HANOI UNIVERSITY OF SCIENCE & TECHNOLOGY (HUST)

PROJECT

TRAINING PROGRAM DEVELOPMENT

Period of 2017-2025

Hanoi, April 2017

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INTRODUCTION

According to recent opinion of experts, the development of training programs is a continuous progress to complete training programs. Therefore, the development of training programs involves the development of a new program or improvement of the existing training program, and as a result, a new and better training program is established. Hence, the term of "development of training programs" denotes a cycle with the goal of "better implementation" of training programs, and more suitable than other terms, denoting activities involved in training programs such as "editing training programs", "developing training programs" or "designing training programs".

The development of training programs includes the following activities: analysis and assessment of human resource needs of the labor market; determination of objectives and output standards; design of training programs, including structures, program frameworks, list of courses and detailed outlines; organization of appraisal of training programs; issue and implementation of training programs; evaluation of training programs on the basis of its performance and wide consultations from lecturers, students and employers.

International experience shows that for higher education institutions in the field of science and technology such as Hanoi University of Science and Technology (HUST), the CDIO approach model (Conceive-Design-Implement-Operate: conception, conceptual design, implementation and operation) is a system of very effective training program development methods. Starting from the design of output standards of each training program, focusing on the graduate's professional capacity and requirements of the labor market, structures and contents of the training program, all are designed according to the CDIO model. The next step is to appraise the Training Program and put the Training Program into practice, and finally to evaluate the Training Program on the basis of testing results and wide consultations of related parties: internal groups that participate in the development of training programs or be directly influenced by the training processes (administrators, lecturers, learners of the University) and external groups (such as businesses, employers).

Undergraduate and graduate training programs of HUST have been applied since 2009 under the training method according to the credit system; up to now, it has revealed a number of limitations in the program structure, some parts are no longer suitable in the curriculum contents and a new way of developing the training program is needed. On which, a new progress of developing training programs based on output standards and learner-oriented approaches and social needs are absolutely necessary and urgent to improve training quality and to attract learners, making use of all resources of the University in training activities.

A. CONTENT SUMMARY OF THE PROJECT

1. Project name:

Development of training programs in the period of 2017-2025

2. Main objectives of the Project

To develop and complete a set of training programs at undergraduate and graduate degrees in order to best meet all the requirements of learners with the following requirements: ensuring training objectives and being consistent with development goals of the University; assuring the practicality and modernity; approaching international standards in structure and contents; ensuring the integration and consistency of the program and the connection between programs.

3. Bases for Project construction

- Training Regulations of universities and colleges according to the credit system, promulgated under the Decision No. 43/2007/QĐ-BGDĐT dated August 15, 2007 of the Minister of Education and Training;
- Training Regulations of masters, promulgated according to Circular No. 15/2014/TT-BGDĐT dated May 15, 2014 of the Minister of Education and Training;
- Training Regulations of doctors, promulgated according to Circular No. 10/2009/TT-BGDĐT dated May 7, 2009 and Circular No. 05/2012/TT-BGDĐT dated February 15, 2012 on amending, supplementing the Training Regulations of doctors, promulgated under the Circular No. 10/2009/TT-BGDĐT dated May 7, 2009 of the Ministry of Education and Training;
- Circular No. 07/2015/TT-BGDĐT dated April 16, 2015 of the Ministry of Education and Training on promulgating Regulations on the minimum knowledge level, competent requirements that learners can achieve after graduation for each training level;
- Decision No. 1982/QĐ-TTg of the Prime Minister dated October 18, 2016 on approving the Vietnam National Qualifications Framework;
- Decree No. 73/2015/1 NĐ-CP dated September 8, 2015 of the Government on stipulating decentralization standards, ranking frameworks and criteria for ranking higher education institutions;
- Decision No. 1924/QĐ-TTg dated October 6, 2016 of the Prime Minister on approving the pilot project to renew the operation mechanism of Hanoi University of Science and Technology;
- Decision No. 4202/QĐ-BGDĐT dated October 4, 2016 of the Minister of Education and Training on approving the Project "Pilot innovation in enrollment for master degree training at Hanoi University of Science and Technology in the period of 2016-2020";
- Regulations on enrollment and training at doctoral level, promulgated according to Circular No. 08/2017/TB-BGDĐT dated April 4, 2017;
- Tasks and working programs of Hanoi University of Science and Technology in the period of 2015-2020.

4. Main contents of the Project

- Analysis of the current situation and the need for the development of training programs;
- General principles for the development of training programs;
- Methods to design output standards of each training program;
- Directions of redesign, adjustment and renewal of existing Training Programs according to defined output standards; regulations on the overall program frameworks and the minimum knowledge level for general knowledge in the Training Program;
- Development of implementation plans.

B. DETAILED CONTENTS OF THE PROJECT

1. Assessment of the current situation and the need for the development of training programs

1.1 Brief of the development of training programs at the University

Since 2007, the University has put the credit training process into stable operation first, then carried out a comprehensive renovation of the training model and program. The University only converts, edits and standardizes the university training program being applied by credit units to measure the volume of modules and quantify the learning labor volume of learners. During this process, only a small part of the training program is renewed and updated in terms of contents. After that, in 2008, the Master's training program of the University is also adjusted to be consistent with the credit system and in accordance with the new regulations in the master training at that time. In 2009, the University implemented the project "Renovating the model and training program for the period of 2009-2015" as approved by the Ministry of Education and Training. The entire University's training programs have been fundamentally renewed in the direction of refining contents and integrating knowledge. The set of training programs in 2009 (referred to as Training Program 2009) is detailed in Appendix 1. The program structure is very flexible according to the Bachelor of Engineering - Engineer training model. After that, 9 application-oriented Bachelor of Technology training programs have been applied from the 2010-2011 school year up to now, contributing to increasing the diversity of training models and training majors, increasing more choices for learners. In 2010, the University implemented the application-oriented and research-oriented master training programs with 41 master training programs for 27 majors and 60 doctoral training programs for 39 majors (refer to Appendix 2 for more details).

The University has generally agreed to apply a new training model since 2009 after many times of researches and discussions. The educational levels have been restructured according to the 4+1+1 model (Bachelor - Engineer - Master) or the combined model 4+2 (Bachelor - Master), these are more suitable according to international standards. For the engineering-technology sector, a completely new point is that students can choose a bachelor of engineering (B.Eng) or bachelor of technology (B.Tech) program with a 4-year study period in addition to the traditional engineering program (5 years). This training model gives learners a broader choice according to individual abilities and aspirations.

From 2009 up to now, training programs have only been slightly adjusted and remained unchanged in structure, basically still the 2009 Training Program.

1.2. Analysis of the current situation of training implementation according to the 2009 Training Program

In terms of training at the University according to the 2009 Training Program, in addition to successful results, there are also many shortcomings about the Training Program, the implementation of the Training Program and the assessment of learning outcomes, namely:

a) Training model

- Model 4 + 1 (from Bachelor of Engineering to Engineer) according to the 2009 Training Program: The Bachelor of Engineering program allows students to choose the option of going directly to the Engineer program, skipping the Final Year Project at the Bachelor of Engineering and only implementing one course of the Final Year Project at the Engineer Level. In addition, the attractiveness of an engineering degree leads to the vast majority of students graduating from universities at the engineer level. Graduation statistics for the last two years showed that most students choose to graduate at the engineer level, while the bachelor of engineering degree has not been as widely received as previously forecast (in the school year of 2013-2014, there are nearly 2000 engineering graduates, but only 3 graduates at bachelor of engineering). It's remarkable that

the Bachelor of Engineering plays an important role in model 4+2 and being considered as a training model asymptotically with international standards.

- Learners need up to 6 years to accumulate enough credits to graduate at the University. Based on the newly issued National Qualifications Framework regulations, that period is too long and not encourages students of the University to continue their studies at the graduate level.

b) Training Program and development methods of the Training Program

- Statistics on the Training Program reflect a large amount of works that has been performed by faculties of the University. However, the Development Council of Training Program has different views, perspectives and approaches, and too focused on the organization and distribution of knowledge according to the regulatory framework without giving any values and relevance of selected courses to be put on first. While the decision to include a module with a certain period in the program must be based on the value of that module's contribution of knowledge and professional skills to a predetermined outcome standard, some Development Councils based on training capacity and compromise with the proposal of the teaching needs of specialized subjects to have a suitable division of teaching time with available human resources. The design of our training programs has revealed many limitations when organizing training under a credit system. In the 2013-2014 school year, the University organized a pilot self-assessment of 4 engineer training programs of the School of Information Technology and Communications, School of Chemical Engineering, School of Electrical, Electronics and Telecommunications, and Telematics conducted by the Center of Quality Assurance according to quality evaluation standards of the AUN- OA Standards, the ranking results are only average.

- The training programs of some majors are not designed according to the principle of broad-based training at the Bachelor of Engineering. For example, the Chemical Engineering has 10 different majors from semester 5 to 6. It is remarkable that these majors are completely different in terms of subjects, even up to 100% of specialized subjects. This leads to the fact that specialized classes are divided, and many majors cannot open classes due to the low number of students or not opening regularly every year. The statistical data of the number of classes and opening duration from 2012-2013 school year to the 1st semester of the 2016-2017 school year showed that the number of disciplines, majors and subjects is less or cannot open as follows:

- 03 majors without training: Mechanical engineering; Metal (Metallurgical) Material engineering and Thermal-Refrigeration Engineering Technology.
- 04 unopen majors: Chemical and physical technology; Printing techniques, majors of Graphics and Information, and Technical Physics - ViHT.
- 07 less open majors: Engineering Pedagogy - Transportation Engineering, Engineering Pedagogy - Machine building engineering, only open once in 5 years; Plastics and Composites, Cellulose and Paper Technology, Materials Engineering - Electrical Materials; Engineering of Metallic materials - Non-ferrous and precious metals; Engineering Physics - Physics Informatics, only open twice in the last 5 years.

- The duration of experimental and practical teaching is rarely compared with foreign training programs in the same sector; in general, the training programs lack the required courses of social knowledge and soft skills (foreign languages, computer applications). Some training programs at the bachelor level are not suitable and not correct with the application-oriented training objectives.

- Undergraduate, graduate and doctoral programs are built independently at different times, so there is no consensus among programs. Some programs have duplicate parts of subjects, requirements on output standards have too many common contents, requirements for each subject in each major are not unified, some subjects overlap or have similar contents among graduate and undergraduate classes (despite having different course codes). The courses taught in the 5th year

(Engineer program) have been designed according to narrow majors, leading to difficulties in developing the Master training program due to narrow industry-oriented graduate perspectives.

- Undergraduate and graduate training programs are short of flexibility for students to actively choose and lecturers can choose topics and thesis in each semester, lack of oriented optional subjects. The training programs are difficult to convert and recognize domestically and internationally; difficult to assess the training quality and accredit the training programs.

- Some contents of training courses are completely unused, applicable to the subsequent training contents, in which especially there are many basic subjects.

- Some graduate training programs are developed very elaborately with high quality; however, there are no students apply for, not attract students (e.g. Nanomaterials, Electronic Materials, Engineering Physics, Materials Science, Nuclear and so on);

- Some graduate training programs have solid constraints, low interference between training programs in the same sector at different training levels. Training programs have not been regularly updated according to the needs of learners and society, so students are scattered. The research-oriented master programs are quite heavy on subjects with few research credits.

c) Output standards of training levels, disciplines and majors

- Output standards have not been designed in careful, elaborate and clear manners. The 2009 training programs have nearly identical output standards among disciplines, majors, and training levels. Objectives for each module and its impacts on the training programs are not clear. This led to a series of inadequacies in the implementation of the Training Program.

- In general, the 2009 Training Program has 3362 subjects, of which 3069 subjects are opened in at least one semester from the 2012-2013 school year until now and 293 courses cannot be opened (Figure 1). The Schools of of Chemistry, Materials Science, and Mechanics have many unused modules. Particularly, the School of Information Technology and Communications, Textile, Leather and Fashion have newly opened modules, so some courses have not been included into teaching (Figure 2).

