

Bachelor of Science Program in Clinical Technology

**(International Program/New Curriculum, Academic
Year 2016)**

Chulabhorn International College of Medicine

Thammasat University

(New curriculum submitted to Office of the Higher Education Commission, Revised 28 January 2016)

Program Overview
Bachelor of Science Program in Clinical Technology
(International Program/New Curriculum, Academic Year 2016)

Institution Thammasat University

Campus/Faculty Rangsit Campus/Chulabhorn International College of Medicine

Section 1 General Information

1. Title of the Program

English : Bachelor of Science Program in Clinical Technology
(International Program)

2. Title of the Degree

English : Full Title Bachelor of Science (Clinical Technology)
 : Abbreviated Title B.Sc. (Clinical Technology)

3. Major Subject

None

4. Total Credits

142 credits

5. Curriculum Characteristics

5.1 Curriculum Type

A four-year bachelor's degree program

5.2 Language

English

5.3 Admission Requirements

Applicants (Thais and foreigners) with good command of English

5.4 Cooperation with Other Institutions

This is a specific program offered by the instructional institution. The program will be cooperated with the following institutions:

Inside Thammasat University

Thammasat University Hospital

Faculty of Medicine, Thammasat University

Faculty of Science and Technology, Thammasat University

Outside Thammasat University

Bumrungrad International Hospital

Tobacco Monopoly Hospital

Chulabhorn Hospital

International Institution

Kyushu University for Health and Welfare, Miyazaki, Japan

5.5 Type of Conferred Degree

A single degree

6. Curriculum Status and Curriculum Approval

This is a new curriculum starting in the First Semester of Academic Year 2016.

The Subcommittee of Thammasat University Council on Curriculum and Academic Management approved the curriculum in the 10/2015 meeting on 17th December 2015.

The University Council approved the curriculum in the 1/2016 meeting on 11th January 2016.

7. Readiness to Implement and Promote the Curriculum with Quality and Standards

Academic Year 2018 (two years after its inauguration)

8. Career Prospects after Graduation

1. Clinical technologists
2. Medical engineering experts at public or private hospitals or equipment centers of local and international organizations
3. Medical engineering experts at medical equipment manufacturers

4. Medical equipment experts at institutions that oversee the quality control and analyze budgets of medical equipment, for example, Food and Drug Administration, Ministry of Public Health, Ministry of Industry, the Customs Department, Ministry of Finance
5. Medical equipment distributors
6. Medical equipment business owners
7. Pursue postgraduate studies on medical engineering or related fields at local or overseas institutions in order to become an instructor or pursue an academic career.
8. Researchers in Biomedical Engineering

9. Name-Surname, Identification Number, Positions, and Academic Qualifications of Instructors Responsible for the Curriculum

No.	Identification Number	Academic Position	Name-Surname	Academic qualification	Major	Graduation	
						Institution	Year
1	310120198xxxx	Associate Professor	Sombat Muengtaweepongsa, MD	- Certificate of Cerebrovascular and Critical Care Neurology	- Cerebrovascular and Critical Care Neurology	- Saint Louis University, Missouri, USA	2007
				- Diploma Thai Board	- General Neurology	- Faculty of Medicine Ramathibodi Hospital, Mahidol University	1998
				- Bachelor of Medicine	- Medicine	- Ramathibodi Hospital, Mahidol University	1992
2	319050001xxxx	Instructor	Dr. Nipaporn Ngernyuang	- Doctor of Philosophy	- Biomedical Science	- Khon Kaen University	2014
				- Master of Science	- Genetics	- Kasetsart University	2007
				- Bachelor of Science	- Biology	- Burapha University	2004
3	136040009xxxx	Instructor	Dr. Suwit Chaisri	- Doctor of Philosophy	- Biomedical Science	- Khon Kaen University	2014
				- Bachelor of Science	- Medical Technology	- Khon Kaen University	2009
4	153990010xxxx	Instructor	Dr. Yardnapar Parcharoen	- Doctor of Philosophy	- Biological Engineering	- King Mongkut's University of Technology Thonburi	2014
				- Bachelor of Science	- Microbiology	- King Mongkut's University of Technology Thonburi	2008
5	3769900172xxx	Instructor	Thanee Eiamsitrakoon, MD	- Diploma Thai Board of Nephrology	- Nephrology	- Thammasat University	2013
				- Diploma Thai Board of Internal Medicine	- Nephrology	- The Royal College of Physicians of Thailand	2011
				- Bachelor of Medicine	- Medicine	- The Royal College of Physicians of Thailand	2006

No.	Identification Number	Academic Position	Name-Surname	Academic qualification	Major	Graduation	
						Institution	Year
6	310050178xxxx	Instructor	Pattarin Pirompanich, MD	- Diploma Thai Board	- Intensive and Critical Care Medicine	- Phramongkutklao Hospital	2014
				- Diploma Thai Board	- Pulmonary Medicine and Pulmonary Critical Care	- Phramongkutklao Hospital	2013
				- Higher Graduate Diploma in Clinical Medical Sciences	- Internal Medicine	- Chiang Mai University	2011
				- Diploma Thai Board	- Internal Medicine	- Chiang Mai University	2011
				- Bachelor of Medicine	- Medicine	- Chulalongkorn University	2007

10. Instructional Venue

Instructional location and equipment are available at Chulabhorn International College of Medicine at Thammasat University, Rangsit Campus

11. External Factors or Necessary Development to Be Considered in Curriculum Planning

11.1 Economic Situation or Development

Marketing research conducted between 2010 and 2015 shows that in Thailand the value of medical equipment manufactured locally and imported from overseas reached over 37,500 - 57,000 million Baht.¹ With this information, several public and private organizations have seen the need for medical equipment development. They have also planned for the development and manufacturing of a wider variety of medical equipment, with higher efficiency, and local production. With several forms of cooperation, they have established small specialized organizations for mutual understanding on quality control of medical equipment (both locally produced and imported from overseas). These organizations will also increase the capacity of medical equipment development by using research evidence and raise the possibility of local industrial production. These organizations include Thai Medical Device Technology Industry Association (THAIMED). The medical equipment cluster promotes cooperation between Thailand Center of Excellence for Life Sciences (TCELS), Mahidol University, National Electronics and Computer Technology Center (NECTEC), National Center for Genetic Engineering and Biotechnology (BIOTEC), National Nanotechnology Center (NANOTEC), and several other organizations.

Therefore, a large number of medical engineering professionals are needed for maintaining and extending the life span of existing equipment, developing locally manufactured equipment, and fostering local industrial production to decrease the need for imported equipment. Medical engineering professionals will also evaluate and control the quality of medical equipment. Their goals are to ensure that medical equipment in the local market meet global standards of quality and safety. These medical devices are important to high-quality public health services and will strengthen Thailand's position as the medical hub of Asia. For all these reasons, it is necessary to produce highly competent medical and engineering professions. The Bachelor of Science in Clinical Technology program is consequently established. Furthermore, this international program is designed in accordance with the establishment of the ASEAN Economic Community (AEC).

(1. Journal of Medical Devices Regulation, volume31, 2012.)

11.2 External Factors or Social and Cultural Development

Thailand's 2014 Development Strategy composes of four main strategies, 30 main issues, and 79 implementation guidelines. Some strategic details are related to the curriculum development.

