Students will be required to read previous projects and use knowledge of electronics and digital systems to calculate, design, test and construct or simulate real circuits or systems. In addition, students must complete a report which show contents of calculation and selection of components, design, and results obtained from simulation and real model. Students also perform presentation skills and send reports to lecturers for assessing.

A.23. Robotics

Credits: 3 (3/0/6) (3 lecture periods, 0 lab period, 6 self-study periods per week)

Prerequisite course(s): Advanced Mathematics, Basic Programming.
Previous course(s): Advanced Mathematics

Course Description:

This course provides students knowledge of serial robotic systems including description of position and orientation of objects in 3D space, and transformation methods for multiple frames, computation of forward and inverse kinematics. In addition, basic computational methods of velocities and static forces for the robots will be provided to student for supporting advanced tasks of simulation and real-time control. This course also introduces some dedicated softwares for design, simulation, and evaluation of the robotic systems.

A.24. Practice Microprocessor

Credits: 2 (0:2:4) (0 lecture periods, 2 lab period, 4 self-study periods per week)
Prerequisite course(s): Microprocessor
Previous course(s): Microprocessor

Course Description:

This subject equips learners with practical programming exercises using microcontrollers. The activities focus on controlling single-led, 7-segment LEDs via the direct method or the scanning method. Other devices such as LCD, GLCD, or led matrix are also is described. The exercises get inputs from buttons, matrix keyboard, digital sensors, analog sensors to control operator. Communication with other sensors via I2C devices, real-time clock, serial EEPROM memory, ADC/DAC are advantages exercises in this course. Moreover, counter-based applications such as external-pulse counting and timer applications are mentioned in detail. Stepper motor and DC motors are introduced with pulse width modulation (PWM).

A.25. SCADA systems

Credits: 3 (3:0:6) (3 lecture periods, 0 lab period, 6 self-study periods per week)
Prerequisite course(s): None
Previous course(s): Programmable Logic Controller; Electrical Circuit; Digital Systems.

Course Description:

The course on SCADA Systems provides learners knowledge related to the structure, classification and application of the Supervisory Control And Data Acquisition System (SCADA). Operation principle of data acquisition block, industrial communication network, data storage, control, monitoring and alerting functions of SCADA system.

In addition, students are introduced to specific software for design SCADA systems

A.26. Signals and Systems

Credits: 3 (3:0:8) (3 lecture periods, 0 lab period, 6 self-study periods per week)
Prerequisite course(s): None
Previous course(s): Calculus 1

Course Description:

This course provides fundamental knowledge and application about the continuous time signals and systems and applications. Topics include communication, continuous -time LTI signals and systems, difference equations, The Laplace Transform and convolution to Continuous-Time System Analysis, Continuous Time Fourier Series(CTFS), Continuous Time Fourier Transform (CTFT), modulation and demodulation system classification and filter system.

A.27. Special Topic in Biomedical Engineering

Credits: 3 (3:0:6) (3 lecture periods, 0 lab period, 6 self-study periods per week)
Prerequisite course(s): None
Previous course(s): Microprocessor, Biomedical Signal Processing, Biomedical Image Processing, Health Information Systems

Course Description:

This course aims to provide learners with basic knowledge about machines and experiments, software applied in biomedical engineering, as well as understanding medical devices in general. Therefore, students will study skills for build and design of effective and practical experiment models. In addition, special topics will provide skills to find reliable international articles, as well as how to write quality scientific articles.

A.28 Data Acquisition and Control Using Computer

Credits: 3 (3:0:6) (3-hour lecture and 6 hours of self-study per week)
Pre-requisite Course(s): None
Previous Course(s): None
Course Description:

This course teaches students about the types, structure, and applications of data acquisition and control systems. It introduces learners to the practical principles of signal and data processing blocks and programming techniques to collect data in reality. Moreover, students will learn about Open Platform Communications (OPC) and Supervisory Control and Data Acquisition (SCADA) systems, including their components and functions within the system.