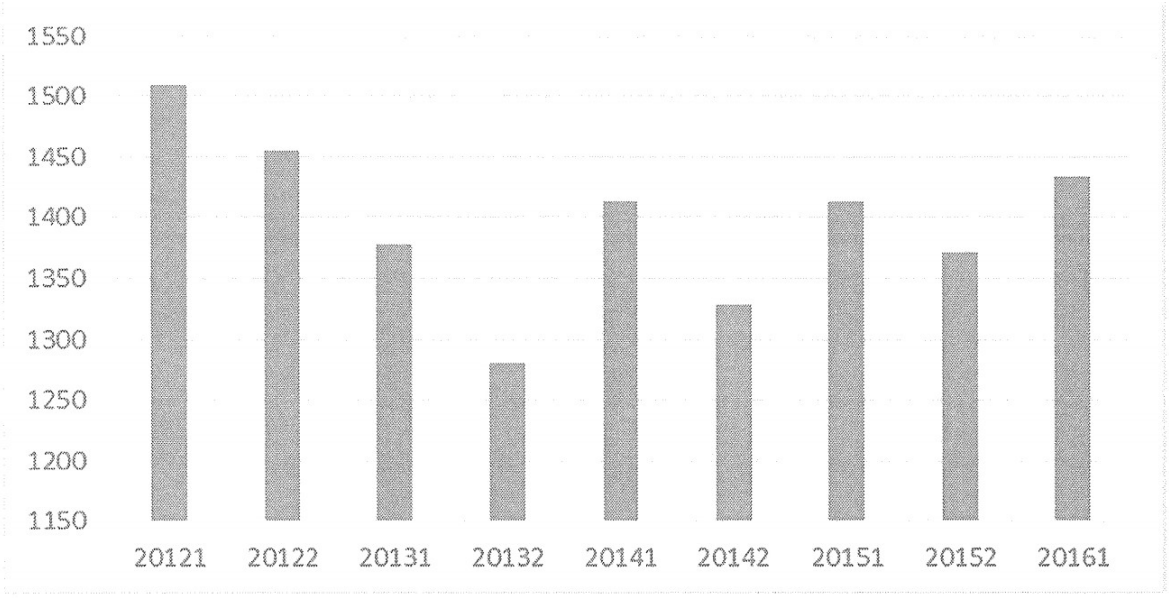


Figure 1: Statistics of courses taught in semesters

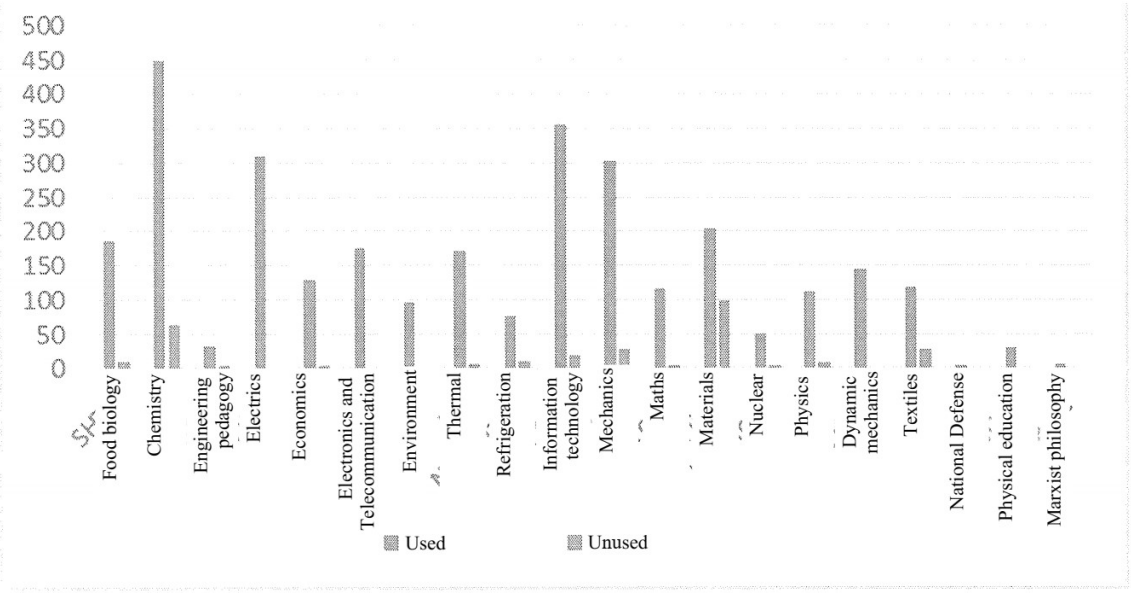


Figure 2: Statistics of courses taught in 2015-2016 school year by modules

d) Assessment of learning results

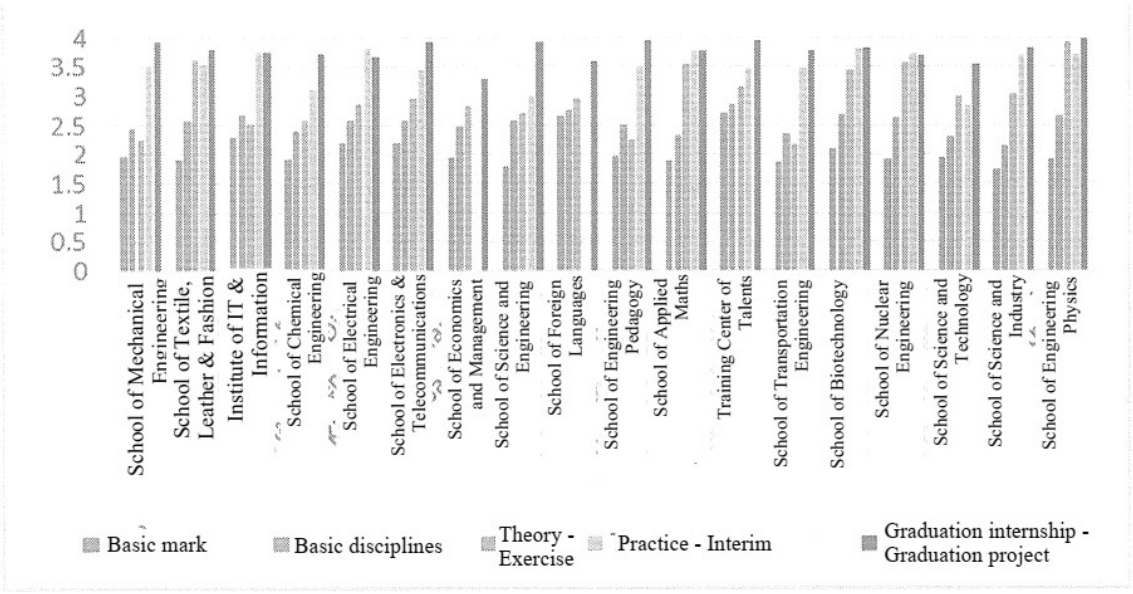


Figure 3: Average marks of students in Schools

- The conversion of the one-time assessment to the assessment of the whole learning process of the module is not really good. Currently, specialized courses, especially practical courses and graduation projects have test scores that are too high compared to test scores of preliminary and basic modules, and do not properly reflect students' capacity and do not generate the competition among students. The method of assessing learning results of modules needs to change towards a more objective and comprehensive.

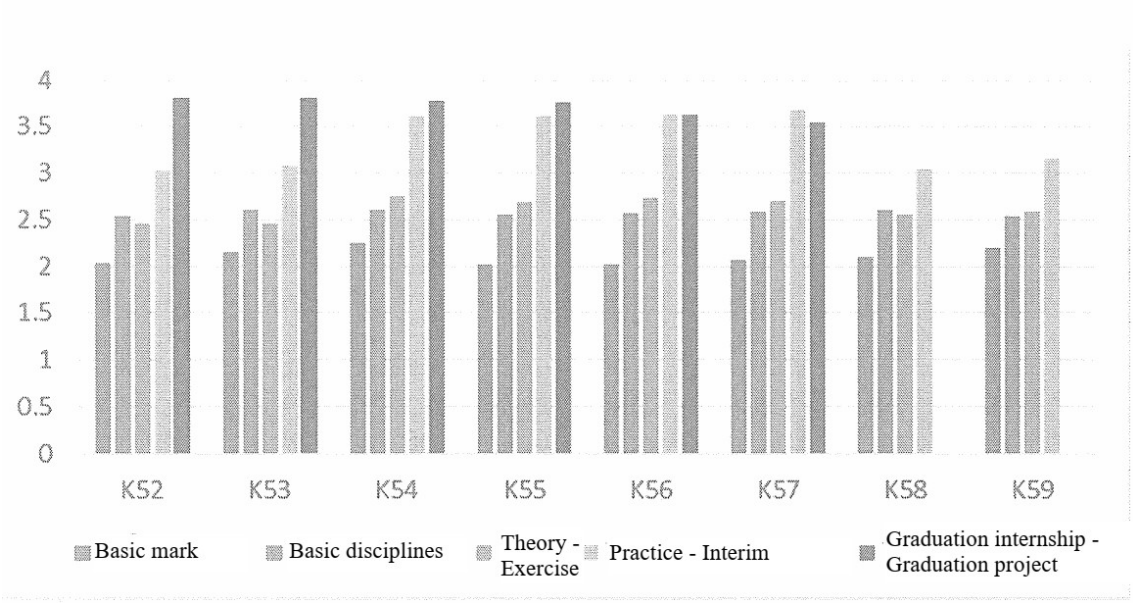


Figure 4: Average marks of students (CPA) in courses

- Based on the average mark in Figures 3 and 4, the test marks of basic modules are significantly lower than those of the specialized courses. In the specialized modules, marks of the practical - internship modules and the graduation project are very high.

1.3 Necessity of the development of training programs

The analysis and evaluation of the above situation has shown that it is very necessary and urgent to develop the training programs to overcome the limitations of the 2009 Training Program to continue to improve the training programs according to modern standards, suitable to the labor market and social requirements, towards the goal of improving training quality and attracting learners, making use of all resources of the University in training activities.

2. Objectives of the Project

2.1. General objectives

To develop and complete the set of training programs at undergraduate and graduate levels in order to best meet learners' requirements according to the following requests:

- To ensure that training objectives are consistent with the development goals of the University (university of multidisciplinary research) and the direction of industry 4.0;

- To be consistent with the provisions of the current training laws at the higher education;

- Being practical and modern, approaching international standards in structures and content;

- To guarantee the integration and consistency of the program as well as the connection between training levels.

2.2. Specific objectives

- The first objective is to complete a set of output standards for training programs, meeting requirements for vocational skills for graduates, current regulations and requirements of other requirements from social practices.

- The second objective is to complete the redesign and adjustment and renewal of current training programs based on established output standards.

- The third objective is to summarize data, evaluate the results of the pilot operation of the Training Program and collect opinions from related parties related to the Training Program to continue to improve the Training Program for the next phase and verify the training program according to international standards.

3. Specific tasks and solutions

3.1. Orientations and principles for the development of training programs

(i) Ensuring the modernity and practicality of the Training Program: The entire training program is designed according to the CDIO approach based on the output standards of the Training Programs to ensure training objectives. Each developed training program needs to be consulted and compared by at least one training program of the same discipline being applied at a university of a developed country. The common feature is that the training programs are built according to international standards, providing broad-based training, providing learners with fundamental and core knowledge, focusing on creative research activities, positive soft skills for society and the environment in professional activities, adaptability in the international working environment.