The government's vision is "Thai people have competitive ability and live comfortably in an equal and fair society." The strategic principles are "to raise money income cumulatively, to earn additional income from new opportunities for balance and sustainable development." The first main issue of the fourth strategic objective is to enhance national competitiveness and economic growth so that the country will be free from middle-income status. The second main issue (industry) number 2.2 is to support future industrial development (such as bioplastics industry). The sixth main issue (local economy connection) number 6.1 is to enhance the competitiveness of services, merchandise, and investment to seize investment opportunities in connected ASEAN. The seventh main issue (development of competitive capability) number 7.1 is to improve competitive capability and number 7.2 is to enhance the nation's branding as a thoroughly modern country. The ninth main issue is the development of cities and areas to support ASEAN opportunities. Number 9.5 is the development of cities that provide excellent health services in response to these policies. Many organizations have developed their organizational strategies to conform to national policies. For instance, Office of the Higher Education Commission (OHEC), Ministry of Education, has realized that higher education needs to enhance and improve their curriculums and instruction in every faculty and department to meet international standards. High-quality, internationally competent graduates will contribute to the nation's competitive capabilities.

2015 Strategies of Ministry of Public Health consistent with national strategies and related with this curriculum development include: development and systematization of health care services, personnel competency development in consonance with short-term and long-term plannings, and enhancement of national strength. The Ministry aims to promote Thailand's health products and services to be widely known internationally in order to boost national economic growth and to enhance health service capability, especially at tertiary level (medical hub). In Post-2015 Health Development Agenda, Thailand is positioned to be the medical hub of Asia and a center of academic development in many specialized fields.

Strategic plans of Ministry of Industry consistent with national strategies and related with this curriculum development include: the connections of local industries with ASEAN Economic Community, adjustment of production structure for knowledge-based industries, and strengthening of business owners' ability to effectively compete in the global market.

12. The Effects Mentioned in No.11.1 and 11.2 on Curriculum Development and Their Relevance to the Missions of the Institution

12.1 Curriculum Development

The curriculum development process focuses on enhancing students' theoretical knowledge and practical skills. Competent students will be able to work in specific organizations specializing in medical equipment and devices necessary for medical diagnosis and treatment of respiratory tract diseases, nephropathy, heart disease, and nervous system diseases. Students acquire the ability and skills to operate, inspect, repair, assess, and analyze problems with medical equipment and devices. Students also develop awareness of patient safety and utmost benefits.

12.2 The Relevance to the Missions of the Institution

The university aims to produce competent clinical technologists with professional competencies, high ethical standards, and a good command of English communication skills. The university also promotes academic services to the local community in order to improve citizens' health, develops academic services to research, and produces qualified personnel in response to the policy of developing Thailand into a leading international medical and healthcare hub. This will lead to the development and enhancement of Thailand and the ASEAN region into equal, secure, and strong communities that are internationally recognized. This is one of Chulabhorn International College of Medicine's main missions and is consistent with Thammasat University's mission for educational management.

13. Cooperation with Other Programs in the Faculty/Other Departments in the Institution

13.1 General Education Courses

These are the university's general courses and courses that are imposed by Chulabhorn International College of Medicine. Every student must earn 30 credits from these courses.

1) General Education Courses Part 1 (21 credits)

TU100	Civic Education	3(3-0-6)
TU101	Thailand, ASEAN, and the World	3(3-0-6)
TU102	Social Life Skills	3(3-0-6)
TU103	Life and Sustainability	3(3-0-6)
TU050	English Skill Development	non-credit
TU104	Critical Thinking, Reading, and Writing	3(3-0-6)
TU105	Communication Skill in English	3(3-0-6)

TU106	Creativity and Communication	3(3-0-6)
TU155	Elementary Statistics	3(3-0-6)

2) General Education Courses Part 2 (9 credits)

TU116	Man and Arts: Visual Art, Music and Performing Arts	3(3-0-6)
TU122	Law in Everyday Life	3(3-0-6)
TU156	Introduction to Computers and Programming	3(3-0-6)

13.2 Basic Science Courses – four courses (12 credits)

SC111	Biology 1	3(3-0-6)
SC123	Fundamental Chemistry	3(3-0-6)
SC125	General Organic Chemistry	3(3-0-6)
SC136	Physics	3(3-0-6)

13.3 Courses/Groups of Courses Offered to Students from Other Faculties, Departments, and Programs

Two courses offered by Chulabhorn International College of Medicine

CMM217	General Anatomy and Physiology	3(2-2-5)
CMM221	Patient Assessment	1(1-0-2)

Administration and Management

General Education, Thai language, English language, and Basic Sciences courses are offered by other faculties. The Curriculum Administrative Committee will coordinate with the departments, course sub-committee, course coordinators, instructors who are representatives from departments and related faculties. They will be responsible for course management, course management evaluation, and instructional resource management in accordance with program objectives.

The management of teaching and learning with other programs in Chulabhorn International College of Medicine will be coordinated between program committees. They will be responsible for course management evaluation, and instructional resource management in accordance with program objectives.

Section 2 Specific Information of the Curriculum

1. Curriculum Philosophy, Importance, and Objectives

1.1 Curriculum Philosophy

Clinical technologists who meet international standards will be able to improve themselves to meet social needs and consider patient benefits their priority.

1.2 The Importance of Curriculum

Bachelor of Science Program in Clinical Technology (International Program) at Thammasat University produces medical personnel who demonstrate their knowledge and practical skills in clinical technology. Clinical technology is an important element of diagnosis procedures and health care for patients who have been diagnosed with diseases which have increasing trends in mortality rate. In response to social changes and needs, this program places an emphasis on producing and training clinical technologists who can deeply and broadly integrate knowledge of basic medical sciences and engineering with medical services. Clinical technologists should be able to continually enhance their knowledge of technology development and medical technology. They have the ability to improve themselves in every aspect to meet the demands of globalized world. They demonstrate moral standards in a spirit of humanity. They acquire analytical and creative decision making skills. They can communicate with others effectively. They work in health care system and public health services properly, both locally and internationally, especially in the ASEAN region. They provide people-centered health care.

1.3 Curriculum Objectives

Chulabhorn International College of Medicine, Thammasat University, has specifically designed Bachelor of Science Program in Clinical Technology (International Program) with the following specifications of graduate characteristics.

1. Graduates acquire academic knowledge, professional skills in clinical technology, and research capability, for providing medical care and treatment for patients with respiratory tract diseases, nephropathy, and nervous system diseases. Graduates also possess engineering knowledge and understanding leading to proficiency in operating, inspecting, repairing, assessing, and analyzing problems with these medical devices and quickly reporting to concerning medical teams for patient safety.
2. Graduates gain knowledge of basic medical sciences by integrating knowledge from the molecular to the organ and body systems levels to help medical teams in treating patients with respiratory tract diseases, nephropathy, and nervous system diseases.

3. Graduates have research capability, always seek knowledge, and are able to self-study by developing questioning skills and the ability to find answers for continuous and sustainable self-improvement.
4. Graduates demonstrate moral and ethical values and professional and social attitudes, are aware of professional standards, and provide medical services by considering the spirit of humanity and understanding multicultural diversities.
5. Graduates think critically and creatively. They are able to make appropriate and reasonable decisions in choosing and operating technological equipment for each patient with respiratory tract diseases, nephropathy, and nervous system diseases by applying evidence based medicine.
6. Graduates have good communication skills necessary for working with patients, family members, and medical teams. They are able to pass on medical and public health knowledge properly. They have good human relations skills and can work effectively with others.
7. Graduates possess proficient English language and information technology skills.
8. Graduates learn the art of living in the society, perform their duties effectively, achieve happiness, and enjoy a good quality of life. They are able to adapt themselves and work in multicultural, multiracial, and changing environments.
9. Graduates have good attitudes towards various community health systems. They apply holistic approach to problem solving, provide people-centered health care services by taking into account physical, mental, social, and spiritual factors, including individuals, families, and communities.