A.29. Application of Ultrasound and Magnetism in Biomedicine

Credits: 2 (3:0:8) (2 lecture periods, 0 lab period, 4 self-study periods per week)
Prerequisite course(s): None
Previous course(s): None

Course Description:

The course on the application of ultrasound and magnetism in biomedicine provides learners with essential information and an overview of some advanced instrumental uses of ultrasound and magnetism in engineering and biology. The content is divided into two sections: ultrasound applications (including the interaction of ultrasound with the matter, sonochemistry, non-destructive materials diagnosis, and the use of high-power ultrasound in treatment) and magnetic applications (including the basics of magnetism and magnetic materials, magnetic sensors, nanomagnetic medical applications, and biomagnetic fields).

A.30. Biomedical Imaging Technology

Credits: 3 (3:0:6) (3-hour lecture and6 hours of self-study per week)
Prerequisite course(s): None
Previous course(s): None

Course Description:

The course on Biomedical imaging technology provides learners with fundamental information and an overview of the structure, operating principles, and operating principles of standard medical imaging equipment. This basic information and overviews offer students a foundation for more in-

depth study in the field of design, installation, operation, and maintenance of standard diagnostic imaging equipment in the medical system.

A.31. Computer Aided Design

Credits: 3 (3:0:6) (3-hour lecture and 6 hours of self-study per week)
Pre-requisite Course(s): None
Previous Course(s): None

Course Descriptions:

This course introduces the learners to the use of CAD software for product design simulation and modeling. The course provides the learners with the knowledge and the ability to use CAD software proficiently. After completing this course, students will be able to design and model structural components of machinery and devices and assemble the components to create functional devices on a computer. Students can then proceed with constructing these device models by creating engineering drawings and blueprints using CAD software.

A.32. Biomedical Image Processing Lab

Credits: 1 (0:1:2) (0 lecture periods, 1 lab period, 2 self-study periods per week)
Prerequisite course(s): Biomedical Image Processing
Previous course(s): Signals and Systems; Biosignal Processing

Course Description:

Based on the knowledge learned in Biomedical Image Processing, the student can simulate biomedical image processing processes on Matlab or Python software and aim to perform on real image processing systems.

A.33. Health and Safety in Biomedical Engineering

Credits: 3 (3:0:6) (3-hour lecture and 6 hours of self-study/week)
Pre-requisite Course(s): None
Previous Course(s): None

Course Descriptions:

This course introduces learners to safety concerns in the biomedical and engineering industries. It equips students with the precaution to identify and resolve safety problems while protecting themselves, others, and medical equipment from sources of hazards during machinery operation and maintenance. These hazards can also include radiation, toxic chemicals, and dangerous bio-chemicals. Moreover, the course further helps learners understand the safety standards related to biomedical devices.

A.34. Biosignal Processing Laboratory

Credits: 1 (0:1:2) (5-hour lab session and 10 hours of self-study per week)
Pre-requisite Course(s): Biomedical Signal Processing
Previous Course(s): None

Course Descriptions:

This course allows students to practice with different biomedical signal and data acquisition methods, methods of signal preprocessing, and statistical analysis of the data. Students will work with various biomedical signals, including ECG, EEG, fNIRS, etc. Moreover, the course also teaches students to use MATLAB software to perform signal processing tasks.

A.35. Biomedical Image Processing

Credits: 3 (3:0:6) (3-hour lecture and 6 hours of self-study per week)
Prerequisite course(s): C Programming Language
Previous course(s): Signals and Systems; Biosignal Processing

Course Description:

The course on Biomedical Image Processing provides students with basic knowledge of computational and programming methods in biomedical image processing. The course covers the types of biomedical images such as CT, MRI, PET, and ultrasound images. The course examines common methods for enhancing and extracting useful information in medical images. In addition, some diagnostic contexts of diseases from X-ray images are used as examples for the methods mentioned.