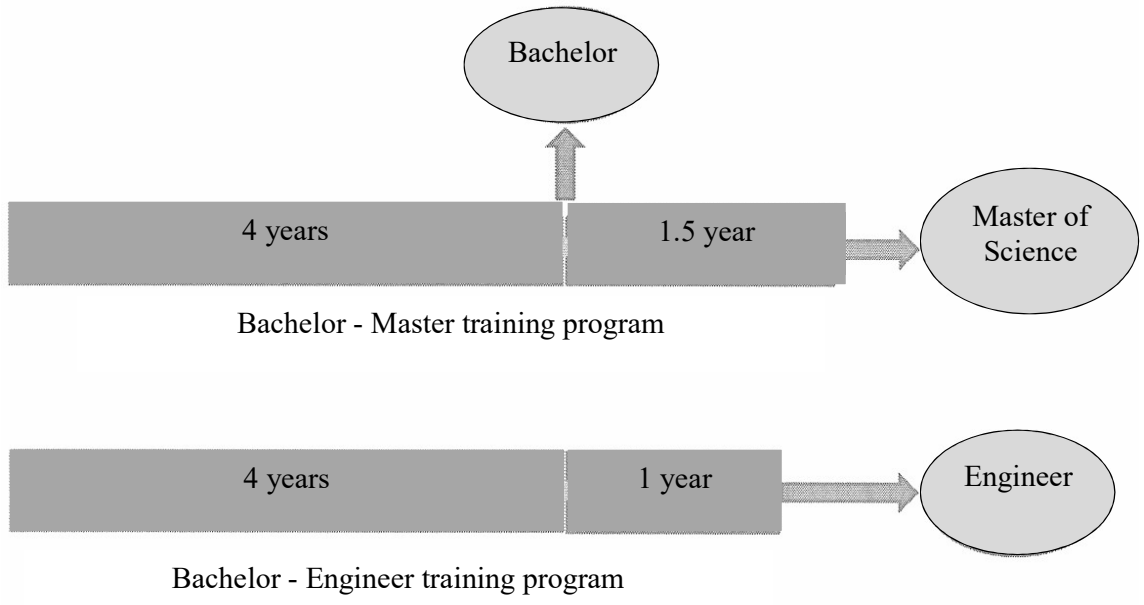


Figure 5: Integrated training programs

(ii) Assuring the integration and uniformity of the Training Program: Training programs are designed in the direction of integration and connection between levels of study with knowledge and optimal teaching and learning time for learners.

+ 4-year Bachelor of Engineering training program (Bachelor of Engineering; Bachelor of Science; Bachelor of Economics - Management; Bachelor of English Language), broad module design and Bachelor's degree (Engineering/Science/Economics-Management/Languages). The objectives and contents of these training programs are built with basic knowledge, solid professional knowledge to be able to adapt well to a wide sector, focusing on the ability to design and develop systems, products, and technical solutions.

+ Bachelor-Engineer integrated training program (5-year design time), granting the Engineer Degree. In-depth training program of engineers is according to the applied field of the discipline.

+ Bachelor - Master integrated training program (5.5-year design time), granting the Bachelor Degree (Engineering/Science/Economics - Management) and Master of Science degree in 2 directions:

- *Academic Research* direction for learners who have career aspirations as lecturers and scientific researchers.
- *Research and development* direction to train technical experts who are capable of designing, researching and developing systems/products.

+ The Master of Science program in Engineering and Technology Management (ETM) aims to train future business leaders and managers with the following basic requirements:

- The program is built in a multi-disciplinary direction including professional and technical knowledge and economic-management and administrative knowledge.
- The knowledge is designed according to modules for learners to choose according to their level and training courses.

+ Training program of Master of Engineering/Master of Business Administration (MBA) is oriented according to the field of application of the discipline.

+ Training program of Bachelor of Technology (4 year design time), granting the Bachelor of Technology, providing learners with broad professional knowledge, focusing on competencies and professional practice skills, application of technology solutions, implementation and operation of systems and technological processes and procedures. Bachelor of Technology and Bachelor of Engineering are equivalent; however, the Bachelor of Technology takes more time than Bachelor of Engineering when continuing to study at higher levels.

(iii) Strict and uniform implementation procedures. A training program is designed generally from undergraduate to graduate level training by a *Training Program Development Council*. This Council maintains operation in a cycle of applying the Training Program (about 6 years) to supplement, correct and update the Training Program regularly and timely. All documents and evidence during the development of the Training Program must be archived according to current regulations. The University stipulates the structure and minimum amount of knowledge of the training program and designs the general knowledge in the general education level according to the group of majors at the undergraduate level, supplementing additional knowledge in terms of economic, social and soft skills development.

Based on the proposal of the Training Program Development Council, the University approves in writing: (1) The name of the Training Program, including names of majors (for the Master of Science program) and name of application modules (for Engineer/Master of Engineering program), (2) Output standards of training programs, (3) Program framework of training programs (including brief description and output standards of modules).

3.2. General principles for development of output standards

- Output standards will be developed according to the CDIO approach to solve two main problems as follows:

- Graduate students need to acquire knowledge, skills and attitudes as required (what to learn);
- What do graduates can do to acquire those knowledge, skills and attitudes (how to learn).

- Basically, the set of Output Standards for a Training Program include 4 groups of contents, in which fully describing output standards of the Training Program. For training programs in the sector of engineering and technology, the output standards must have the following contents:

- Technical knowledge and reasoning
- Professional skills and personal skills
- Team work skills

- Ideal formation skills, design, implementation and operation.

3.3. Some orientations on training program design

3.3.1. Model of training levels and design time

Training model with the proposed design time is shown in Figure 6:

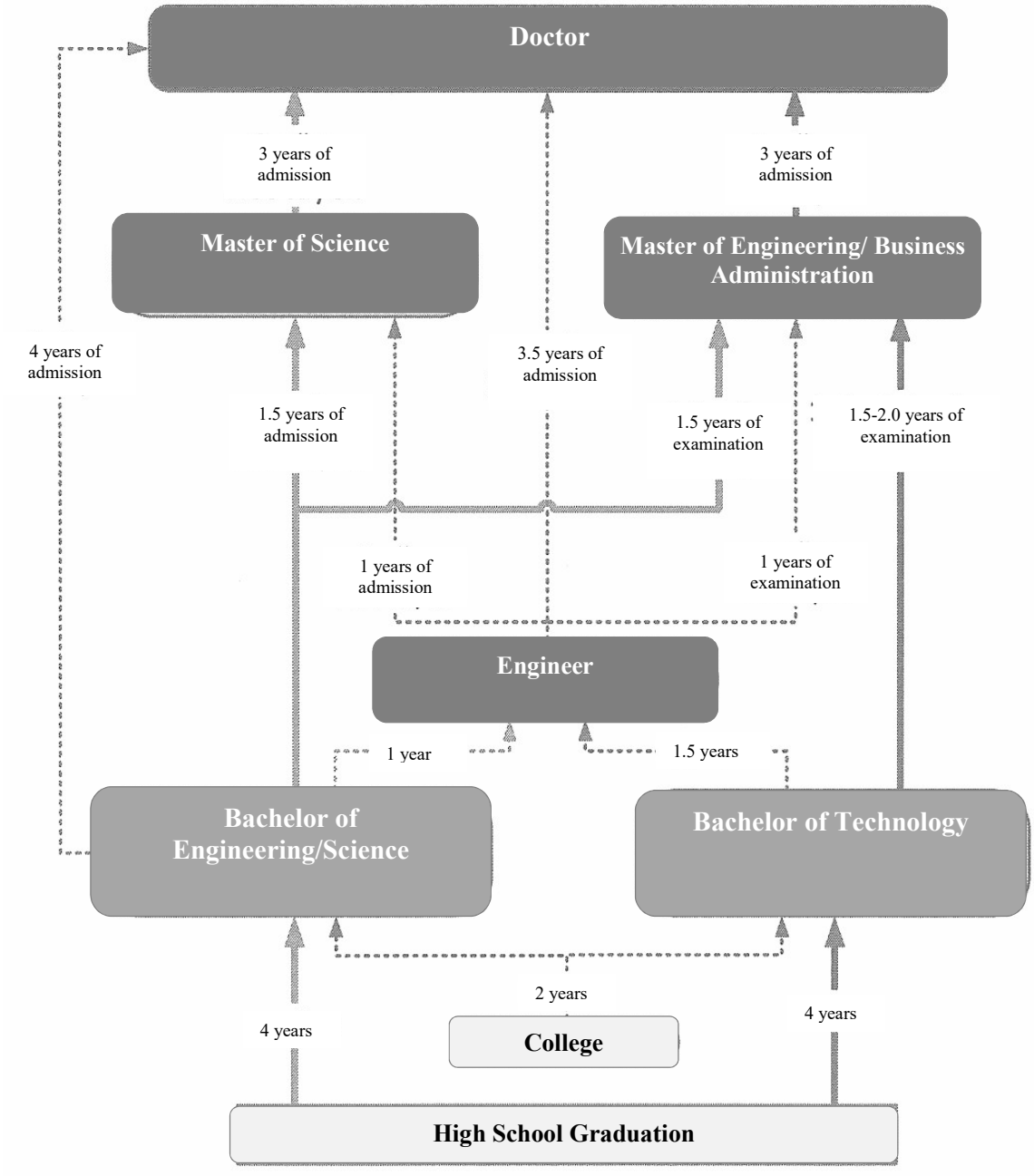


Figure 6: Structure and design duration of training programs

3.3.2 Framework of new training program

- The structure and minimum knowledge of the Training Program from Bachelor of Engineering/Science/Economics - Management are described in Figure 7. Detailed information

about the knowledge design is shown in Table 1-3. Table 4 describes the framework of training program of the Bachelor of Technology.

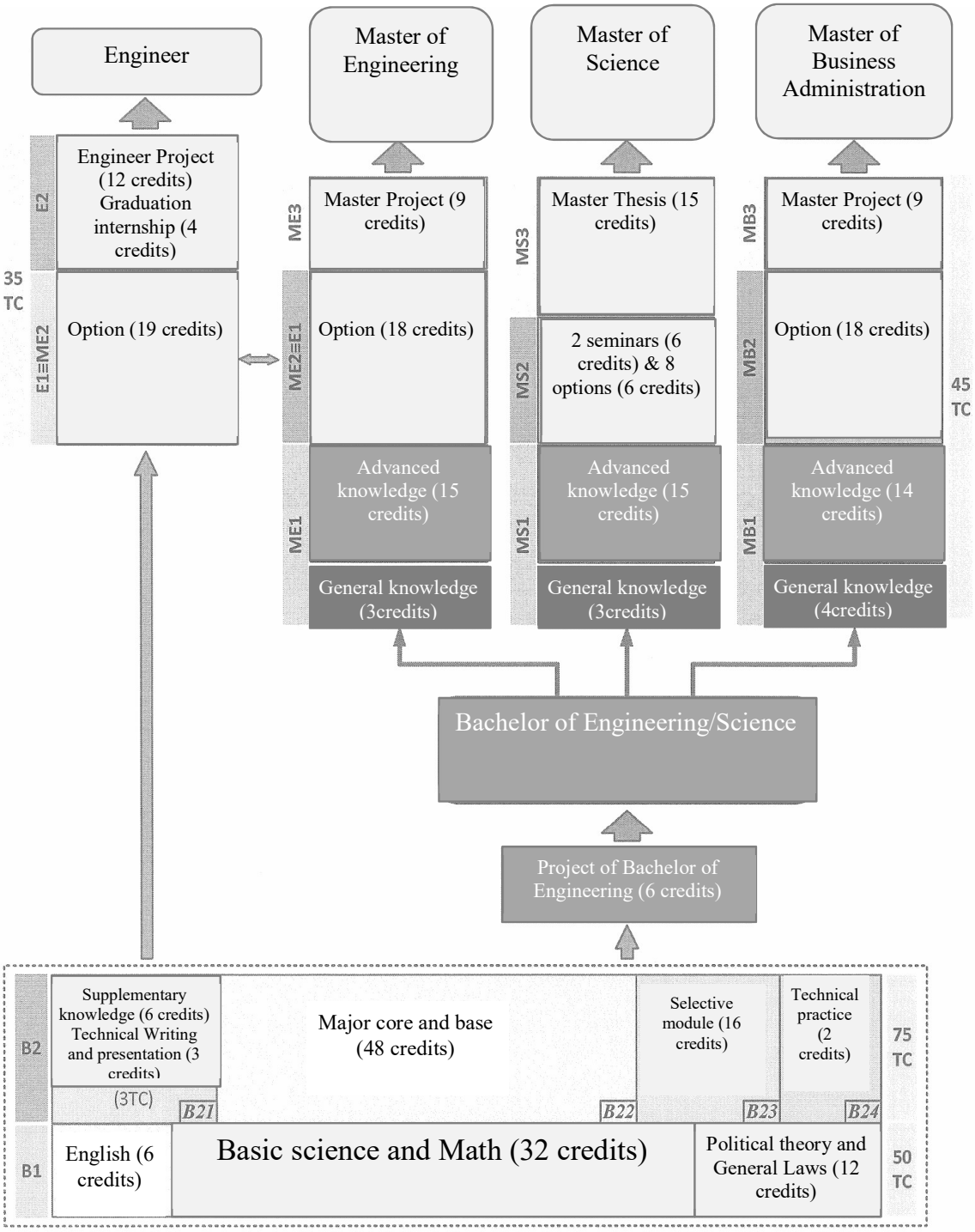


Figure 7: Framework of training program of Bachelor of Engineering and other integrated programs