2. Plan for Curriculum Development/Improvement Expected to be Completed in Four Years

2.1 Plan for Curriculum Development/Improvement

Improvement/Revision	Strategies	Evidence/Indicators
1. Developing instruction and learning system to produce graduates who have developed academic excellence and “international identity.” Graduates possess up-to-date academic knowledge, skills, and excellent English proficiency,	1. Developing fundamental factors necessary for producing high-quality graduates. The program will use these factors for students’ quality improvement: <ul style="list-style-type: none"> - Students use e-Learning systems supported by 	1. Percentage of students who pass their first English proficiency examination according to the university's requirements. 2. Complete documents of TQF 2 (Program Specifications) TQF 3 (Course Specifications) and TQF 5

Improvement/Revision	Strategies	Evidence/Indicators
<p>understand cultural diversity, and have high moral standards. They can solve patients' problems promptly and appropriately and are highly sought after by international companies and organizations.</p>	<p>Language Center to improve their English skills.</p> <ul style="list-style-type: none"> - Organizing international student exchange programs and inviting instructors from institutions overseas in order to educate students about cultural diversity. - Creating organizational culture that supports knowledge based societies. Encouraging and nurturing students' curiosity and thirst for knowledge. - Emphasizing on student-centered instructional processes and participation and interaction between students and instructors. - Learning processes focus on encouraging students to make observations, think, and research. Both theoretical principles and practices are given prominence. - Hiring special instructors such as doctors, experts, or specialists to teach professional courses. <p>2. Developing learning procedures of the curriculum to place emphasis on student quality. Aiming to produce graduates who are able to apply and integrate overall knowledge for professional</p>	<p>(Course Reports) are prepared.</p> <ol style="list-style-type: none"> 3. Teaching plan in the forms of TQF 3 and TQF 4 (Field Experience Specifications) that supports students' self study. 4. Percentage of every specific course offered in the program. Invite guest lecturers and experts from overseas to give lectures. 5. Students must attend practical training or cooperative education activities. (See TQF 4) 6. Students who conduct undergraduate research project. (4 credits) 7. Percentage of graduates who pass the examination for professional license on their first attempt. 8. TQF 3 and TQF 5 are prepared for every course. 9. Networks of collaborations with external organizations that provide professional practice locations for students who take Clinical Technology practice course. 10. Percentage of students who pass their first examination according to the university's requirements. 11. Percentage of students who work as freelancers within 1 year. Average salary rates of graduates are higher than those imposed by Office of the Civil Service Commission (OCSC).

Improvement/Revision	Strategies	Evidence/Indicators
	<p>performances.</p> <ul style="list-style-type: none"> - Changing the curriculum to problem-based learning/topic-based learning instead of content-based learning. - Establishing the tutorial system and managing the system effectively and efficiently. - Instructors are responsible for evaluating student learning outcomes which support PDCA system to improve teaching efficiency. (PDCA or Deming Cycle or Shewhart Cycle are approaches and tools for implementing a quality management.) <p>Comprehensive examinations are held before graduation to evaluate students' ability to integrate knowledge for professional performances.</p>	

2.2 Improvement Plan of Instructional Resources

Improvement/Revision	Strategies	Evidence/Indicators
<p>1. Preparing classrooms, network system operating rooms, network hosts, and instructional resources to provide effective teaching and learning within and outside of scheduled class time.</p>	<ol style="list-style-type: none"> 1. Installing instructional media and equipment in the classrooms for effective teaching. Instructors can create instructional media as they want. 2. Providing laboratories with high-quality equipment that meet international standards so that students can study and practice in good environments. 3. Laboratories that open 24 hours a day and have sufficient basic structures and spaces for students' work and self-study. 4. Providing libraries in the institutions and virtual libraries with sufficient textbooks, reference books, and instructional equipment for further teaching and learning. 5. Providing network system operating rooms with equipment that educate students about maintaining and controlling network system in actual environments. 	<ol style="list-style-type: none"> 1. Gathering and recording information about equipment-student ratio, the number of hours students use laboratories or equipment, and network system speed-student ratio. 2. Gathering the number of students registered for laboratory courses or training courses. 3. Gathering the number of textbooks and existing digital media and the amount of usage. 4. Conducting a survey of student satisfaction with educational equipment services

2.3 Counselling and Help for Students

Improvement/Revision	Strategies	Evidence/Indicators
<p>1. Producing graduates who possess qualifications required by employers in an appropriate duration. Graduates have academic and emotional competencies, and positive attitude from joining extracurricular activities.</p>	<ol style="list-style-type: none"> 1. Providing a specific time for student counseling. 2. Preparing students' academic and behavioral history for future communications. 3. Finding a way to keep in touch with students. 4. Providing service centers that support English learning. 5. Appointing coordinators who support instructional services and student counseling. Budget for extracurricular activities and encourage students to participate in these activities. 6. Appointing extracurricular activities coordinators. 	<ol style="list-style-type: none"> 1. Number of counseling hours. 2. Number and ratio of graduates in each year. 3. Students' academic and behavioral history available for advisors. 4. Number of extracurricular activities, participating students, and ratio of student support budget to total management budget. 5. Qualified staff members who support teaching and learning, and are responsible for activity coordination. 6. Conducting a survey of student satisfaction with student support in each semester.

2.4 Labor Market, Social Needs and Employer Satisfaction with Graduates' Performance

Improvement/Revision	Strategies	Evidence/Indicators
<p>1. Producing graduates with the following qualifications:</p> <ul style="list-style-type: none"> - Balanced knowledge and skills required by employers. - Good attitude and leadership skills, ability to understand and live in the society competently and effectively, social responsibility relevant to Thai cultural standards. 	<ol style="list-style-type: none"> 1. Asking employers for advice for future curriculum improvement. 2. Evaluating graduates' skills, knowledge, ethical code of conduct, and teamwork skills. 3. Organizing training and discussion activities to educate students about real-life experiences. 4. Moral values are interwoven in teaching both inside and outside the classroom. 5. Offering social sciences courses that emphasize on the development of emotional intelligence in various aspects. 6. Helping and supporting extracurricular activities that highlight social responsibility and Thai cultures. 	<ol style="list-style-type: none"> 1. Using advice from employers for improving and revising the curriculum. 2. Analyzing the results of employer satisfaction with graduates' performance. 3. Number of social sciences courses that emphasize code of conduct and principles of working with others. 4. Number of activities or projects regarding social responsibility and cultural inspiration. 5. Statistics of graduates working in clinical technology and related fields.

Section 3 Educational Management System, Curriculum Implementation and Structure

1. Educational Management System

1.1 System

Thammasat University has a dual-semester system. One academic year is divided into two required semesters, each of which lasts 16 weeks.

Thammasat University has adopted the following credit system.

- 1) Lecture courses (Theory) - 1 hour/week equal 1 credit.
- 2) Practice or experiment courses (Practical study) - 2-3 hours/week equal 1 credit.
- 3) Training or field training (Professional Practice) - 3 -6 hours/week throughout an entire regular semester (between 45-90 hours) equal 1 credit.
- 4) Special projects (practical training under instructors' supervision) - 3 hours/week throughout an entire regular semester (45 hours in total) equal 1 credit.

1.2 Summer Session

None

1.3 Credits Equivalent to Semester Basis

None

2. Curriculum Implementation

2.1 Academic Calendar and Office Hours

Monday - Friday: 8.30 AM - 16.30 PM

First Semester	August-December
Second Semester	January-May
Summer Session	June-July

2.2 Student Qualifications

The qualifications of the applicant must conform to Undergraduate Study Regulations of Thammasat University (Revised 1997) Article 7 with the following features:

- 1) Applicants must hold a high school diploma or equivalent (Science Major); the degree can be either domestic or abroad.
- 2) Applicants must have a record of good conduct and be in satisfactory physical and mental health. Applicants must not have serious contagious diseases or disabilities that can be possible hindrances when studying, for example, colour blindness.
- 3) Applicants must submit English proficiency test scores that meet the minimum requirement for admission of Thammasat University (International Program). Test must be no more than two years old at the time of application.