A.36. Biosignal Processing

Credits: 4 (4:0:8) (4-hour lecture and 8 hours of self-study per week)
Pre-requisite Course(s): None
Previous Course(s): Signals and Systems

Course Descriptions:
This course provides students with the basics of human biostatistics and hypothesis testing. Furthermore, learners are provided with knowledge related to the collection and processing of electrocardiogram (ECG), electroencephalogram (EEG) and fNIRS signals. In addition, the course also provides learners with knowledge related to building noise filtering applications, processing of received biological signals, theoretical basis and algorithms implemented on Matlab software.

A.37. Healthcare Information Systems Lab

Credits: 1 (0:1:2) (5-hour lab session and 10 hours of self-study per week)
Prerequisite course(s): Healthcare Information Systems
Previous course(s): Biomedical Embedded Systems; Digital system, Microprocessor

Course Description:

This course provides students with the knowledge and skills to use software and hardware to practice computer-based health information systems (HIS). Students are taught to design electronic medical record systems; collect, store and manage all kinds of medical information.

A.38. Biomedical Instrumentation

Credits: 3 (3:0:6) (3-hour lecture and 6 hours of self-study per week)
Pre-requisite Course(s): Basic Electronics
Previous Course(s): Electrical Circuits, Digital

Course Descriptions:
This course provides learners with basic knowledge about the principles of medical device design, medical device safety, classification of bio-electrodes, types of biosignals, biomedical signal amplification circuits and sensors commonly used in medical equipment. Knowing how to use methods to measure blood flow, volume, respiratory system, and sound. The course also equips basic knowledge about medical devices such as: Blood pressure monitor, Ultrasound machine, EGG, EEG, MRI, Electromyography, X-ray, Blood glucose measurement.

A.39. Digital Systems

Credits: 3 (3:0:6) (3-hour lecture and 6 hours of self-study per week)
Pre-requisite Course(s): Basic Electronics
Previous Course(s): Basic Electronics; Circuit Theory
Course Descriptions:

This course provides students with the knowledge of digital systems, the fundamental theories of Boolean algebra, the structures and operations of essential elements in digital circuits, the structure of digital ICs, computational methods, and the design of sequential and combinational logic circuits. In addition, the course also provides students with operating principles and methods of calculating and designing digital oscillator and timing circuits, memory structure and the principle of analog-to-digital converters, methods of using memory, and analog-to-digital converters in the digital systems. Course Learning Outcomes (CLOs)

A.40. Human and Animal Physiology and Anatomy

Credits: 3 credits (3:0:6) (3-hour lecture and 6 hours of self-study per week)
Pre-requisite Course(s): None
Previous Course(s): None

Course Descriptions:
The field of physiology includes the scientific study of the functions and mechanisms in living systems. As a sub-discipline of biology, physiology focuses on how organisms, organ systems, individual organs, cells, and biomolecules perform chemical and physical functions within a living system. According to the classes of organisms, the field can be divided into medical physiology, animal physiology, plant physiology, cell physiology, and comparative physiology.

The subject of human and animal physiology will focus on providing students with knowledge of the functional structure of organs in the human body. Students will understand the physiological systems, including the immune, cardiovascular, nervous, epidermal, muscular, respiratory, endocrine, and digestive systems. At the same time, the subject introduces more knowledge about many diseases and medical devices to diagnose and treat those diseases related to the above organs. Students learn the fundamental theories of structure, function, operating principle of medical devices related to human and animal physiological systems as above.

A.41. Healthcare Information System

Credits: 4 (3:0:6) (3-hour lecture and 6 hours of self-study per week)
Pre-requisite Course(s): None
Previous Course(s): None

Course Descriptions:
Knowledge of healthcare information systems used in healthcare system applications, the development trends of systems serving the development of healthcare, the process of building and operating a medical information system.