Table 1: Description of Bachelor of Engineering - Engineer integrated training program framework

Training program	Credit	Remark
Bachelor - Engineer integration	**160**	
General education	**50**	**Development Council of General Education**
Basic science and math	32	Orienting the design of modules under training groups in appropriate manners
Political Theory General Law	12	According to regulations of the Ministry of Education and Training
Physical Education/National Defense & Security Education	-	
English	6	Includes 2 basic English courses
Professional Education	***110***	**Training Program Development Council**
Major core and base	48	Including from 1-3 design, fabrication/implementation projects. It is possible to arrange from semester 4 to 7, not more than 1 project for each semester
Supplementary knowledge	9 (6+3)	Including two compulsory knowledge parts: supplementary knowledge about society, start-up and other skills (6 credits) & Technical Writing and Presentation (3 credits). - The University provides a list of many supplementary courses. The Council chooses about 12 credits from this list, and students have to choose 6 credits to study (equivalent to 2-3 modules). - Technical Writing and Presentation: a compulsory module, designed to study in semester 7 or 8.
Self-selection by modules	16	The selected module facilitates students to access to an applied major. - Module is a group of modules designed to *approach an application sector* of the Engineer Program determined by the Training Program Development Council; - Students choose a module by themselves and must study all the courses in that module. - The total number of credits of the modules ensures a minimum of 30 credits for students' selection. The volume of knowledge between the "Major core and base" and "Self-selection by modules" can be adjusted within ±2 credits, but the total number of credits remains unchanged.
Technical Internship	2	Taken from the third year grade
Optional engineer	19 (13+6)	Optional engineer (19 credits) consists of two parts:

		- Compulsory professional knowledge, including 13 credits, is designed in modules, each module corresponds to an application area, consisting of at least one Design Project with a duration of 3 credits, focusing on design skills. Students can select and must study all the modules. - Self-selected knowledge with 6 credits for students to choose from in the general list as designed by the Training Program Development Council.
Graduation internship	4	Mainly implemented at industrial facilities
Engineer project	12	Graduation topic needs to be associated with the field of application and background suitable to the content of the internship.

Table 2: Description of Bachelor of Science - Master of Science integrated training program framework

Training program	Credit	Remark
Bachelor of Science and Master of Science integration	**176**	
General education	**50**	**Development Council of General Education**
Basic science and math	32	Orienting the design of modules under training groups in appropriate manners
Political Theory General Law	12	According to regulations of the Ministry of Education and Training
Physical Education/National Defense & Security Education	-	
English	6	Includes 2 basic English courses
Professional Education	***81***	**Training Program Development Council**
Major core and base	48	Including from 1-3 design, fabrication/implementation projects. It is possible to arrange from semester 4 to 7, not more than 1 project for each semester
Supplementary knowledge	9 (6+3)	Including two compulsory knowledge parts: supplementary knowledge about society, start-up and other skills (6 credits) & Technical Writing and Presentation (3 credits). - The University provides a list of many supplementary courses. The Council chooses about 12 credits from this list, and students have to choose 6 credits to study (equivalent to 2-3 modules). - Technical Writing and Presentation: a compulsory module, designed to study in semester 7 or 8.
Self-selection by modules	16	The selected module (16 credits) is designed according to module in a wide sector of the training modules (wide module).

		- Students choose a module by themselves and must study all the courses in that module. - The total number of credits of the modules ensures a minimum of 30 credits for students' selection. The volume of knowledge between the "Major core and base" and "Self-selection by modules" can be adjusted within ±2 credits, but the total number of credits remains unchanged.
Technical Internship	2	Taken from the third year grade
Bachelor project	6	
Postgraduate	**45**	**Training Program Development Council**
General knowledge	3	Philosophy
Advanced knowledge	15	Advanced and in-depth knowledge according to majors of the training program.
Option	12	Training Program Development Council designs knowledge contents in two directions as follows: - *Academic research*: Focusing on in-depth theory, of which 2 seminars (6 credits) are directly related to the content of the master thesis. The specific content of the seminar is decided by the lecturer in charge; evaluating the results in the form of presenting a scientific report in front of professional board (subjects); - *Research and development direction* focus on learner's design capacity, in which 2 seminars are replaced by 2 design projects, organized in groups of learners. The project content is directly related to the content of the master's thesis.
Thesis of Master of Science	15	

Table 3: Description of Bachelor of English program

Training program	Credit	Remark
Bachelor of English	**131**	
General education	**34**	**Development Council of General Education**
General knowledge	12	
Political Theory General Law	12	According to regulations of the Ministry of Education and Training
Physical Education/National Defense & Security Education	-	
Second foreign language	10	Other than English language
Professional Education	***97***	**Training Program Development Council**
Major core and base	67	
Supplementary knowledge	6	The University offers a list of many additional courses on social, start-up and

		other skills (6 credits). The Council chooses about 12 credits from this list, and students must choose 6 credits to study (equivalent to 2-3 modules).
Self-selection by modules	15	The selected module (16 credits) is designed according to module in a wide sector of the training modules (wide module). - Students choose a module by themselves and must study all the courses in that module. - The total number of credits of the modules ensures a minimum of 30 credits for students' selection. The volume of knowledge between the "Major core and base" and "Self-selection by modules" can be adjusted within ±2 credits, but the total number of credits remains unchanged.
Technical Internship	3	
Final year thesis	6	

Table 4: Description of Bachelor of Technology program

Training program	Credit	Remark
Bachelor of Technology	**131**	
General education	**50**	**Development Council of General Education**
Basic science and math	32	Orienting the design of modules under training groups in appropriate manners
Political Theory General Law	12	According to regulations of the Ministry of Education and Training
Physical Education/National Defense & Security Education	-	
English	6	Includes 2 basic English courses
Professional Education	***81***	**Training Program Development Council**
Major core and base	48	Including from 1-3 design, fabrication/implementation projects. It is possible to arrange from semester 4 to 7, not more than 1 project for each semester
Supplementary knowledge	9 (6+3)	Including two compulsory knowledge parts: supplementary knowledge about society, start-up and other skills (6 credits) & Technical Writing and Presentation (3 credits). - The University provides a list of many supplementary courses. The Council chooses about 12 credits from this list, and students have to choose 6 credits to study (equivalent to 2-3 modules). - Technical Writing and Presentation: a compulsory module, designed to study in semester 7 or 8.

Self-selection by modules	12	The selected module (12 credits) is designed according to module in a wide sector of the training modules (wide module). - Students choose a module by themselves and must study all the courses in that module. - The total number of credits of the modules ensures a minimum of 24 credits for students' selection. The volume of knowledge between the "Major core and base" and "Self-selection by modules" can be adjusted within ±2 credits, but the total number of credits remains unchanged.
Technical Internship	2	Taken from the third year grade at industrial enterprises
Bachelor of Technology Project	6	

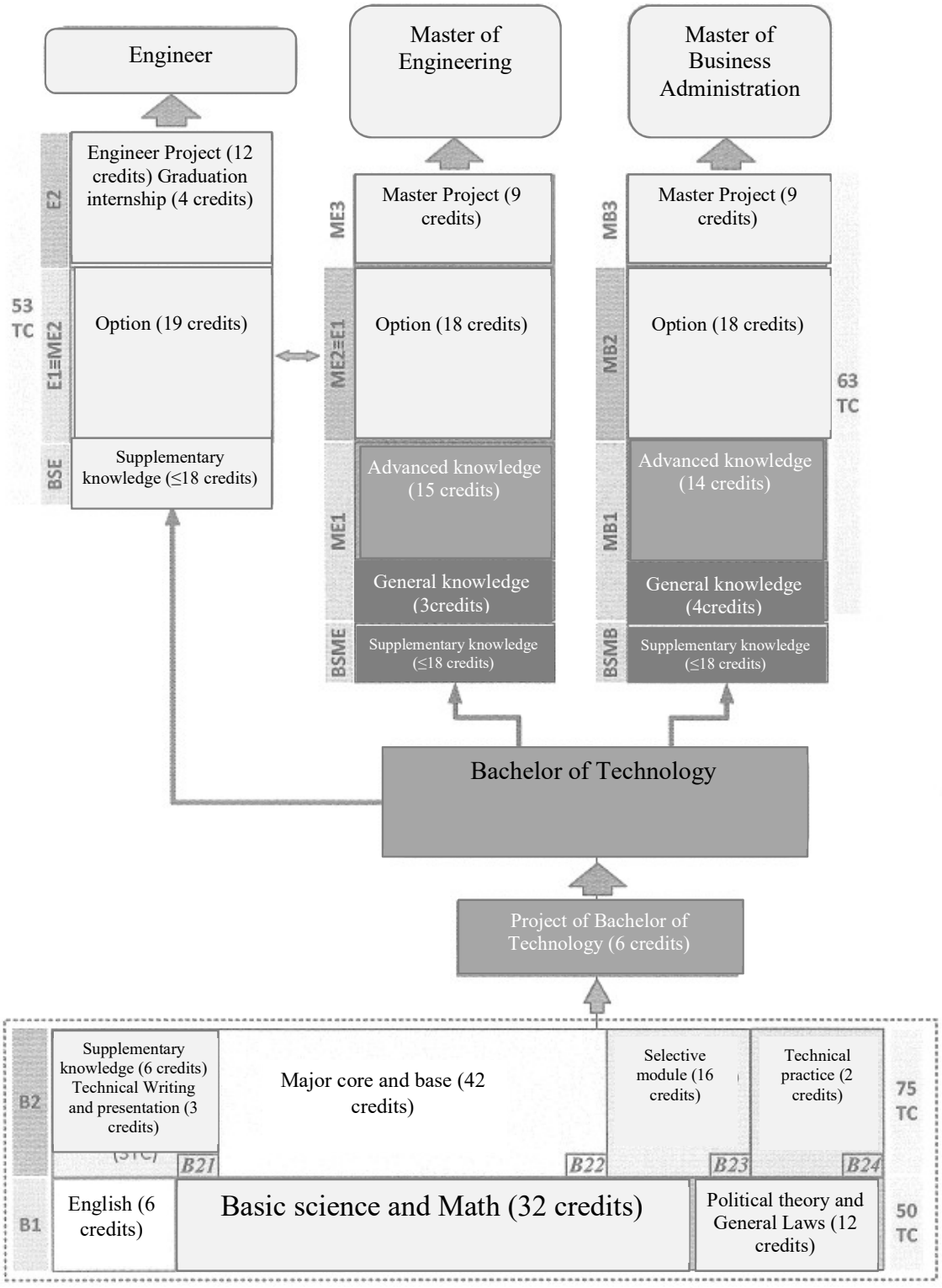


Figure 8: Framework of Bachelor of Technology training program and higher level

3.3.3. Design orientation of courses and modules

a) University training program

- The General Education Development Council (GEDC) of the University is responsible for designing the general knowledge in the general education sector, supplementing additional

knowledge about society, soft skills, start-up (6 credits) and writing skills and scientific presentations in English (3 credits). For knowledge about the political theory, physical education, national defense - security education is in accordance with the regulations of the Ministry of Education and Training. The program of some courses of General Mathematics and Physics will be designed in accordance with the characteristics of each group of majors.

- Selected courses are designed according to a set of courses (modules). Each module follows a defined specialist topic, which is assigned a brief title to describe the module's core knowledge. The courses in a module are designed so that the knowledge contents have a close relationship and it is noted when determining the conditions for the pre-study course and the modules of selected courses according to the module. Students choose to study by module to have a sufficient professional knowledge as required.

- The selected module in Engineer program is designed according to the fields of application of the training program. This is a new point in the development of the Training Program to increase the practicality of program, and at the same time, to make the most of the intellectual strengths and creative abilities of the subjects of the Schools, even outside the Schools, to join to create an application field of the discipline. The sectors of application proposed by the Training Program Development Council should be based on the survey results on the employment situation of graduates and demands of industrial production and expert opinion. Based on the actual situation and new survey results, the Training Program Development Council may continue to supplement new fields and design new modules.

- For each module of the Training Program:

+ To strengthen subjects that require student's autonomy and to promote the creativity in learning; for example, design project modules (individuals or groups work together) can be included in the training program at the 3rd year.