Student Recruitment and Selection Methods

- 1) Student recruitment and selection should follow Student Selection Regulations of Office of the Higher Education Commission (OHEC) or Thammasat University's student selection methods approved by the University Council.
- 2) Interview will be conducted in English to ensure that students have a sufficient level of English language proficiency.

2.3 Problems Encountered by Newly Enrolled Students

- 1) Students may experience social and academic adjustment problems arising from the transition from high school to university.
- 2) Students from non-English backgrounds may encounter language problems in the classroom.

2.4 Strategies to Solve the Problems/Limitations in No.2.3

- 1) Supervisors will pay special attention to newly enrolled students in order to solve students' adjustment problems arising from the transition from high school to university.
- 2) Students who demonstrate insufficient English language competencies will be provided extra English language tuition before taking the course and throughout the academic year.

2.5 Five-Year Plan for Student Recruitment and Graduation

The number of students in each academic year is 30.

Year of Study	The Number of Students in each Academic Year				
	2016	2017	2018	2019	2020
Year 1	30	30	30	30	30
Year 2	-	30	30	30	30
Year 3	-	-	30	30	30
Year 4	-	-	-	30	30
Total	30	60	90	120	120
Number of prospective graduates	-	-	-	30	30

2.6 Planned Budget

Personnel budget		xxx,000,000 Baht
Salary and wage	xxx,000,000 Baht	
Implementation budget		xxx,000,000 Baht
Compensation	xxx,000,000 Baht	
Expense	xxx,000,000 Baht	
Material cost	xxx,000,000 Baht	
Public utilities	xxx,000,000 Baht	
Welfare	xxx,000,000 Baht	
Investment budget		xxx,000,000 Baht
Educational equipment	xxx,000,000 Baht	
Subsidies		xxx,000,000 Baht
Subsidies	xxx,000,000 Baht	
Incidental expenses	xxx,000,000 Baht	
Fees (submitted to the university)	xxx,000,000 Baht	
Total		xxx,000,000 Baht

Annual operating expenditures per student are 160,000 Baht. This program is managed as a special program (to award the bachelor's degree).

2.7 Educational System

- Classroom-Based Education
- Print-Based Distance Education
- Broadcast-Based Distance Education
- e-Learning Based Distance Education
- Internet-Based Distance Education
- Others such as Self-Directed Learning

2.8 Cross Credit Transfer and Cross Enrollment

- 1) Cross credit transfer and cross enrollment must follow Thammasat University's Undergraduate Study Regulations B.E. 2540 (A.D. 1997) and its Amendments, items 10.10 and item 15.
- 2) Procedures for cross enrollment must follow Thammasat University Official Announcement on guidelines, terms and conditions on cross enrollment in different study programs and universities for undergraduate students, B.E. 2552 (A.D. 2009).

3. Curriculum and Instructors

3.1. Curriculum

3.1.1. Total Number of Credits and Duration of Study

The total number of credits throughout the curriculum is 142.

The duration of the curriculum for full-time students is at least seven regular semesters and no more than 14 regular semesters.

3.1.2. Curriculum Structure

Students must register in no less than 142 credits in all the courses listed in the curriculum components and requirements as follows:

- | | | |
|---|-----|---------|
| 1) General education courses | 33 | credits |
| 2) Specific courses | 103 | credits |
| - Basic science and medical science courses | 19 | credits |
| - Professional courses | 84 | credits |
| 3) Free elective courses | 6 | credits |

3.1.3. Course Titles

3.1.3.1. Course Codes

Course titles in the curriculum are made up of two abbreviated letters and three coded numbers.

1) Abbreviated letters

CMM General courses that students in several programs study together. These courses are offered by Chulabhorn International College of Medicine.

CMT Courses in Clinical Technology offered by Chulabhorn International College of Medicine

2) Three coded numbers have the following meanings.

Number in the last digit (ones' place) refers to course number 0 – 9.

Number in the second digit (ten's place) refers to course groups.

- 1 refers to General Engineering
- 2 refers to Mechanical Engineering
- 3 refers to Electrical Engineering
- 4 refers to Chemical Engineering
- 5 refers to General Medicine
- 6 refers to Nephrology Equipment
- 7 refers to Respiratory Equipment
- 8 refers to Neurology Equipment

Number in the first digit (hundred's place) refers to courses in each academic year.

- 1 refers to first-year courses
- 2 refers to second-year courses
- 3 refers to third-year courses
- 4 refers to fourth-year courses

3.1.3.2. Lists of Courses and Curriculum Requirements

1) **General Education Courses** 33 credits

General Education Courses – Part 1 (24 Credits)

Group	Code	Course Name	Credits
(Lecture-practice-self study)			
Humanism	1 prescribed course (3 credits)		
	TU102	Social Life Skills	3(3-0-6)
Social Science	2 prescribed courses (6 credits)		
	TU100	Civic Education	3(3-0-6)
	TU101	Thailand, ASEAN, and the World	3(3-0-6)
Science and Mathematics			
Science	2 prescribed courses (6 credits)		
	TU103	Life and Sustainability	3(3-0-6)
	TU155	Elementary Statistics	3(3-0-6)
Language	3 prescribed courses (9 credits)		
	TU050	English Skill Development	non-credit
	TU104	Critical Thinking, Reading, and Writing	3(3-0-6)
	TU105	Communication Skills in English	3(3-0-6)
	TU106	Creativity and Communication	3(3-0-6)

General Education Courses – Part 2 (9 Credits)

Students have to take the following courses according to Chulabhorn International College of Medicine's requirements (9 credits).

Code	Course Name	Credits
(Lecture-Practice-Self Study)		
TU122	Law in Everyday Life	3(3-0-6)
TU116	Man and Arts: Visual Art, Music and Performing Arts	3(3-0-6)
TU156	Introduction to Computers and Programming	3(3-0-6)

Specific Courses (103 credits)**- Basic Sciences and Medical Science Courses (19 credits)**

SC111	Biology 1	3(3-0-6)
SC123	Fundamental Chemistry	3(3-0-6)
SC125	General Organic Chemistry	3(3-0-6)
SC136	Physics	3(3-0-6)
CMM217	General Anatomy and Physiology	3(3-0-6)
CMM221	Patient Assessment	1(1-0-2)
CMT250	Medical Biology	3(3-0-6)

- Professional Courses (84 credits)

CMT210	Mathematics for Clinical Technology	3(3-0-6)
CMT211	Engineering Graphics for Clinical Technology	3(3-0-6)
CMT212	Biomaterials	3(3-0-6)
CMT221	Biomechanics for Clinical Technology	3(3-0-6)
CMT230	Fundamentals of Electrical Engineering for Clinical Technology	3(3-0-6)
CMT231	Electronic Devices and Circuits for Clinical Technology	3(3-0-6)
CMT232	Digital and Microprocessor for Clinical Technology	3(3-0-6)
CMT234	Signals and Systems for Medical Applications	3(3-0-6)
CMT235	Basic Electrical Engineering Laboratory for Clinical Technology 1	1(0-3-0)
CMT236	Basic Electrical Engineering Laboratory for Clinical Technology 2	1(1-3-0)
CMT241	Fluid Mechanics for Clinical Technology	3(3-0-6)
CMT313	Facility and Infrastructure for Hospital	3(3-0-6)
CMT333	Measurement and Instrumentation for Medical Applications	3(3-0-6)
CMT342	Mass Transfer for Clinical Technology	3(3-0-6)
CMT343	Heat Transfer for Clinical Technology	3(3-0-6)
CMT351	Anatomy and Physiology for Clinical Technology	3(3-0-6)
CMT352	Professional Ethics for Clinical Technology	2(2-0-4)

CMT353	Introduction to Human Diseases	3(3-0-6)
CMT360	Hemodialysis and Peritoneal Dialysis Machine	3(3-0-6)
CMT361	Advance in Hemodialysis for Clinical Technology	2(2-0-4)
CMT362	Bioelectric Impedance Analysis	2(2-0-4)
CMT370	Mechanical Ventilation and Oxygen Devices	3(3-0-6)
CMT371	Hemodynamic & Respiratory Monitoring	3(3-0-6)
CMT380	Flow Hemodynamic Ultrasonography	2(2-0-4)
CMT381	Machine for Nervous System	3(3-0-6)
CMT454	Seminar	2(0-4-2)
CMT455	Journal Club	2(0-4-2)
CMT463	Clinical Experience in Dialysis Unit	3(0-6-3)
CMT472	Clinical Experience in Respiratory Care Unit	3(0-6-3)
CMT482	Clinical Experience in Nervous System Unit	3(0-6-3)
CMT456	Research Project and Review	4(0-8-4)

Free Elective Courses (6 credits)

Students can choose to take any courses offered by Thammasat University or Chulabhorn International College of Medicine as free elective courses (not less than 6 credits in total). However, the following courses **cannot** be chosen as free elective courses.