A.42. Introduction to Biomedical Engineering

Credits: 3 (2:1:4) (4-hour lecture, 1-hour lab session and 4 hours of self-study/week)
Pre-requisite Course(s): None
Previous Course(s): None

Course Descriptions:

This course introduces first-year undergraduates to the field of biomedical engineering. It equips learners with a broad range of technical knowledge in biomedical technology and introduces them to the roles of biomedical engineers, their ethical and professional responsibilities. The course also prepares learners with essential soft skills such as collaboration, communication, and presentation skills. It also equips students with the right tools and study methods to advance their working capabilities and future performance. Furthermore, students will learn and participate in activities to structure and manage a research project. These activities can help them manage their team, their work, and schedule to complete any project efficiently on time. Throughout this course, students will be exposed to various types of problems and scenarios to learn how to put knowledge into practice.

A.43. Biomedical Embedded Systems Engineering Lab

Credits: 1 (0:1:2) (5-hour lab session and 10 hours of self-study per week)
Prerequisite course(s): Biomedical Embedded Systems
Previous course(s): None

Course Description:

This course teaches students to program embedded and real-time operating systems. In addition, students are taught how to integrate hardware with software. Students will learn how to collect and analyze data from biomedical sensors and build an embedded biomedical system in practice.

A.43. Biomedical Instrumentation Lab

Credits: 2 (0:2:4) (2-hour lab session and 4 hours of self-study per week)
Pre-requisite Course(s): Biomedical Instrumentation
Previous Course(s): Fundamental Electronics

Course Descriptions:

This course provides learners with knowledge about the structures and working principles of medical devices. It guides them on the operation of medical devices for patient examination, monitoring, and prognosis in healthcare. Some devices include newborn incubators, electrotherapy devices, ultrasound for therapy and diagnostic applications, sphygmomanometer, electrocardiogram, patient monitor, endoscope, etc. Students will learn how to measure parameters directly on the human body and analyze measurement or simulation results with proven real-world results.

A.44. Embedded Systems in Biomedical Engineering

Credits: 3 (3:0:6) (3-hour lecture session and 6 hours of self-study per week)
Prerequisite course(s): Digital Systems
Previous course(s): Basic Electronics; Microprocessor

Course Description:

The Embedded Systems in Biomedical Engineering course provides students with the knowledge needed to build embedded systems used in medical devices for diagnosis, prognosis, patient management, and telemedicine. In addition, students will learn how to combine hardware and software in an embedded system for application in medical device manufacturing. Furthermore, students are taught designing, programming, simulating, testing, and evaluating a biomedical embedded systems.

A.45. Digital Electronic Circuit Design Lab

Credits: 1 (0:1:2) (5-hour lab session and 10 hours of self-study per week)
Pre-requisite Course(s): Digital Practice
Previous Course(s): None

Course Descriptions:
This course provides learners with advanced practice in using devices and advanced practice in digital electronic application circuits such as Counters, Adders and Comparators, Combinational Logic, Shift Registers, Memory, DAC, ADC, ... In addition, students can also build a specific application product on digital circuits, know how to work in groups, read datasheets in English, write weekly reports.

A.46. Digital Systems Design Lab

Credits: 1 (0:1:2) (5-hour lab session and 10 hours of self-study per week)
Pre-requisite Course(s): Digital systems
Previous Course(s): Basic Electronics; Practice Basic Electronics

Course Descriptions:
This course guides students to practice assembling digital electronic circuits such as logic gates, Flip-Flop, counters, registers, combinational and sequential circuit design, memory, analog-digital conversion, and application circuits in reality.

A.47. Biomedical Sensor Technology

Credits: 3 (3:0:6) (15-hour lecture and 6 hours of self-study per week)
Pre-requisite Course(s): Basic Electronics
Previous Course(s): Digital Systems

Course Descriptions:
This course introduces students to the knowledge of biomedical sensor technology, from theory and working principles to these sensors' applications. In addition, this course also deals with measurement techniques, sensor signal processing, and sensing systems in medical equipment.