+ To increase the duration of practical/experimental training, redesign the experimental modules to match the output standards.

+ To consider the design of specialized modules so that topics can be changed after each school year so that knowledge is updated according to requirements of engineering and technology.

+ To focus on courses with knowledge of applying information technology such as data calculation and simulation methods and tools.

+ To require technology bachelors supplementing knowledge of 13 credits as at least to ensure that their knowledge level is equivalent to Bachelor of Engineering when they study at a higher level (Figure 8).

- Foreign language skills: The University will raise the output English language standard to a higher level (as expected, TOEIC 500 and equivalent), and opening English language classes (optional, out of the program) so that students who study a certain number of hours will be considered to meet the English standards according to their academic level (in addition to internal English exam format).

b) Postgraduate Training Program

- The training program consists of two main sectors (general knowledge): advanced knowledge and elective knowledge.

- For the training program of Master of Engineering, the elective knowledge (13 credits) according to applied fields has the knowledge content as same as the Engineer program of the same discipline (Figure 3). Therefore, Engineers need to learn general knowledge (Philosophy), advanced knowledge and do master thesis with a period of 1 year to receive the Master of Engineering.

- For the training program of Master of Science, in addition to the advanced and in-depth knowledge (15 credits) and elective modules (6 credits) with 2 to 3 modules respectively, the knowledge includes 2 seminars or 2 design projects (6 credits) designed in the following directions:

(1) Academic research: Focusing on in-depth theory of the majors so that graduates can do researches, teaching or study at a higher level. In which, 2 seminars (6 credits) are directly related to the content of the master thesis. The specific content of the seminar is decided by the lecturer in charge; evaluating the results in the form of presenting a scientific report in front of professional board (subjects);

(2) Research and development direction focus on learner's design capacity, research and development of products/systems to train learners so that they can become R&D specialists in industry and enterprises; in which 2 seminars are replaced by 2 design projects, organized in groups of learners. The project content is directly related to the content of the master's thesis

- The training program of Master of Science on Engineering-Technology Management is organized and developed by the University with a separate (multi-pronged) Council.

The general regulations on the minimum volume of knowledge of the Training Program are as follows:

3.3.4. List of training programs 2017

The list of Bachelor Training Programs that will develop in 2017 is in Appendix 3. The Training Program Development Council proposes *application sectors* for engineer training in the Bachelor-Engineer Integrated Training Program and majors/intensive orientation for education of Master of Science in the Bachelor - Master Integrated Training Program.

3.4. Development principles of subjects (detailed course outline)

- Each subject (module) of a knowledge module in the Training Program has a certain role in achieving the output standards, and there is a relationship and interaction between other modules in the Training Program. Therefore, the subject place and its roles in the training process and its relationship with other subjects must be clearly defined.

- For a Subject Program, it is necessary to identify:

+ The position of that subject in the training program, specifying the subject type, prerequisite subject and the next subject, and at the same time it is necessary to state the structure, subject content, teaching and learning time.

+ Subject targets, objectives of each subject regarding to knowledge, skills and attitudes. This is considered as the standard of knowledge and skills of the subject and serves as the basis for the management and test of course results.

+ Based on specific objectives of subjects and contents, it is necessary to show the study materials, materials for each contents of the subject. Also based on the objectives of subjects, quantity and level of students, and conditions on teaching equipment, lecturers select and combine appropriately organizational forms and teaching methods.

3.5. Missions of the Training Program Development Council and Training Program Appraisal Council

3.5.1. Training Program Development Council (TPDC)

- The University proposes the list of members of the Training Program Development Council and submits to the Director for decision on establishment. The minimum number of members of a Council is 7 people. To attract good professionals to join and develop the Training Program, each Council should have about 15%-20% of its members who are external experts of the University.

- The Training Program Development Council is a professional council in charge of the following tasks: organizing the preparation and development of one or several assigned training programs; evaluating the quality of the Training Program during the implementation process to supplement, adjust and complete the Training Program. Therefore, a Training Program Development Council operates during the end of a training cycle (approximately 6 years). During its operation, the Council's personnel can be adjusted and supplemented according to the actual situation to ensure the completion of tasks.

- A Council is responsible for developing and completing the undergraduate and graduate training programs of the training sector. For the development of doctoral training programs, training programs of special programs (talented, advanced) will continue to be implemented next year (2018). Training programs of Bachelor of Engineering and Bachelor of Technology in the same course/discipline must be developed by the same Training Program Development Council.

- The University shall establish a Training Program Development Council of Master of Science on *Engineering - Technology Management* (ETM) - see Section 3.1.

- After completing the list of modules in the Training Program, the detailed outline of the modules will be compiled by a specialized group that is established by the School or by the Department as assigned by the School.

3.5.2. General Knowledge Development Council (GKDC)

The University shall establish a General Knowledge Development Council (GKDC) according to modules, including the modules of Physical Education, National Defense-Security Education, and Political Theory. In addition, the Council is also responsible for developing the content of the courses in the general complementary knowledge for the whole university to be selected by the General Knowledge Development Council.

3.5.3. Training Program Appraisal Council (TPAC)

- Training Programs are assessed by the *Training Program Appraisal Council* as decided by the Director and issued operating regulations. The Training Program Appraisal Council is liable for advising the Director about whether a training program developed by a Training Program Appraisal Council is satisfactory or not.

- The Training Program Appraisal Council is responsible for appraising one or several training programs in terms of structures of the training program and the minimum knowledge of each sector in the training program; the compliance with regulations and procedures of development of the training program as well as the adequacy of the evidence in the process of developing the training program according to regulations. Professionally, the Training Program Appraisal Council invites external experts to review the training program and make comments and assessments on the quality of the training program.

- The Training Program Appraisal Council ends its operation after completing the task of appraising the assigned training program.

4. Implementation plan

Starting date	Closing date	Main task	Presided over by	Cooperation units
April 15, 2017	April 30, 2017	Establishing the Training Program Development Council	University (approved)	Schools (proposed)
May 5, 2017	May 19, 2017	Determining the list of application sectors/majors of the 2 integrated programs	Training Program Development Council	School
May 5, 2017	July 5, 2017	Developing output standards for training programs	Training Program Development Council	Graduate, postgraduate training, Quality guarantee, Political works, Student works
May 15, 2017	July 15, 2017	Building the part of the training program in the general knowledge and supplementary knowledge	General Education Council	Graduate Training Department, Postgraduate training School, Training Program Development Council
July 15, 2017	September 15, 2017	Designing 2 integrated training programs, Bachelor Training Programs, and Master Training Programs on Economics/Business Administration	Training Program Development Council	School
September 15, 2017	October 15, 2017	Appraising Training Programs	Training Program Appraisal Council	Graduate Training Department, Postgraduate training School
October 16, 2017	November 15, 2017	Editing and perfecting the training program according to appraisal evaluation	Training Program Development Council	School
December 01, 2017	December 15, 2017	Promulgating the set of 2017 training programs	University	School
December 01, 2017	January 15, 2018	Developing a detailed course outline	School, Department	Graduate Training Department, Postgraduate training School

5. Cost estimation for implementation

The Project implementation cost estimation is listed in detail in Appendix 4.

C. CONCLUSION

The Project is established on the basis of evaluating and summarizing graduate and postgraduate training activities in the past time, summarizing many comments and suggestions from academic units, experts and lecturers of the University.

The development of training programs for training levels and disciplines at Hanoi University of Science and Technology is a major, correct and urgent policy for the purpose of perfecting the training programs according to increasing requirements of the labor market, contributing to improving the quality of undergraduate and graduate training programs of the University.

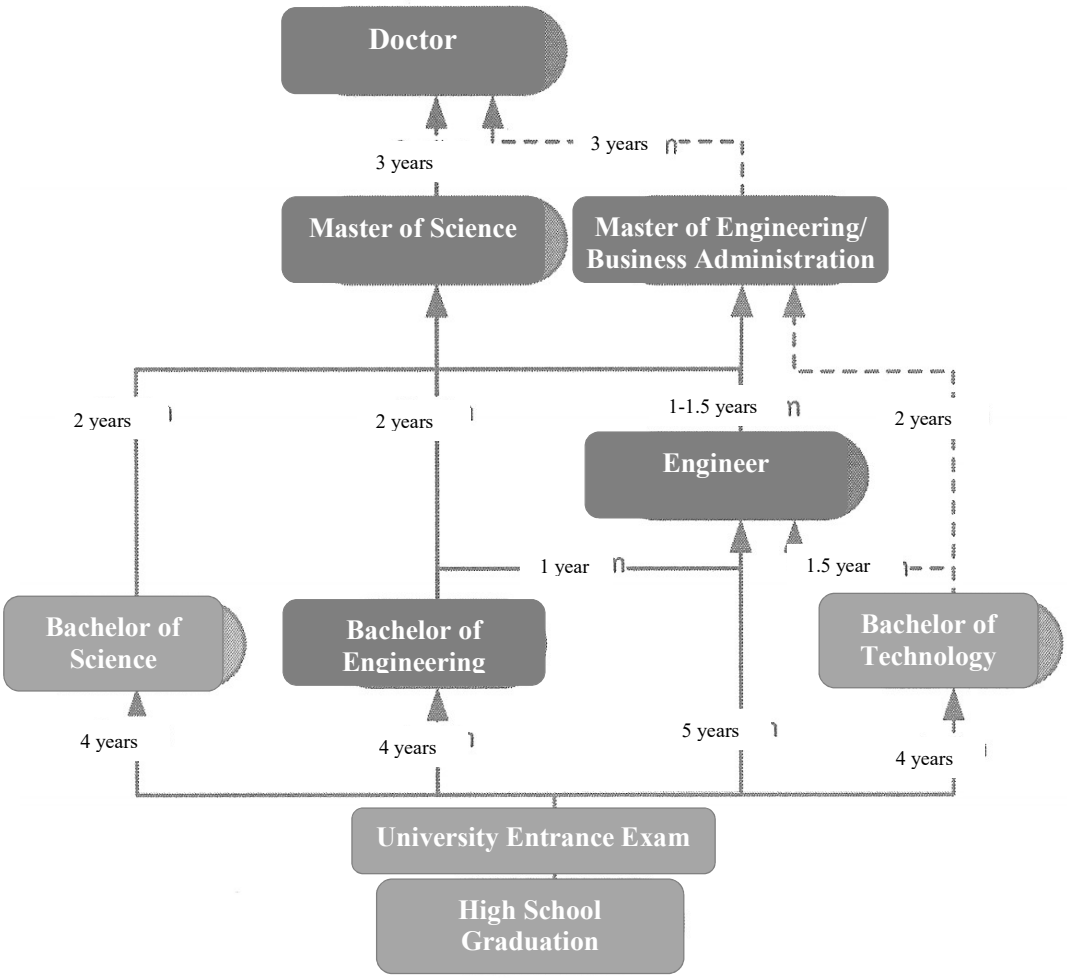
REPRESENTATIVE OF PROJECT DEVELOPMENT
PRESIDENT OF UNIVERSITY
TRAINING DEPARTMENT
(*Signed and sealed*)
Prof. Dr. Nguyen Phong Dien

APPENDIX 1: UNIVERSITY TRAINING PROGRAM IN 2009

1. Training model

The training model of Hanoi University of Science and Technology (HUST) applied from the admission courses in 2009 has been radically renewed in the direction of international integration. The training levels are restructured according to the model of 4-4-1 (Bachelor-Engineer-Master) combined with 4-2 (Bachelor-Master), consistent with the model of universities of the British-American system and the European system. Training levels include:

- Bachelor (Bachelor of Science, Bachelor of Engineering and Bachelor of Technology subject to training majors), the designed training duration is 4 years;
- Engineers (for engineering majors only), the designed training period for continuous learners is 5 years, for those graduating from Bachelor of Engineering is 1 year (4+1) and graduating with a Bachelor of Technology is 1.5 years (4+1.5);
- Master (Master of Science, Master of Engineering and Master of Business Administration subject to the training orientation and training major), the designed training time for Bachelor graduates is 2 years (4+2) and for Engineering graduates is from 1 to 1.5 years (5+1);
- Doctorate, the training duration according to design for Master graduates is 3 years and for Engineering graduates (with excellent degree) is 4 years;



The decentralization of training levels and the stream of training orientations diversify and increase the attractiveness of training programs, better meeting the needs of learners and employers, contributing to improving the quality and effectiveness of training. The training model is designed to ensure vertical connectivity (between levels of study) and horizontally (between disciplines) in

the school, while still expanding the capacity to connect with different levels of schools (domestic and foreign schools), facilitating learners to choose the most suitable options, learning to work, learning for life.