- 1) All basic courses in Science and Mathematics (including courses that are not categorized as the General Education Courses – Part 2).
- 2) All the General Education Courses – Part 1 and 2 with the abbreviated titles beginning with “TU”, TH162 Report Writing, and TH163 Communicative Writing in the Organization.

3.1.4 Study Plan

First Academic Year			
First Semester	Credits	Second Semester	Credits
TU100 Civic Education	3	TU102 Social Life Skill	3
TU101 Thailand, ASEAN, and the World	3	TU104 Critical Thinking, Reading, and Writing	3
TU103 Life and Sustainability	3	TU106 Creativity and Communication	3
TU105 Communication Skill in English	3	TU116 Man and Arts: Visual Art, Music and Performing Arts	3
SC111 Biology 1	3	TU122 Law in Every day Life	3
SC123 Fundamental Chemistry	3	SC125 General Organic Chemistry	3
		SC136 Physics	3
Total	18	Total	21
Second Academic Year			
First Semester	Credits	Second Semester	Credits
TU156 Introduction to Computers and Programming	3	CMT212 Biomaterials	3
CMT210 Mathematics for Clinical Technology	3	CMT231 Electronic Devices and Circuits for Clinical Technology	3
CMT211 Engineering Graphics for Clinical Technology		CMT232 Digital and Microprocessor for Clinical Technology	3
CMM217 General Anatomy and Physiology	3	CMT234 Signals and Systems for Medical Applications	3
CMT221 Biomechanics for Clinical Technology	3	CMT236 Basic Electrical Engineering Laboratory for Clinical Technology 2	1
CMT230 Fundamentals of Electrical Engineering for Clinical Technology	3	CMT241 Fluid Mechanics for Clinical Technology	3
CMT235 Basic Electrical Engineering Laboratory for Clinical Technology 1	1	CMT250 Medical Biology	3
Total	19	Total	19

Third Academic Year			
First Academic Year	Credits	Second Academic Year	Credits
TU155 Elementary Statistics	3	CMT313 Facility and Infrastructure for Hospital	3
CMM221 Patient Assessment	1	CMT360 Hemodialysis and Peritoneal Dialysis Machine	3
CMT333 Measurement and Instrumentation for Medical Applications	3	CMT361 Advance in Hemodialysis for Clinical Technology	2
CMT342 Mass Transfer for Clinical Technology	3	CMT362 Bioelectric Impedance Analysis	2
CMT343 Heat Transfer for Clinical Technology	3	CMT370 Mechanical Ventilation and Oxygen Devices	3
CMT351 Anatomy and Physiology for Clinical Technology	3	CMT371 Hemodynamic and Respiratory Monitoring	3
CMT352 Professional Ethics for Clinical Technology	2	CMT380 Flow Hemodynamic Ultrasonography	2
CMT353 Introduction to Human Diseases	3	CMT381 Machine for Nervous System	3
Total	21	Total	21
Fourth Academic Year			
First Semester	Credits	Second Semester	Credits
CMT454 Seminar	2	Free Elective 1	3
CMT455 Journal Club	2	Free Elective 2	3
CMT463 Clinical Experience in Dialysis Unit	3	CMT456 Research Project and Review	4
CMT472 Clinical Experience in Respiratory Care Unit	3	Internship (200 hours)	0
CMT482 Clinical Experience in Nervous System Unit	3		
Total	13	Total	10

3.1.5 Course Descriptions

1) General Education Courses

TU100 Civic Education

3(3-0-6)

Instillation of social conscience and awareness of one's role and duties as a good global citizen. This is done through a variety of methods such as lecture, discussion of various case studies, and field study outings. Students are required to organize a campaign to raise awareness or bring about change in an area of their interest.

TU101 Thailand, ASEAN, and the World

Study of significant phenomena around the world, in the ASEAN region and in Thailand in terms of their political, economic, and sociocultural dimensions. This is done through approaches, theories and principles of social science research via discussion and raising examples of situations or people of interest. The purpose of this is to create a perspective of diversity, to understand the complexity of global interrelationships, to build a global mindset, and to be able to challenge old paradigms and open up a new, broader worldview.

TU102 Social Life Skills

Holistic health care, addressing the physical, emotional, social, and spiritual needs. Important skills for leading a happy life in society. Students learn to develop their ability in physical health care to manage stress, build emotional security, understand themselves, and adapt to psychological, emotional, and social problems. Students also learn to understand the meaning of aesthetics, experiencing and appreciating the relationship between art and humanity in different fields, namely visual arts, music, performing arts, and architecture.

TU103 Life and Sustainability

This course provides an introduction to the importance of life-cycle systems perspectives in understanding major challenges and solutions to achieving more sustainable societies in this changing world. Students learn about the relationship between mankind and the environment in the context of energy and resource use, consumption and development, and environmental constraints. Furthermore, an examination of social conflict and change from the life-cycle perspective will be used to develop an understanding of potential solution pathways for sustainable lifestyle modifications.

TU050 English Skill Development

Practice basic skills for listening, speaking, reading, and writing in English through an integrated method. Students acquire basic knowledge to continue studying English at a higher level.

TU104 Critical Thinking, Reading, and Writing

Development of critical thinking through questioning, analytical, synthetic, and evaluation skills. Students learn how to read without necessarily accepting all the information presented in the text, but rather consider the content in depth, taking into account the objectives, perspectives, assumptions, bias and supporting evidence, as well as logic or strategies leading to the author's conclusion. The purpose is to apply these methods to student's own persuasive writing based on information researched from various sources, using effective presentation techniques.

TU105 Communication Skills in English

Development of English listening, speaking, reading and writing skills, focusing on the ability to hold a conversation in exchanging opinions, as well as reading comprehension of academic texts from various disciplines related to students' field of study.

TU106 Creativity and Communication

Creative thought processes, with critical thinking as an important part, as well as communication of these thoughts that lead to suitable results in social, cultural, and environmental context, at personal, organizational, and social levels.

TU116 Man and Arts: Visual Art, Music and Performing Arts

This course is a study of art in relation to its function and the development of people, society, and environment by focusing on various creative works, such as visual arts, music, and performing arts, depicting the culture and perception of mankind. The course also aims to instill learners with real awareness of art values through personal experience, and also the appreciation of the aesthetic values of creative works. An emphasis is placed upon the influence of art on Thai values and the Thai way of life.

TU122 Law in Everyday Life

3(3-0-6)

To study general aspects of law as correct patterns of human conduct in society. To equip learners with basic principles of public law (Rules of Law), and its values which are associated with citizens' moral

core. To provide basic knowledge in public law and private law, involving the issues of rights and duties, dispute settlement, Thai Justice procedures, the usage and interpretation of law principles, with an emphasis on case studies in our daily lives.