9.46. Biomedical Sensors Instrumentation Lab

Credits: 1 (0:1:2) (5-hour lab session and 10 hours of self-study/week)
Pre-requisite Course(s): Biomedical Sensor Technology
Previous Course(s): None

Course Descriptions:
The course introduces the students to the practice and experimental studies of a wide range of biomedical sensors. Each experiment is self-contained, and the student will present the findings in written form through a lab report which will have a set of experiment-specific questions to answer. This written report also forms the basis for the assessment. All students work in groups and carry out multiple experiments, which vary based on the sensors used.

A.47. Biomedical Electronic Circuit Lab

Credits: 2 (0:2:4) (5-hour lab session and 10 hours of self-study per week)
Pre-requisite Course(s): Biomedical Electronic Circuit Design
Previous Course(s): None

Course Descriptions:

This course guides learners to practice electronic circuits used in biomedicine, including biomedical signal amplifier circuits using Op-Amp algorithm amplifier circuits, biomedical signal filter circuits low-pass, high-pass, wide-band filter circuits, etc., measurement circuits that communicate with biomedical sensors such as electrocardiogram and electromyography signals.

A.48. Wireless Technology

Credits: 4 (3:0:6) (3-hour lecture and 6 hours of self-study per week)
Pre-requisite Course(s): None
Previous Course(s): Basic Electronics, Digital Systems

Course Descriptions:

This course provides students with an understanding of common wireless technologies, including Wifi, Bluetooth, Zigbee, NFC, RFID and can expand to introduce other wireless technologies that have applications in the field of medical devices. Students also learn the basics of radio communications such as frequency bands, modulation techniques, and multiple access techniques. In each wireless technology, security issues and the application of that technology are also introduced. Students also have the opportunity to learn about the integration of wireless technologies into medical device design and applications in biomedical electronics.

A.49. Thesis

Credits: 3 credits (0:1:1) (0 lecture periods, 1 lab period, 3 self-study periods per week)
Prerequisite course(s): None
Previous course(s): all Labs and projects

Course Description:

Students will explore prior research using knowledge of electronics, digital systems and microprocessors to calculate, program, and operate a complete systems. Furthermore, students must complete report sections of topics to present understanding, analysis, and evaluation. Students also show presentation skills and teamwork for assessment.

A.50. General Chemistry

Credits: 3 (3:0:6) (3 lecture periods, 0 lab period, 6 self-study periods per week)
Prerequisite course(s): None
Previous course(s): None

Course Description:

This course is designed to provide students with the basic knowledge of chemistry, the ability to read scientific and technical literature to gain the necessary understandings about the physical world around and to perceive the presence of chemistry in engineering majors. This course helps students understand the nature of atoms and molecules, thereby explaining the properties of matter. In addition, this course also helps students develop the ability to solve fundamental quantitative problems related to thermodynamics, reaction kinetics, stoichiometry, solution properties and electrochemical processes.

A.51. General law

Credits: 2 (2:0:4) (2 lecture periods, 0 lab period, 4 self-study periods per week)
Prerequisite course(s): None

Previous course(s): None

Course Description:

This course is designed to provide students with the basic knowledge about the general theory of State and Law including origin, form, function, the system of State; nature, functions, source, the form of law… The course also consists of basic knowledge of the Vietnamese legal system and some basic regulations of some laws like Criminal law, Civil law, Labour law, marriage and family law.

A.52. Mathematical Statistics for Engineers

Credit: 03 (3/0/6) (3 theory credits, 0 practice credit).
Time allocation: 15 weeks (3 theory credits + 0*0 practice credit + 6 self-study credits / week)
Prerequisite course(s): None
Previous courses: Calculus 2 or Mathematical Economics 1
Course Description:

This course is designed to cover topics from mathematical statistics that are of interest to students from engineering and/or the sciences. Topics should include descriptive statistics, elementary probability, random variables and distributions, mean variance, parameter estimation, hypothesis testing and time permitting- correlation, regression and analysis of variance.

A.53. Calculus 1

Credits: 3 (3:0:6) (3 lecture periods, 0 lab period, 6 self-study periods per week)
Prerequisite course(s): None
Previous course(s): None
Course Description:

This course is designed to provide students with the basics limit, continuity, differentiation and integration of one variable functions.