1.1. Bachelor Training Programs

Bachelor programs are designed for 4-year duration, basic orientation, broad major training; equipping learners with foundational knowledge and basic professional competencies to be able to adapt to different works in the broad field of training. Bachelor's programs are divided into 3 categories:

- Bachelor of Science (BS), Bachelor of Business Administration (BBA) and other equivalent forms, applicable to the sciences, economics, languages. Graduates of a Bachelor of Science (and other equivalent) who wish to study an engineering program must complete a conversion program in accordance with the second degree requirements.
- Bachelor of Engineering (BEng), applied to the branches of engineering, provides training in the direction of computation, design and development of systems, technical products, and technology. Graduates of Bachelor of Engineering from HUST can study for 1 more year to receive an Engineering Degree or 2 years to receive a Master of Science/Master of Engineering.
- Bachelor of Technology (B.Tech) applies to the fields of Technology (engineering), application-oriented training and operation of systems and technological equipment. Bachelor of Technology can study for about 1.5 years to get an Engineering degree or 2 years to get a Master of Engineering.

1.2. Engineering Training Programs

Engineering programs are designed for a duration of 5 years (1 year for Bachelor of Engineering graduates), applicable to engineering, career-oriented, narrow (specialized) training, complementary provide learners with advanced technical knowledge and in-depth professional competencies to be ready to meet practical requirements of works. Engineering graduates can also continue to study for a master's program (1-1.5 years), in case of excellence, they can be considered to be a PhD student.

Students who are matriculated into a group of engineering majors can choose to pursue either a Bachelor of Engineering program or an Engineering program. For a discipline, the 5-year Engineering program is the same as the Bachelor of Engineering program in the first 7 semesters; however, the last 3 semesters will focus on a major.

1.3. Master Training Programs

Master's degree programs are streamed in two directions:

- Master of Science (MSc) program is research-oriented, for those who follow the path of teaching and research.
- Master of Engineering (MSc) or Master of Business Administration (MBA) program is career-oriented and applied for those who want to supplement both advanced specialized knowledge (as for engineers) as well as a broader knowledge of science and engineering for a broader range of activities, especially in interdisciplinary work.

2. Master and Doctoral training modules and majors since 2009

School in charge	Major name	Major name and training orientation
Engineering/Bachelor of Engineering		
School of Mechanical Engineering	l. Mechanical engineering	1. Mechanical engineering
	2. Mechanical engineering (engineering)	2. Machine manufacturing technology
		3. Welding technology
		4. Precision mechanics and optics

		5. Pressure machining
		6. Science & Technology of Plastics and Composite
	3. Electromechanical engineering	7. Electronic Technology
School of Transporation Engineering	4. Mechanical engineering (dynamics)	8. Hydraulic machines and automation
		9. Internal combustion engine
		10. Cars and specialized vehicles
	5. Aeronautical Engineering	11. Aeronautical Engineering
	6. Ship engineering	12. Ship engineering
School of Heat Engineering and Refrigeration	7. Heat engineering	13. Energy Engineering
		14. Refrigeration machines and equipment
School of Electrical Engineering	8. Electrical and electronic engineering	15. Electrical system
		16. Electrical-Electronic Equipment
	9. Control and automation engineering	17. Automatic control
		18. Industrial automation
		19. Industrial Informatics and Measurement
School of Electronics and Telecommunications	10. Electronic & communication engineering	20. Electrical engineering - Computer engineering
		21. Avionics - aerospace engineering
		22. Information Technology - Communication
		23. Biomedical Engineering
		24. Broadcasting techniques
School of Information and Communication and Technology	11. Computer Engineering	25. Computer Engineering
	12. Computer Science	26. Computer Science
	13. Communication and computer networks	27. Communication and computer networks
	14. Software Engineering	28. Software Engineering
	15. Information systems	29. Information systems
	16. Information technology	30. Information technology
		31. Information security
School of Applied Mathematics and Informatics	17. Math-Informatics	32. Math-Informatics
School of Chemical Engineering	18. Chemical Engineering	33. Organic Petrochemical Technology
		34. Polymer-Composite material technology
		35. Electrochemical technology and metal protection
		36. Silicate material technology
		37. Technology of inorganic substances
		38. Chemical and physical technology
		39. Chemical technology process and equipment
		40. Cellulose and paper technology
		41. Chemical technology and plant protection
		42. Machinery and equipment for chemical-petroleum technology
	19. Printing and Communication	43. Printing and Communication Technology
School of Biotechnology & Food Technology	20. Bioengineering	44. Bioengineering
	21. Food Engineering	45. Food Technology
		46. Quality management
		47. Process and Equipment of Food Technology
School of Environmental Science and Technology	22. Environmental Engineering	48. Environmental technology
		49. Environmental management
School of Materials Science & Engineering	23. Materials engineering	50. Materials mechanics and forming technology
		51. Materials chemistry and manufacturing
		52. Materials physics and process technology
	24. Metallic material engineering	53. Iron and steel engineering
		54. Lamination technology and equipment

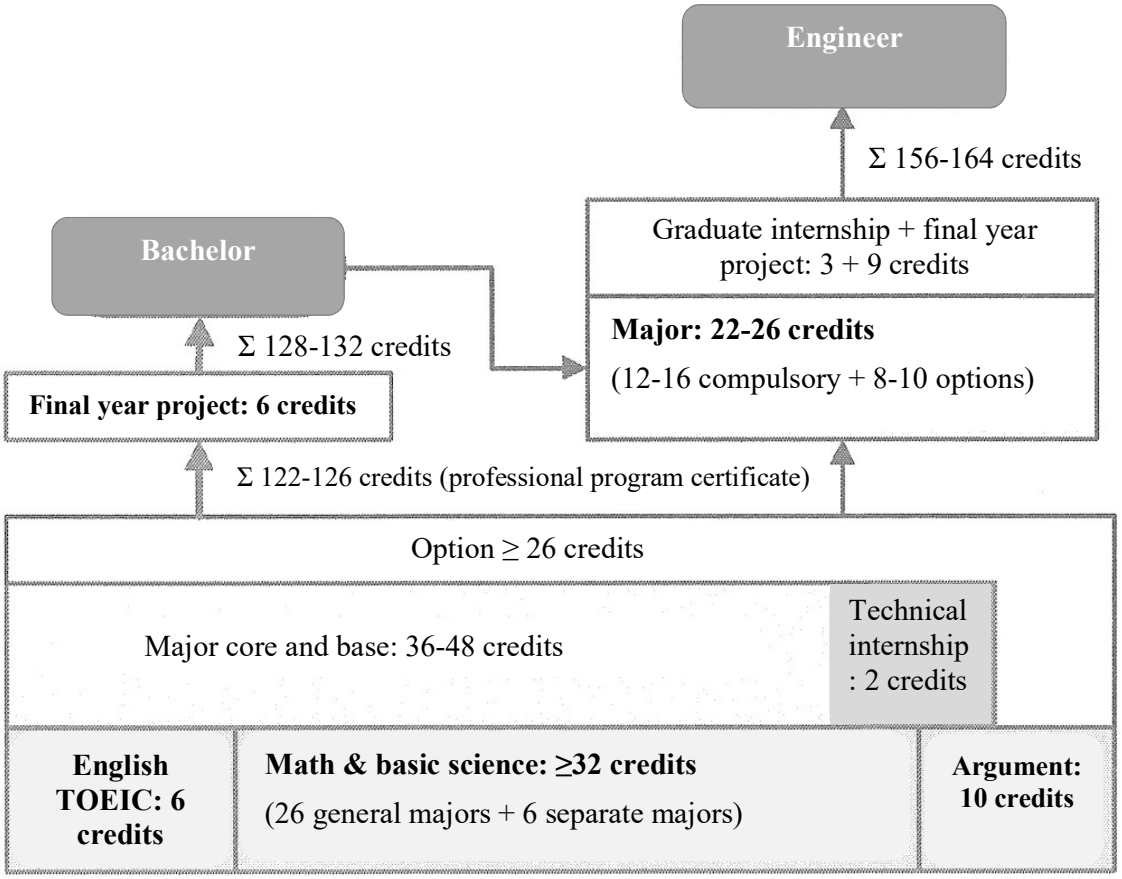
		55. Casting
		56. Materials & Surface Heat Treatment
		57. Non-ferrous materials and composites
School of Textile - Leather and Fashion	25. Weaving techniques	58. Textile technology
		59, Dyeing and finishing technology
	26. Sewing technology	60. Technology of sewing products
		61. Design of garment and fashion products
	27. Leather technology	62. Design of leather and footwear products
School of Engineering Physics	28. Engineering Physics	63. Light physics and engineering (applicable until the end of 2015)
		64. Electronic materials technology (applicable until the end of 2015)
		65. Informatics physics
		66. Electronic materials and nanotechnology (applicable from 2016)
		67. Optics and photovoltaics (applicable to 2016)
School of Nuclear Engineering & Environmental Physics	29. Nuclear Engineering	68. Nuclear energy engineering
		69. Applied nuclear engineering and environmental physics
Bachelor (4 years)		
Bachelor of Technical Pedagogy (4 years)		
School of Engineering Pedagogy	30. (Bachelor) industrial engineering pedagogy	70. (Bachelor) Pedagogy of Information Technology Engineering
		71. (Bachelor) Pedagogy of Electronic Engineering
		72. (Bachelor) Pedagogy of Electrical engineering
		73. (Bachelor) Pedagogy of Mechanical Engineering
Bachelor of Science (4 years)		
School of Chemical Engineering	31. (Bachelor of Science) Chemistry	74. (Bachelor of Science) Chemistry
School of Economics & Management	32. (Bachelor of Science) Business Administration	75. (Bachelor of Science) Business Administration
	33. (Bachelor of Science) Industrial Management	76. (Bachelor of Science) Industrial management
	34. (Bachelor of Science) Industrial Economics	77. (Bachelor of Science) Energy Economics
	35. (Bachelor of Science) Finance and Banking	78. (Bachelor of Science) Corporate Finance
	36. (Bachelor of Science) Accounting	79. (Bachelor of Science) Accounting
School of Foreign Languages	37. (Bachelor of Science) English language	80. (Bachelor of Science) English for sciEnce, Technology and Technology
		81. (Bachelor of Science) International professional English
School of Applied Mathematics and	38. (Bachelor of Science) Management Information Systems	82 (Bachelor of Science) Management Information Systems
Bachelor of Technology (4 years)		
School of Mechanical Engineering	39. (Bachelor of Technology) Mechanical Engineering Technology	83. (Bachelor of Technology) Mechanical Engineering Technology
	40. (Bachelor of Technology) Machine-Building Technology	84. (Bachelor of Technology) Machine-Building Technology
	41. (Bachelor of Technology) Automotive engineering technology	85. (Bachelor of Technology) Automotive engineering technology

School of Transporation Engineering	42. (Bachelor of Technology) Automotive Engineering Technology	86. (Bachelor of Science) Automotive Technology
School of Electrical Engineering	43. (Bachelor of Technology) Control engineering technology and automation	87. (Bachelor of Technology) Control engineering technology and automation
	44. (Bachelor of Technology) Electrical & Electronic Engineering Technology	88. (Bachelor of Technology) Electrical & Electronic Engineering Technology
School of Electronics and Telecommunications	45. (Bachelor of Technology) Electronic & Telecommunication Engineering Technology	89. (Bachelor of Technology) Electronic & Telecommunication Engineering Technology
School of Information and	46. (Bachelor of Technology) Information Technology	90. (Bachelor of Technology) Information Technology
School of Chemical Engineering	47. (Bachelor of Technology) Chemical Engineering Technology	91. (Bachelor of Technology) Chemical Engineering Technology
School of Biotechnology & Food Technology	48. (Bachelor of Technology) Food Technology	92. (Bachelor of Technology) Food Technology
Special training courses		
Advanced programs		
School of Electronics and Telecommunications	1. (Advanced Program) Biomedical engineering	
School of Materials Science and Engineering	2. (Advanced Program) Materials engineering	(Advanced Program) Electrical materials
School of Materials Science and Engineering	3. (Advanced Program) Metallic Materials Engineering	
School of Mechanical Engineering	4. (Advanced Program) Electromechanical Engineering	
School of Electrical Engineering	5. (Advanced Program) Electrics - Electronics	(Advanced Program) Automatic control
School of Electronics and Telecommunications	6. (Advanced Program) Electrics - Electronics	(Advanced Program) Microelectronics
School of Electronics and Telecommunications	7. (Advanced Program) Electrics - Electronics	(Advanced Program) Electronics and telecommunications
School of Electrical Engineering	8. (Advanced Program) Electrics - Electronics Cabinet area	(Advanced Program) Electrical system
High-quality Engineer Programs		
School of Information and	1. (High-quality) Information System	
School of Electrical Engineering	2. (High-quality) Industrial Informatics	(CLC) Industrial Informatics
School of Transporation	3. (High-quality) Aviation Engineering	
Talent Engineer Programs		
School of Mechanical Engineering	1. (Talent Engineer) Mechatronic Engineering	
School of Information and	2. (Talent Engineer) Information Technology	
School of Chemical Engineering	3. (Talent Engineer) Organic technology - Petrochemical	

School of Applied Mathematics	4. (Talent Engineer) Applied Mathematics	
School of Electrical Engineering	5. (Talent Engineer) Automatic control	(Talent Engineer) Automatic control
School of Electronics and Telecommunications	6. (Talent Engineer) Electronics and Telecommunications	
School of Engineering Physics	7. (Talent Engineer) Engineering Physics	

3. Framework of University training program 2009

The training program of HUST applied in 2009 is gradually renewed on the basis of international standards.