TU155 Elementary Statistics (3-0-6)

To identify the nature of statistical problems, review of descriptive statistics, probability, random variables and some probability distributions (binomial, Poisson, and normal), elementary sampling and sampling distributions, estimation and hypothesis testing for one and two populations, one-way analysis of variance, simple linear regression and correlation, chi-square test.

2) Basic Science and Medical Science Courses

SC111 Biology 1 3(3-0-6)

Fundamental biological concepts of animals, structures, and basic metabolic processes of animals at molecular, cellular, tissue, organ, organ system, and organism levels; structures and functions of nucleic acids in genetic inheritance; animal classifications, growth and development, behavior, evolution, and animal ecology.

SC123 Fundamental Chemistry 3(3-0-6)

Atomic structure, stoichiometry, chemical bonds, properties of representative and transition elements, gases, liquids and solutions, solids, thermodynamics, chemical kinetics, chemical equilibrium and acid-base equilibrium, electrochemistry, and organic chemistry.

SC125 General Organic Chemistry 3(3-0-6)

Hybridization, nomenclature and properties of organic compounds, stereochemistry, reactions and mechanisms of organic compounds, hydrocarbons, alcohols, ethers, carbonyl compounds, carboxylic acids and amine derivatives, carbohydrates, lipids, and amino acids.

SC136 Physics 3(3-0-6)

Principles of mechanics, fluid mechanics, thermodynamics, mechanical waves, electromagnetic waves, optics, modern physics, applications in health science and medical science.

CMM217 General Anatomy and Physiology

3(2-2-5)

Prerequisite: Have earned credits of or simultaneously studying with SC111, SC123, SC136

Basic principles of structures, functions, and mechanisms of actions of cell, tissue and organ in the following systems; nervous, cardiovascular, blood and coagulation, lymphatic, immune, muscular and skeletal, respiratory, urinary, digestive and accessory organs, reproductive, and endocrine. Metabolic procedures and the adaptation of body systems to maintain homeostasis within the human body in normal conditions, in environmental changes, or in pathological conditions; including inflammation, repair, and other consequences.

CMM221 Patient Assessment

1(1-0-2)

Systematic basic health assessment, clinical skills such as interviewing, history taking, physical examination, medical recording, specimen collection, laboratory and radiology investigation, and results interpretations; signs and symptoms of common diseases; basic medical procedures; basic instruments commonly used in medical care, basic practices in operating rooms and patient units; principles of counselling offered to patients and their relatives, evaluation of patient problems; clinical analysis, reasoning and decision making; communication, patients' rights, and ethics in medical practice.

CMT250 Medical Biology

3(3-0-6)

This course introduces students to the basic knowledge of biochemistry and molecular biology at all levels of body function (cellular, tissue, organ and whole body). It provides the basic knowledge of hematology, qualitative and quantitative abnormalities of blood cells, coagulation system, thrombus formation and thrombolysis. It also covers the introductory knowledge of basic microbiology, medical microbiology, basic immunology, immune system disorders, tumor immunology, and organ transplantation. Pharmacokinetics, pharmacodynamics, drug resistance, tolerance, and interactions are explored.

Professional courses

CMT210 Mathematics for Clinical Technology

3(3-0-6)

Prerequisite: Have earned credits of SC142

Vector analysis: vector functions, coordinate transformations, gradient, divergence, and curl, complex numbers, Taylor Series and its applications, Laplace transform and its applications, first and second order ordinary differential equations, first and second order partial differential equations.

CMT211 Engineering Graphics for Clinical Technology 3(3-0-6)

Prerequisite: Have earned credits of SC136

The significance of drawing, drawing instruments, lining and lettering, work preparation, analytic geometry, dimensioning and description, orthographic projection, pictorial drawing, freehand sketching, sectioning, technical drawing, electrical drawing, computer-aided drawing, three-dimensional imaging system, three-dimensional printing, digital imaging, and communications in medicine (DICOM).

CMT212 Biomaterials 3(3-0-6)

Fundamentals of materials science and processing; polymers, ceramics, and metals and application in biotechnology; chemical and physical modifications of biomaterials, characteristic analysis of biomaterials; design of bio-based composites for medical and dental applications, and drug delivery system; material-tissue interactions; biomaterials for organ replacement and sensors.

CMT221 Biomechanics for Clinical Technology 3(3-0-6)

Basic principles of engineering mechanics, force systems and resultants, equilibrium, fluid statics, free body diagram, moment of force, structural analysis, friction, distributed forces, kinematics and kinetics of particles, Newton's second law, and kinematics of rigid bodies, work and energy, impulse and momentum, principles of engineering mechanics and application in medical science.

CMT230 Fundamentals of Electrical Engineering for Clinical Technology 3(3-0-6)

Basic circuit elements, basic DC and AC circuit analysis, equivalent circuits, voltage, current and power, diodes and their applications, amplifiers and operational amplifiers (op-amp), transformers, DC power supply, introduction to electrical machinery, generators, motors and their uses, methods of power transmission, application of discussed concepts in health science.

CMT231 Electronic Devices and Circuits for Clinical Technology 3(3-0-6)

Prerequisite: Have earned credits of CMT230

Characteristics and modes of operation of bipolar junction transistor (BJT) and field effect transistor (FET), biasing, BJT and FET amplifiers, differential amplifiers, frequency response, filters, oscillator and timing circuits, applications of electronic devices such as operational amplifiers (op-amp), instrumentation amplifiers, transducers, and couplers.

- CMT232 Digital and Microprocessor for Clinical Technology 3(3-0-6)
 Number system, codes, Boolean algebra, logic gates, combinational and sequential circuits, introduction to microprocessors, input/output interface, serial communications, A/D and D/A conversions, analog signal interface, programming techniques, and applications of microprocessors and microcontrollers.
- CMT234 Signals and Systems for Medical Applications 3(3-0-6)
 Prerequisite: Have earned credits of CMT210
 Continuous-time and discrete-time signal and system, linear time-invariant system (LTI), signal analysis using the Fourier transform, Laplace transform, and Z-transform, applications of signals and systems, noise and filtering, modern techniques in signal analysis, and examples of medical signal processing.
- CMT235 Basic Electrical Engineering Laboratory for Clinical Technology 1 1(0-3-0)
 Prerequisite: Have earned credits of or simultaneously studying with CMT230
 A laboratory course to introduce students to basic equipment and measurements in electrical engineering. Weekly topics are selected from CMT230.
- CMT236 Basic Electrical Engineering Laboratory for Clinical Technology 2 1(0-3-0)
 Prerequisite: Have earned credits of CMT235
 A laboratory course to expose students to concepts learned in class and to provide opportunities for problem-solving experience. Weekly topics are selected from CMT231, CMT232, CMT234 or other related topics.
- CMT241 Fluid Mechanics for Clinical Technology 3(3-0-6)
 Prerequisite: Have earned credits of SC136 and CMT210
 Students learn about fluid statics, compressible and incompressible fluids, mass, momentum, and energy balances for macroscopic and microscopic systems, flow in pipes, flow of non-Newtonian fluids, Bernoulli's equation, Navier-Stoke equations, introduction to boundary layer theory, flow around submerged objects, flow through porous media, fluid flow measurement, pumps and other fluid-moving machines, filtration, and fundamentals of fluid applications in medicine such as hemodynamic, hemodialysis, and mechanical ventilation and oxygen devices.