A.54. Mathematical Economics 1

Credits: 3 (3/0/6) (3 theory credits, 0 practice credit).
Prerequisite course(s): None
Previous course(s): None
Course Description:

Mathematical Economics 1 course provides the basic knowledge of matrix, determinant, linear equation system, vector space R^n, quadratic form, differentiation of functions of ne variable and many variables. This course also provides some applications in economics.

A.55. Calculus 3

Credits: 3 (3:0:6) (3 lecture periods, 0 lab period, 6 self-study periods per week)
Prerequisite course(s): None
Previous course(s): Calculus 1, Calculus 2

Course Description:
This course equips students with the basic knowledge about vector-value functions, functions of several variables, partial derivatives, double and triple integrals, line and surface integrals, and vector calculus. Students also learn how to apply this knowledge to solve problems in physical science and other practical use cases.

Calculus 2

A.56.

Credits: 3 (3:0:6) (3 lecture periods, 0 lab period, 6 self-study periods per week)
Prerequisite course(s): Calculus 1
Previous course(s): Calculus 1
Course Description:

This course is designed to provide students with the basic knowledge of the integration of functions of a variable, of infinite series, of power series, and of vectors in the plane and in space.

9.57. Physics 1

Credits: 3 (3:0:6) (3 lecture periods, 0 lab period, 6 self-study periods per week)
Prerequisite course(s): Mathematics 1
Previous course(s): None

Course Description:
This course is designed to provide students with the fundamental physics including mechanics and thermodynamics as a basic *knowledge* for approaching major college subjects of study in science, engineering and technology. Our students will be trained with the physical knowledge in order to interpret the movement, the energy and the other physical phenomena related to objects in the nature with a size from molecular to planet. After this course, they can apply the studied knowledge in scientific research as well as in engineering development and advanced technology. The content of this subject consists of chapters from 1 to 22 in the book "Physics for Scientists and Engineers with Modern Physics", 9th Edition of R.A. Serway and J.W. Jewett. The goal of this subject helps our students to be familiar with the scientific methods, the fundamental laws of physics, interpretation of scientific knowledge in general physics and logical reasoning skills as well as strategies in preparation for learning major subjects according to the bachelor program for engineers. In order to achieve this goal, this course will focus on the combination between an understanding of the concepts and necessary skills for solving many different forms of standard problems (homework) at the end of each chapter. Besides that, this course will also help our students to understand how to build mathematical models based on experimental results and know how to analyze, to write, to present as well as to develop a specific model based on the recorded data. They can use this model to predict the results of other experiments. They will know limits of the model and can use it in the prediction.

9.58. Physics 2

Credits: 3 (3:0:6) (3 lecture periods, 0 lab period, 6 self-study periods per week)
Prerequisite course: Mathematics 1, Mathematics 2, Physics 1, Physics - Laboratory 1
Previous course(s): none

Course Description:
This course is designed to provide students with the basic knowledge of physics including electricity, magnetism, light and optics, which is compulsory to access specialized courses in science, engineering and technology branches. Students will be equipped with the knowledge of phenomena in the natural world, and can apply the knowledge in scientific research, and in technical and technological developments. The content of the module consists of chapters 23 to 38 of the book. The goal of this module is to help students become familiar with the scientific method, the fundamental laws of physics, improve their scientific knowledge of physics in general, reasoning skills, as well as strategies to prepare for learning in specialized science classes in programs for engineers. To achieve this goal, the module will provide both understandings of the concepts and skills of solving standard problems (homework) at the end of each chapter. Besides, this module will help students understand how to build a mathematical model based on

experimental results, how to record, display, analyze data and develop a model based on the data which can be used to predict the results of other experiments. At the same time, students will know the limits of the model and can use them in the prediction, they will know limits of the model and can use it in the prediction.