3.1. Frame of Bachelor of Engineering Program

No.	Program	Number of credits
1	**General education**	**≥ 48**
1.1	Math and basic science - Compulsory all majors - Each supplementary major	≥ 32 26 ≥ 6
1.2	Political theory	10
1.3	Physical education	Certificate
1.4	National defense education-security	Certificate
1.5	English	6
2	**Professional Education**	**64-78**
2.1	Major core and base	36-48

2.2	Option based on self-orientation	≤18
2.3	Option	≥ 8
2.4	Technical Internship	2
2.5	Bachelor's Final Year Project	6
	Total program volume	**128-132**

3.2 Frame of Engineer Program

No.	Program	Number of credits
1	**Bachelor's Subject Program** (including sections 1.1-2.3 of the Bachelor of Engineering Program)	**122-126**
2	**Engineering program**	**34-38**
2.1	Required majors	12-18
2.2	Elective majors	8-10
2.3	Final internship and Final Year Project	12
	Total program volume	**156-164**

3.3 Frame of Bachelor of Technology Program

No.	Program	Number of credits
1	**General education**	**48**
1.1	Math and basic science - Compulsory all majors - Each supplementary major	32 24 8
1.2	Political theory	10
1.3	Physical education	Certificate
1.4	National defense education-security	Certificate
1.5	English	6
2	**Professional Education**	**80**
2.1	Major core and base	36-42
2.2	Major	12-18
2.3	Option	8
2.4	Technology Internship	12
2.5	Technology Bachelor's Final Year Project	6
	Total program volume	**128**

3.4 Frame of Bachelor of Economics and Management Program

No.	Program	Number of credits
1	**General education**	**45**
1.1	Math and basic science	29
1.2	Political theory	10
1.3	Physical education	Certificate
1.4	National defense education-security	Certificate
1.5	English	6
2	**Professional Education**	**87**
2.1	Major core and base	46
2.2	Major	20
2.3	Option	13
2.4	Engineering Internship	2
2.5	Final Year Project	6

	Total program volume	**132**

3.5 Frame of Bachelor of English Program

No.	Program	Number of credits
1	**General education**	**32**
1.1	Political theory	10
1.2	Physical education	Certificate
1.3	National defense education-security	Certificate
1.4	Second foreign language	10
1.5	General knowledge of compulsory foreign languages and general informatics	6
1.6	General knowledge of selected foreign languages	6
2	**Professional Education**	**100**
2.1	Major core and base	73
2.2	Option by self-orientation	14
2.3	Option	4
2.4	Graduation Internship	3
2.5	Final Year Project	6
	Total program volume	**132**

3.6 Standard English level

To be qualified to study and work in an international environment, students of HUST must have English level equivalent to 450 points as minimum according to TOEIC standards before doing their thesis or graduation project. To ensure that students have a study plan to meet this output standard, the University stipulates the English standard requirements according to the level of the school year:

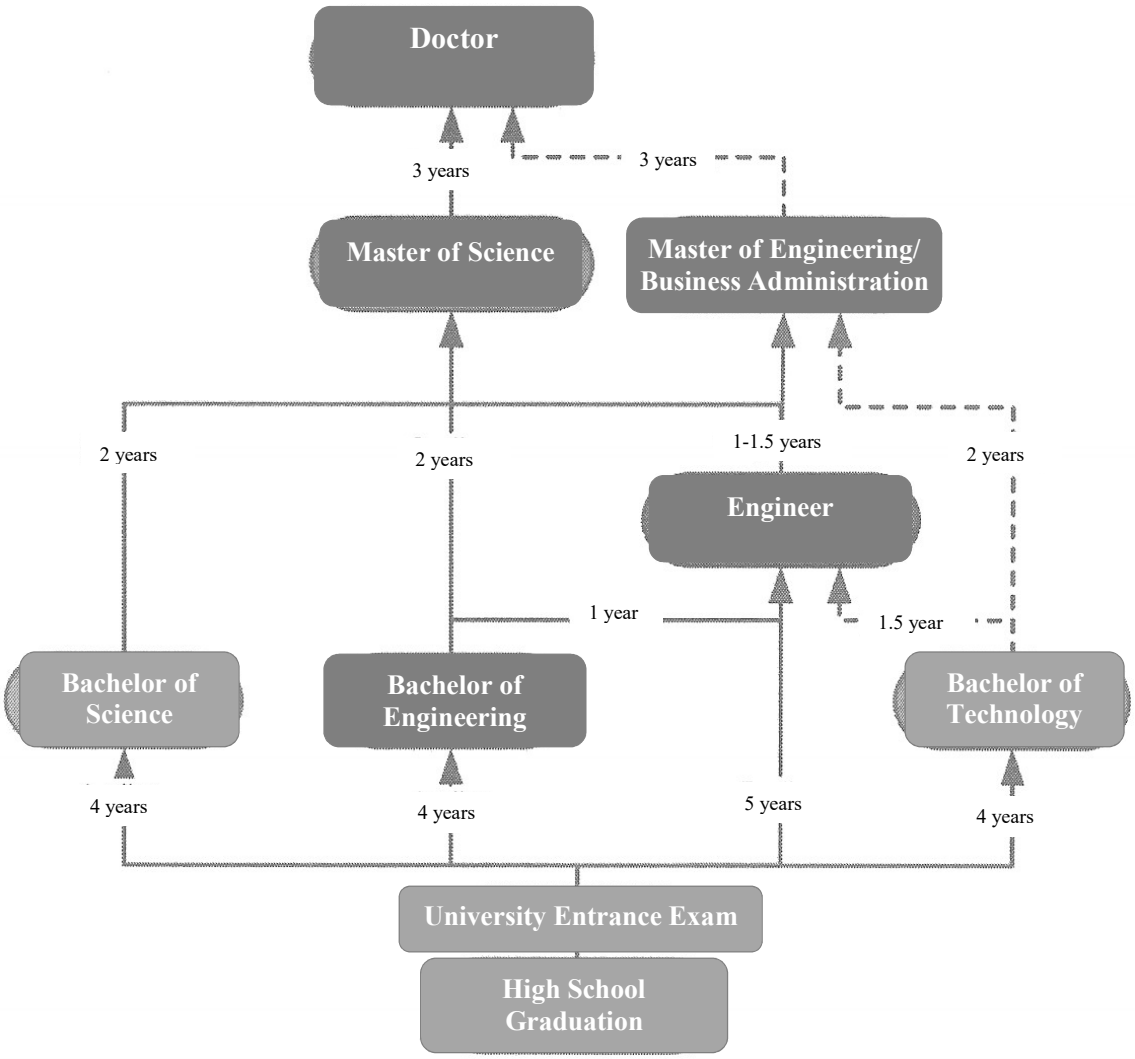
- Second-year students: 300 points
- Third-year students: 350 points
- Students from the fourth year level: 400 points
- Before doing graduation project/thesis: 450 points.

APPENDIX 2: GRADUATE EDUCATION PROGRAM IN 2009

1. Training model

Under the orientation of continuing comprehensive innovation to integrate with the university and graduate training model of the world, and at the same time to ensure effective implementation of the direction of the Ministry of Education and Training on training according to social needs, Hanoi University of Science and Technology has developed the project named "Innovation of training models and programs at Hanoi University of Science and Technology for the period of 2009-2015" and has been approved by the Ministry of Education and Training to implement; accordingly, the master's degree of Hanoi University of Science and Technology is organized in two models including Master of Science and Master of Engineering.

- Master (Master of Science, Master of Engineering and Master of Business Administration subject to the training orientation and training major), the designed training time for Bachelor graduates is 2 years (4+2) and for Engineering graduates is from 1 to 1.5 years (5+1);
- Doctorate, the training duration according to design for Master graduates is 3 years and for Engineering graduates (with excellent degree) is 4 years;



1.4 Master Training Programs

Master training programs are designed for 1 to 2 years, learners have in-depth professional qualifications, systematic thinking methods, basic scientific knowledge and solid technical foundations, good practical skills, ability to master related science and technology problems and ability to solve practical problems of the major. Master students have high ability to do independent, group and integrated scientific research.

Master degree programs are streamed in two directions:

- Master of Science (MSc) program is research-oriented, for those who follow the path of teaching and research.
- Master of Engineering (MSc) or Master of Business Administration (MBA) program is career-oriented and applied for those who want to supplement both advanced specialized knowledge (as for engineers) as well as a broader knowledge of science and engineering for a broader range of activities, especially in interdisciplinary work.

Training duration:

- The official training period of the training courses of Master is from 2011 and 2013 and from 1 year 2 years.
- For majors such as "Business Administration", "Theory and methods of technology teaching", engineering majors specialized in engineering products, the duration for credit training system is from 1.5 to 2.5 years.
- The official training of master enrollment training course since 2014 is 2 years.

1.5. Doctoral training programs

Master training programs are designed for a period of 3 to 4 years. Learners have a high level of expertise and ability to independently research and lead research groups in the fields of major, have scientific thinking, ability to approach and solve specialized scientific problems, and be able to present and introduce scientific contents, at the same time be capable of training undergraduate and graduate degrees.

Training duration:

- Progressive collective training system: 3 consecutive years for graduate students who have Master degree, and 4 years for graduate students who have university degrees.
- Non-progressive collective training system: graduate students who have Master degree register to study for 4 years and guarantee the total study and research time at the University is 3 years and the first 12 months of continuous collection at the University.