CMT333 Measurement and Instrumentation for Medical Applications 3(3-0-6)

Prerequisite: Have earned credits of CMT231

Fundamentals of measurement; units and standard instruments; standard and calibration of electrical instruments; voltage, current and power measurements; impedance measurement; measurement systems: electrodes, sensors and transducers, signal-conditioning circuits, analog-to-digital converters; digital techniques in measurement; noises; signal-to-noise ratio enhancement techniques: shielding, grounding, filtering; data analysis and measurement errors; common physiological measurements: electrophysiological measurements, pressure measurements, blood flow measurements, temperature measurements, respiratory measurements; electrical safety in measurement and instrumentation.

CMT342 Mass Transfer for Clinical Technology 3(3-0-6)

Prerequisite: Have earned credits of CMT210

Mass transfer mechanisms, Fick's law, steady-state diffusion, mass transfer coefficient, membrane separation, and adsorption. Application of mass transfer in hyperbaric oxygen therapy. Application of mass transfer in water purification. Understanding the importance of water testing to determine water quality, water quality standards, contaminants in water and maximum allowable concentrations. Identifying technical aspects of water treatment systems used for dialysis and monitoring of hemodialysis water quality. Advantages and disadvantages of all the purification methods.

CMT343 Heat Transfer for Clinical Technology 3(3-0-6)

Prerequisite: Have earned credits of CMT210

Energy balance, heat balance, Fourier's law, steady-state and transient conduction, convection and radiation heat transfer, heat exchangers, and fundamentals of heat transfer in porous media and tissues.

CMT351 Anatomy and Physiology for Clinical Technology 3(3-0-6)

Prerequisite: Have earned credits of CMM211

Advanced anatomy and physiology in nervous systems, cardiovascular, respiratory, and urinary systems, beyond the introductory level, and emphasis on the clinical relevance of the structures and functions. The nervous system: anatomy and physiology of central and peripheral nervous systems, biophysical principles governing ion channel functioning and how alterations in these functions can be associated with clinical pathologies; integration of sensory, somatic and autonomic systems, and the computational analysis of problems in motor control and perception. The cardiovascular, respiratory and urinary systems: anatomy and

physiology of the 3 systems, the electrical, mechanical, and metabolic aspects of cardiac pumping, organization of the vasculature, principles of diffusion, the rheology of blood transfer of solutes at the capillary level, gas transfer in the lung, blood oxygenation, urine formation, haemodialysis, haemofiltration, transfer across the peritoneal membrane – dialysis/drug delivery.

CMT352 Professional Ethics for Clinical Technology 2(2-0-4)

Introduction to medical ethics including general ethics, values and norms, individual freedom, rights, and responsibility; definition and major principles of medical ethics; perspectives of medical ethics: the Hippocratic Oath, the Declaration of Helsinki, the WMA Declaration of Geneva, the International Code of Medical Ethics (adopted in 1949 and amended in 1968, 1983, and 2006), and the Medical Council of India Code of Ethics (2002). Individual ethics: patients' right to know the truth and confidentiality, the right to receive detailed information on the illness, health and healing services, and access to health care. The ethics of human life: prenatal sex determination. Medical ethics regarding families and society: euthanasia, cancer care, and end-of-life care. Medical ethics regarding death and dying: use of life-support systems, the right to die with dignity, and ethical perspectives on suicide. Professional ethics: promise and confidentiality, differences between medical malpractice and negligence. Teaching/learning experience: increasing the awareness and knowledge of students of the value dimensions of interactions with patients, colleagues, relatives and public; fostering the development of analytical, decision-making, and judgment skills; cultivating awareness of the importance of respecting patients' right; and teaching students about clinical technologists' duties and responsibilities.

CMT353 Introduction to Human Diseases 3(3-0-6)

Prerequisite: Have earned credits of CMM211, CMM222

Clinical approach to human diseases by using basic knowledge of pathophysiology, patient manifestations and investigations; interpretation of laboratory results such as blood chemistry analysis, arterial blood gas analysis, urinalysis interpretation, medical imaging analysis, and basic therapeutic processes.

CMT313 Facility and Infrastructure for Hospital 3(3-0-6)

Basic concepts of facility and infrastructure. Part I includes facility maintenance and operations: HVAC units, electrical systems, generators, pumps, compressors, coolers, air purifiers, respirators, plumbing

system, fire safety system, suction machines, sterilizing equipment, electric beds, wheelchairs, arthroscopic equipment, X-ray machines, and heart monitors. Part II includes facility management: clinical pathways in hospitals, cost allocation for facility management in hospitals, connections between clinical pathways and facility management, transparent facility management using a product model, optimization potential, process optimization in hospitals, benchmarking of overall facility management performance, benchmarking of operating room performance, and case studies for various types of hospitals.

CMT360 Hemodialysis and Peritoneal Dialysis Machine 3(3-0-6)

Prerequisite: Have taken CMT241, CMT342

Control systems of hemodialysis machines, extracorporeal circuit, dialysate delivery system, and composition of dialysate; machine maintenance; design of hemodialysis machines, dialyzer and vascular access; peritoneal dialysis apparatus, peritoneal catheter and peritoneal dialysis machines.

CMT361 Advance in Hemodialysis for Clinical Technology 2(2-0-4)

Prerequisite: Have taken CMT241, CMT342

Control systems of continuous hemodialysis machines and extracorporeal circuit; advanced hemodialysis techniques such as plasmapheresis, hemoperfusion, and liver dialysis; machine maintenance; design of advanced hemodialysis machines and specific dialyzers.

CMT362 Bioelectric Impedance Analysis 2(2-0-6)

Prerequisite: Have taken CMT230, CMT333

Students know the principles of electrical impedance and applying electric current flow through body tissues which can be used to calculate an estimate of total body water (TBW) and body fat. Students also learn how to maintain and repair bioelectrical impedance machines.

CMT370 Mechanical Ventilation and Oxygen Devices 3(3-0-6)

Prerequisite: Have taken CMT241

Students know the principles and components of mechanical ventilation and oxygen devices. Students also learn how to maintain, repair, and set mechanical ventilation and oxygen devices for patients.

CMT371 Hemodynamic and Respiratory Monitoring 3(3-0-6)

Prerequisite: Have taken CMT230, CMT241

Students know the principles and components of hemodynamic and respiratory monitoring equipment, for example, blood pressure monitors, cardiac output monitors, pulse oximeters, capnography monitors which track end-tidal carbon dioxide, and electrocardiography equipment. Students also learn how to maintain, repair, and operate hemodynamic and respiratory monitoring equipment with patients.

CMT380 Flow Hemodynamic Ultrasonography 2(2-0-4)

Students understand the principles of echocardiography and ultrasound measurements of hemodynamic changes and blood flow velocities. Students study characteristics of flow in intra- and extra-cranial arteries, geometric factors, measurement techniques, and physical alterations caused by diseases. Other topics include measurements of pressure and velocity distributions, ultrasonographic imaging of the carotid arteries, and application of flow hemodynamics in neurological diseases.

CMT381 Machine for Nervous System 3(3-0-6)

Students study the importance of targeted temperature management for neuroprotection and intracranial pressure control. Students understand heat transfer principles for targeted temperature management in various methods, especially surface and endovascular techniques; methods and mechanisms of targeted temperature management; methods of monitoring core temperature, application of targeted temperature management in critical care neurology.

CMT454 Seminar 2(0-4-2)

Students present and discuss case studies of patients and biomedical equipment that is used to treat them under the supervision of advisors. Students express their opinions based on scientific evidence and answer questions asked in the meeting.

CMT455 Journal Club 2(0-4-2)

Students choose medical journals on a topic related to biomedical equipment or its subspecialties, with good data and innovative research. Students study the papers to achieve the following objectives: conducting a structured critical appraisal, understanding the limitations of the application of evidence, recognizing and understanding basic study design, distinguishing between strong and weak methodology, gaining familiarity with basic statistical tests, gaining insight into specific clinical problems, and obtaining oral and written presentation skills. The presentation should provide background information of the research, explain any non-standard techniques, present important findings, discuss the author's

conclusions, determine whether the data presented support the author's conclusions, and suggest possibilities for future research based on the conclusions.