Appendix 2.2 Relationship between ELOs with knowledge, skills and attitudes, and professional ethics

Contents	ELOs-after completing the programme-graduates
General knowledge	**ELO-1.** Ability to apply, formulate and solve principles, theorems, concepts of engineering, science and mathematics in the field of biomedical engineering
Technological knowledge	**ELO-2.** Ability to develop, conduct, and operate appropriate experiments and devices on boards, machines, and data obtained to interpret and produce results
Generic skills and Attitude	**ELO-3.** Ability to recognize professional and ethical responsibilities associated with biomedical engineering issues that affect the social, environmental, economic, and global contexts **ELO-4.** Ability to recognize and apply knowledge in appropriate and long-term learning strategies **ELO-5.** Ability to effectively apply knowledge to teamwork, to provide Entrepreneurship and leadership to achieve objectives **ELO-6.** Ability to explain, demonstrate, and communicate technical issues to people in the BME field and even in English
Technical area	**ELO-7.** Ability to analyze and interpret data obtained from the experiments to apply appropriate circuits and systems **ELO-8.** Ability to effectively evaluate issues, systems and applications in biomedical field that can impact on social, economic, environmental and global contexts to have conclusions **ELO-9.** Ability to create biomedical engineering systems using new knowledge and skills

Appendix 2.3 Information of domestic and international BME programmes

No.	Programmes	Credits	Knowledge, Skills, Attitudes	Years
1	BME engineer, International University, VNU, Ho Chi Minh city. (English programme)	150	- Having knowledge of regenerative medicine, pharmaceutical technology, application and experiment in biomedical field - Ability to independently work, contribute in working group, solve problems in the fields of medicine, pharmacy and biomedicine. - Output English: IELTS 6.0	4
2	Physics-biomedical engineer, HCMC University of	156	- Having knowledge of technical and applied physics, experimental in the field of biomedical physics	4.5

	Technology, VNU, Ho Chi Minh city. (Vietnamese programme)		- Ability to independently work, contribute in working group, solve problems on in the field of biomedical physics - Output English: IELTS 6.0/TOEFL iBT 79	
3	BME engineer, Hanoi University of Science and Technology, (Vietnamese programme)	180	- Having knowledge of operating, describing and deploying medical devices - Having skills to independently work, contribute in working group in biomedical field - Output English: TOEIC 650	5
4	BME engineer, National University of Singapore (NUS), (English programme) Input English: IELTS 6.0	160	- Having knowledge of basic science and technology relevant to the profession. - Having knowledge of design, operation and application of medical equipment - Ability to use communication, learning and teamwork skills, independently work, integrity, and ethical responsibility.	4
5	BME engineer, Arizona Stated University (ASU), America, (English programme) Input English: IELTS 6.5	130	- Having knowledge of applying principles of engineering, mathematics, and scientific research and solve problems in engineering, biology, and medicine. - Having a specialized educational background in biomedical engineering, continuing to study postgraduate, medicine or other medical professional schools. - Ability to apply engineering skills with professional ethics and contribute to the needs of society and individuals	4
6	BME engineer, HCMC University of Technology and Education, Ho Chi Minh city, (Vietnamese programme)	150	- Having knowledge and skills of operating, describing, applying, deploying, and designing medical devices - Having skills to independently work, contribute in working group in biomedical field - Ability to apply engineering knowledge and skills with professional ethics and contribute to the needs of society and individuals - Output English: IELTS 6.0	4

Criterion 7. Facilities and Infrastructure

Appendix 7.1. Job description of support staff

No.	Offices	*Job description*
1	Facility Management	1. Management of land, buildings and other infrastructure including: Halls, working rooms, classrooms, laboratories, practice workshops, warehouses, yards. Moreover, procurement and management of using facilities. 2. Planning for investing annual projects on facilities.