2. Master and doctoral training modules and majors since 2009

Schools in charge	Major	Master	Doctor
Mechanics	1. Engineering mechanics	1. Mechanical engineering	1. Mechanical engineering
	2. Solid mechanics	--	2. Solid mechanics
	3. Mechanical engineer (engineering)	2. Machine building	3. Machine building technology
		3. Welding technology	4. Welding engineering
		--	5. Machine tool engineering
		--	6. Auto devices and control system
	4. Electromechanical engineering	4. Electromechanical engineering	--
Transportation Engineering	5. Aviation engineering		7. Aeronautical and aerospace engineering
	6. Ship engineering	--	8. Ship engineering
	7. Mechanical engineering (Transportation)	5. Hydraulic engineering	9. Mechanical engineering and hydraulic equipment
		6. Engineering of internal combustion	10. Thermal engine engineering

		7. Automotive engineering	11. Automotive and tractor engineering
	8. Fluid mechanics	--	12. Fluid mechanics
Heat - Refrigeration	9. Heat engineering	8. Heat engineering	13. Heat technology and equipment
			14. Refrigeration technology and equipment
Electrics	10. Electrical & Electronic engineering	9. Electrical system	15. Network and electrical system
		10. Electrical & electronic equipment	16. Electrical equipment
	11. Automated control engineering and Automation	11. 1 Automated control engineering and Automation	17. Control theory and optimal control
			18. Automatic control equipment and system
			19. Industrial automation
			20. Signal measurement and handling
		12. Measurement and control systems	--
Electronics and Telecommunications	12. Electronic engineering & communication	13. Electronic engineering	21. Electronic Engineering
		14. Telecommunications Engineering	22. Telecommunications Engineering
		15. Biomedical Engineering	--
	13. Biomedical Engineering	--	--
IT & Communications	14. Computer engineering	16. Computer Engineering	23. Computer Engineering
	15. Computer Science	17. Computer Science	24. Computer Science
	16. Communications & computer networks	18. Computer networks and data communication	25. Computer networks and data communication
	17. Software Engineering	19. Software Engineering	26. Software technology
	18. Information system	20. Information systems	27. Information systems
	19. Information technology	21. Information technology	--
Math-Informatics	20. Math-Informatics	22. Mathematical base for informatics	28. Mathematical base for informatics
	21. Applied math	23. Applied math	29. Computational Mathematics
			30. Optimization theory
	22. Calculus	--	31. Calculus
	23. Differential and integral equations	--	32. Differential and integral equations
	24. Probability theory and mathematical statistics	--	33. Probability theory and mathematical statistics
Chemical Engineering	25. Chemical Engineering	24. Refinery & petrochemical technology	34. Petrochemicals and organic catalysis
		--	35. Electrochemical technology and metal protection
		25. Silicate material technology	
		--	36. Chemical technology of inorganic substances
		--	37. Chemical technology equipment
		26. Chemistry	--

		27. Chemical Engineering	--
		28. Printing and Communication	--
	26. Theoretical chemistry and physical chemistry	--	38. Theoretical chemistry and physical chemistry
	27. Organic chemistry	--	39. Organic chemistry
	28. Macromolecular and composite	--	40. Technology of macromolecular materials and combinations
Biotechnology & Food Technology	29. Bioengineering	29. Biotechnology	41. Biotechnology
	30. Food Engineering	30. Food Technology	42. Food Technology
		31. Quality management in the food industry	
	31. Post-harvest technology	--	43. Post-harvest technology
Environment	32. Environmental engineering	32. Environmental engineering	44. Water and wastewater environmental technology
			45. Solid waste environmental technology
			46. Air environment technology
	33. Management of natural resources and environment	33. Resource and environment management	--
Materials Engineering	34. Materials engineering	34. Materials Science and Engineering (Metallic Material Science and Engineering)	47. Orientation: Material shaping technology 48. Orientation: Inorganic materials technology
	35. Metallic materials engineering		--
	36. Metallography	--	49. Metallography
Textile	37. Technology of textile and garment	35. Technology of textile materials	-
	38. Technology of textile and garment		50. Technology of textile and garment
Technical physics	39. Engineering Physics	36. Engineering Physics	51. Engineering Physics
	40. Theoretical Physics and Mathematical Physics	37. Theoretical Physics and Mathematical Physics	52. Theoretical Physics and Mathematical Physics
	41. Solid Physics	--	53. Solid Physics
Nuclear Engineering	42. Nuclear Engineering	38. Nuclear Engineering	54. --
Engineering Pedagogy	43. Theory and Pedagogy	39. Engineering pedagogy	55. Electrical engineering pedagogy
		--	56. Electronic engineering pedagogy
		--	57. Information technology technical pedagogy
		--	58. Mechanical engineering pedagogy
Management Economics	44. Business Administration	40. Business Administration	--
	45. Industrial management	--	59. Industrial management
	46. Economic management	41. Economic management	--
	47. Economics	42, Economics	60. Economics

School of Science and Technology of Calculation (ICSE))	48. Information technology	43. Computational Science and Engineering	--
ITIMS	49. Materials science and engineering	44. Electronic materials science and engineering	--
	50. Electronic materials	--	61. Materials
			62. Technology of electrical materials
AIST	51. Engineering Physics	45. Nanoscience and technology	--
	52. Optical materials, optoelectronics and Photon	--	Technology of optical materials, photovoltaics and photon
MICA	53. Computer Science	46. Sensory, multimedia and interactive environments	--

3. Framework of Postgraduate training program

The training program of HUST has been applied since 2009. The master training program has been renewed since 2013 and the doctoral program has been renewed since 2015 according to requirements of the Ministry of Education and Training.

- ❖ Master training program includes the following knowledge bases:

Contents		**Application orientation (60 credits)**	**Research orientation (60 credits)**
General knowledge (Philosophy, English)		9	9
Basic knowledge	General compulsory knowledge	16 credits	
	Selective basic knowledge	6 credits	
Specialized knowledge	Compulsory specialized knowledge	12	9
	Selective specialized knowledge	9	6
Final year project		9	15

- ▪ Learners are graded according to their bachelor/engineering majors: correct major; similar majors and relevant majors.
- ▪ The training period is from 1 to 2 years subject to the type of subjects and the training majors.

- ❖ Doctoral training program includes the following knowledge bases:

	Training content	**A1**	**A2**	**A3**
1	Supplementary course	0	Master of Science	16 credits ≥ supplementary ≥ 4 credits
	Master course	8 credits		
2	Overview essay	2 credits		
	Doctoral thesis	Total 3 doctoral topics, 2 credits for each		
3	Science research and doctoral essay	90 credits (for 3 years for progressive collective training program and 4 years for non-progressive collective training program).		

- *Subject A1*: Learners have a Master of Science of HUST, Master of Science of prestigious overseas universities with a master's degree in the same discipline/major as a Doctorate.
- *Subject A2*: Learners have a university degree according to discipline/major, graded at "Excellent" or "Good". These subjects must participate in additional study of the entire Master of Science program (except for master thesis).
- *Subject A3*: Learners have a Master of Science in engineering (application-oriented master) in correct major or have a Master of Science in a relevant discipline.

APPENDIX 3: LIST OF BACHELOR TRAINING PROGRAMS IN 2017
(May be adjusted according to the actual situation)

TT	Name of training programs of bachelor of Engineering/Technology/Economic Management	Name of training programs of Bachelor of Technology
1	Mechanical engineer	Machine building technology
2	Mechatronic Engineering	Mechatronic engineering technology
3	Aviation technique	Automotive engineering technology
4	Ship engineering	
5	Mechanical Engineering	
6	Heat engineering	-
7	Electrical Engineering	Electrical engineering technology
8	Control and automation engineering	Control and automation engineering technology
9	Electronics and Telecommunications Engineering	Technology of Electronics and Telecommunications Engineering
10	Computer science	Information technology
11	Computer Engineering	
12	Information system	
13	Software technology	
14	Communication and computer networks	
15	Math-Information	-
16	Management information systems	
17	Chemical engineering	Chemical engineering technology
18	Printing technique	-
19	Chemistry (Science Technology)	-
20	Bioengineering	Food Technology
21	Food Engineering	
22	Environmental engineer	-
23	Materials Engineering	-
24	Weaving techniques	-
25	Sewing technology	-
26	Technical physics	-
27	Nuclear engineering	-
28	Industrial engineering pedagogy	-
29	Business administration	-
30	Industrial management	
31	Industrial economics	
32	Accounting	
33	Finance - Banking	
30	English language	-

APPENDIX 4: COST ESTIMATION FOR IMPLEMENTATION

No.	Expense	Quantity (credit)	Payment (VND/credit)	Provision (VND)	Remark
I.	**Development of framework programs and program outlines**				
1.	***Developing framework programs for general knowledge (50 credits)***				*General Council*
	1.1 Preparing the program	500	125,000	62,500,000	*50 credits for General education - 12 credits for program theory + 9 credits of supplementary knowledge = 47 credits ~ 50 credits Number of major groups: 6 groups as expected: 50 credits *10=500 credits*
	1.2 Correction and editing	500	75,000	37,500,000	
	1.3 Evaluation and refutation	500	50,000	25,000,000	
2	***Developing detailed outlines for general subjects***				
	2.1 Preparing detailed outlines	500	375,000	187,500,000	
	2.2 Correction and editing	500	150,000	75,000,000	
	2.3 Evaluation and refutation	500	100,000	50,000,000	
	Total I			**437,500,000**	
II.	**Development of program frameworks and program outlines for general and specialized subjects for Master Degree**				
1	***Developing program frameworks for basic and specialized subjects (81 credits)***				
	1.1 Preparing the program	3062	125,000	382,750,000	*34 training programs for Bachelor of Engineering + 9 training programs for Bachelor of Technology (81 credits -9 credits of supplementary knowledge = 72 credits for each program)*
	1.2 Correction and editing	3062	75,000	229,650,000	
	1.3 Evaluation and refutation	3062	50,000	153,100,000	
2	***Developing program frameworks for basic and specialized subjects***				
	2.1 Preparing the program	3062	375,000	1,148,250,000	
	2.2 Correction and editing	3062	150,000	459,300,000	

	2.3 Evaluation and refutation	3062	100,000	306,200,000	
	Total II			**2,679,250,000**	
III.	**Development of program frameworks for additional knowledge of Industry - Technology - Engineer**				
1	***Developing program frameworks for additional knowledge of Industry - Technology - Engineer (18 credits)***				
	1.1 Preparing the program	288	125,000	36,000,000	*9 programs for Bachelor of Technology. Each program needs to supplement 18 credits → total number of credits is 16*18=162 credits.* *Excluding the costs for development of detailed outlines because this is the knowledge selected from the modules of the Bachelor of Engineering.*
	1.2 Correction and editing	288	75,000	21,600,000	
	1.3 Evaluation and refutation	288	50,000	14,500,000	
	Total III			**72,000,000**	
IV.	**Development of program frameworks and program outlines for engineers**				
1	**Developing program frameworks for subjects for engineers (34 credits)**				
	1.1 Preparing the program	2380	125,000	297,500,000	*68 training programs for engineers as expected. Each program includes 35 credits. Total number of credits is 35*68=2380 credits*
	1.2 Correction and editing	2380	75,000	178,500,000	
	1.3 Evaluation and refutation	2380	50,000	119,000,000	
2	**Developing detailed outlines for subjects**				
	2.1 Preparing the program	2380	375,000	892,500,000	
	2.2 Correction and editing	2380	150,000	357,000,000	
	2.3 Evaluation and refutation	2380	100,000	238,000,000	
	Total IV			**2,082,500,000**	
V.	**Development of program frameworks and program outlines for masters**				
1	***Developing program frameworks (45 credits)***				
	1.1 Preparing the program	2025	125,000	253,125,000	*45 training programs*

					*for masters as expected. Each training program includes 45 credits. Total number of credit is 45*45=2025 credits.*
	1.2 Correction and editing	2025	75,000	151,875,000	
	1.3 Evaluation and refutation	2025	50,000	101,250,000	
2	**Developing detailed outlines of subjects**				
	2.1 Preparing the program	2025	375,000	759,375,000	
	2.2 Correction and editing	2025	150,000	303,750,000	
	2.3 Evaluation and refutation	2025	100,000	202,500,000	
	Total V			**1,771,875,000**	
			TOTAL (I÷V)	**7,043,125,000**	

Bases for cost estimation: Pursuant to Circular No. 123/2009/TT-BTC of the Ministry of Finance with the expenditure level specified in Clause 1, Article 4 as follows:

1. Costs for development of framework programs, subject programs, and textbooks for training majors:

a/ Costs for development of framework programs:

- Cost for program preparation: 25,000 VND/lesson (equivalent to 375,000/credit)
- Cost for correction and editing: 15,000 VND/lesson (equivalent to 225,000/credit)
- Cost for evaluation and refutation: 10,000 VND/lesson (equivalent to VND 150,000/credit)

b/ Costs for development of subjects:

- Cost for program preparation: 75,000 VND/lesson (equivalent to 1,125,000/credit)
- Cost for correction and editing: 30,000 VND/lesson (equivalent to 450,000/credit)
- Cost for evaluation and refutation: 20,000 VND/lesson (equivalent to 300,000/credit)

c/ Costs for compiling textbooks:

- Textbook writing: 70,000 VND/standard page
- Overall correction and editing: 25,000 VND/standard page
- Costs for evaluation and refutation: 35,000 VND/standard page

d/ Costs for modification and supplementation of framework programs, subject curricular, and textbooks: the maximum level shall not exceed 30% of the above new development expenditures.