		3. Carrying out electrical and water maintenance and being responsible for inspecting and repairing electrical, sound, light, and water equipment and for procurement and supply of materials for services. 4. Performing or being responsible for inspecting and managing the performance of contracts for services on environmental sanitation, taking care of trees. 5. Inspecting clear and beautiful environmental sanitation, green parks with grass and trees, and other facilities. 6. Checking opening, closing, and cleaning of classrooms and working rooms of the offices and Labs. 7. Performing retail purchase, storage, distribution and recovery of damaged tools.
2	Equipment and Maintenance	**I. Tasks on procurement and management of equipment and supply** 1. To make plans and estimate the demand for technical equipment - materials. To monitor and check the performance of contracts and to purchase in order for equipment. 2. To organize the procurement and preservation of equipment - technical materials, to ensure well the requirements of training and scientific research 3. To provide Lab materials to serve teaching and learning of students with the quality and on time. 4. Warehouse management, allocation of equipment - technical materials to units following plans, procedures, and management process. 5. To calculate and adjust equipment for supplying among units to ensure reasonable use and high efficiency. 6. To organize, manage, exploiring for use, mantain, and repair of machines and equipment. 7. To guide and be in charge of the annual inventory, inspection, classification, and evaluation of using asset efficiency. 8. To be a member of the board for inventory and liquidation of Assets. 9. To manage, adjust and repair means of transport according to the decentralization of HCMUTE leader. 10. To have the function to carry out the bidding process for equipment projects according to the government's regulations, including: project formulation, bidding, monitoring equipment supply and reporting results.
		II. Equipment maintenance and repair duties 1. Periodic maintenance and repair of equipment 2. Coordination with other units to maintain and repair specialized equipment periodically once per semester.
3	Information and Network	Planning to develop IT infrastructure and applications to meet HCMUTE's development strategy. Managing network infrastructure, portals, and business applications. Research and application of advances in science

		and technology to build software systems for management and professional working. Verification and appraisal of IT projects. Formulating and developing rules and regulations on the use of IT services. Building, maintaining and developing a stable and highly qualified human resource. 1. Building an online system to support course registration, class schedules and score management. 2. Maintenance, software installation and equipment installation. Maintaining office computers, personal computers, internet networks, and website of HCMUTE.
4	Library	1. To advise and assist the principal in formulating long-term and short-term planning and operation plans of the library; organize and coordinate the entire information system - library 2. Preserving and periodically inventory documents, technical facilities and other assets of the library. Sorting out old and damaged documents in accordance with regulations. 3. Implementation of the annual activity reports and extraordinary reports when required. 4. Developing a plan to organize professional, foreign language, and informatics training for library staff to develop quality human resources. 5. To supplement and diversify domestic and foreign information resources to meet the needs of teaching, learning and scientific research. To acquire documents published by HCMUTE, accepted scientific works, conference documents, thesis reports, education program, textbooks, and other types. 6. To organize the handling, arrangement, storage, preservation, and management of documents; To build an appropriate search system; setting up automatic information retrieval and access network; Building databases, compiling and publishing information publications according to the provisions of law. 7. To organize reading space; development of library facilities; To guide readers to effectively exploit information resources and services. 8. Researching and applying advanced scientific and technological achievements to library modernization. 9. Introducing and promoting HCMUTE's information resources to learners and society. 10. Developing a reading culture and create a lifelong learning environment.

Criterion 8. Output and Outcomes

Appendix 8.1. Solutions for improvement

Reason	Solution
Students affected by social issues such as the Covid-19 pandemic	HCMUTE has a policy for students to receive grade I if they cannot complete the course due to the reason of being affected by the pandemic.
Students feel les confident about their knowledge.	The Youth Union organizes courses and pre-exam preparation sessions. Students can consolidate their knowledge and learn from senior students.

Students feel confused and unfamiliar with the learning method in university	The department organizes the “Introduction to BME” course that focuses not only on knowledge but also on learning methods.
Students neglect their studies, falling behind.	At the end of an academic year, the faculty will summary a list of paralysis students. BME department will have individual meetings with students that belong to the BME program. We hope these meetings will help to early identify issues and have possible instructions for the students.

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