CMT463 Clinical Experience in Dialysis unit 3(0-6-3)

Prerequisite: Have taken CMT360

Students practice in a dialysis unit under the supervision of physicians, dialysis nurses, and clinical technicians. Students are trained to be responsible for ensuring that renal dialysis equipment is properly maintained and works effectively and efficiently. Students study the care of arteriovenous fistulas and grafts. Students practice repairing and testing electronic equipment, maintaining hemodialysis machines as well as water treatment systems, setting up and repairing automated peritoneal dialysis equipment. Students also study the care of exit site of peritoneal catheter.

CMT472 Clinical Experience in Respiratory Care Unit 3(0-6-3)

Prerequisite: Have taken CMT370 and CMT371

Students practice in a respiratory care unit under the supervision of physicians, nurses, and clinical technicians. Students are trained to be responsible for ensuring that mechanical ventilators and equipment used in the respiratory care unit are properly maintained and work effectively and efficiently. Students are trained to be able to set mechanical ventilators for patients and use hemodynamic and respiratory monitoring equipment properly.

CMT482 Clinical Experience in Nervous System Unit 3(0-6-3)

Prerequisite: Have taken CMT333 and CMT381

Students practice in a stroke unit under the supervision of physicians, dialysis nurses, and clinical technicians. Students are trained to be responsible for ensuring that duplex ultrasound, Transcranial Doppler, and targeted temperature machines are properly maintained and work effectively and efficiently. Students practice repairing, testing, and maintaining these machines.

CMT456 Research Project and Review 4(0-8-4)

This course focuses on a supervised research practice or writing literature reviews. Students can select a research project of their choice. The project must have a clearly defined topic which has been approved by the academic supervisor of the project. The project must receive research ethical approval. Supervisors and students should negotiate at the beginning when they will meet, when work will be handed in,

and what kind of assistance and feedback will be given. Students must present a complete plan of the project and submit their completed research report or literature review prior to course completion.

3.2 Name-Surname, Identification Number, Positions, and Academic qualifications of Instructors

3.2.1 Full-time Instructors of the Program

No.	Identification Number	Academic Position	Name-Surname	Academic qualification	Major	Graduation	
						Institution	Year
1	310120198xxxx	Associate Professor	Sombat Muengtaweepongsa, MD	- Certificate of Cerebrovascular and Critical Care Neurology	- Cerebrovascular and Critical Care Neurology	- Saint Louis University, Missouri, USA	2007
				- Diploma Thai Board	- General Neurology	- Faculty of Medicine, Ramathibodi Hospital, Mahidol University	1998
				- Bachelor of Medicine	- Medicine	- Ramathibodi Hospital, Mahidol University	1992
2	319050001xxxx	Instructor	Dr. Nipaporn Ngernyuang	- Doctor of Philosophy	- Biomedical Science	- Khon Kaen University	2014
				- Master of Science	- Genetics	- Kasetsart University	2007
				- Bachelor of Science	- Biology	- Burapha University	2004
3	136040009xxxx	Instructor	Dr. Suwit Chaisri	- Doctor of Philosophy	- Biomedical Science	- Khon Kaen University	2014
				- Bachelor of Science	- Medical Technology	- Khon Kaen University	2009
4	153990010xxxx	Instructor	Dr. Yardnapar Parcharoen	- Doctor of Philosophy	- Biological Engineering	- King Mongkut's University of Technology Thonburi	2014
				- Bachelor of Science	- Microbiology	- King Mongkut's University of Technology Thonburi	2008

No.	Identification Number	Academic Position	Name-Surname	Academic qualification	Major	Graduation	
						Institution	Year
5	3769900172xxx	Instructor	Thanee Eiamsitrakoon, MD	- Diploma Thai Board of Nephrology	- Nephrology	- Thammasat University	2013
				- Diploma Thai Board of Internal Medicine	- Nephrology	- The Royal College of Physicians of Thailand	2011
				- Bachelor of Medicine	- Medicine	- The Royal College of Physicians of Thailand	2006
6	310050178xxxx	Instructor	Pattarin Pirompanich, MD	- Diploma Thai Board	- Intensive and Critical Care Medicine	- Phramongkutklao Hospital	2014
				- Diploma Thai Board	- Pulmonary Medicine and Pulmonary Critical Care	- Phramongkutklao Hospital	2013
				- Higher Graduate Diploma in Clinical Medical Sciences	- Internal Medicine	- Chiang Mai University	2011
				- Diploma Thai Board	- Internal Medicine	- Chiang Mai University	2011
				- Bachelor of Medicine	- Medicine	- Chulalongkorn University	2007

* Number 1 and 6 are instructors at the Faculty of Medicine.

3.2.1 Other Full-time Instructors who also Teach in This Program

No.	Identification Number	Academic Position	Name-Surname	Academic qualification	Major	Graduation	
						Institution	Year
1	319050001xxxx	Instructor	Dr. Nipaporn Ngernyuang	- Doctor of Philosophy - Master of Science - Bachelor of Science	- Biomedical Science - Genetics - Biology	- Khon Kaen University - Kasetsart University - Burapha University	2014 2007 2004
2	136040009xxxx	Instructor	Dr. Suwit Chaisri	- Doctor of Philosophy - Bachelor of Science	- Biomedical Science - Medical Technology	- Khon Kaen University - Khon Kaen University	2014 2009
3	343990002xxxx	Instructor	Dr. Atipat Yasiri	- Doctor of Philosophy - Bachelor of Science	- Medical Microbiology - Microbiology	- Khon Kaen University - Khon Kaen University	2014 2005
4	340990053xxxx	Associate Professor	Dr. Taweeporn Sittiracha	- Doctor of Philosophy - Master of Science - Bachelor of Science	- Neurophysiology - Physiology - Biochemistry	- Monash University Australia - Mahidol University - Chulalongkorn University	1988 1975 1973
5	153990010xxxx	Instructor	Dr. Yardnapar Parcharoen	- Doctor of Philosophy - Bachelor of Science	- Biological Engineering - Microbiology	- King Mongkut's University of Technology Thonburi - King Mongkut's University of Technology Thonburi	2014 2008
6	360990060xxxx	Instructor	Dr. Saranyoo Ponnikorn	- Doctor of Philosophy - Bachelor of Science	- Biochemistry - Biology	- Mahidol University - Chiang Mai University	2011 2006
7	335030005xxxx	Instructor	Dr. Niramai Srojajak	- Doctor of Philosophy	- Biochemistry	- Mahidol University	2011

No.	Identification Number	Academic Position	Name-Surname	Academic qualification	Major	Graduation	
						Institution	Year
				- Bachelor of Science	- Biotechnology	- Thammasat University	2004
8	344010068xxxx	Instructor	Dr. Angkana Krajang	- Doctor of Science - Master of Science - Bachelor of Science	- Molecular Biology - Biotechnology - Biology	- Srinakharinwirot University - King Mongkut's Institute of Technology Ladkrabang - Mahidol University	2012 2004 2000
9	330990061xxxx	Instructor	Dr. Thararat Nualsanit	- Doctor of Philosophy - Bachelor of Science	- Pharmaceutics - Pharmaceutical Sciences	- Mahidol University - Khon Kaen University	2011 1999
10	332060069xxxx	Instructor	Dr. Sopida Sookprasert	- Doctor of Philosophy - Master of Science - Bachelor of Science	- Biochemistry - Biochemistry - Chemistry-Biology	- Khon Kaen University - Khon Kaen University - Khon Kaen University	2013 2008 2004
11	110149902xxxx	Instructor	Dr. Tippawan Pissawong	- Doctor of Philosophy - Bachelor of Science	- Immunology - Medical Technology	- Mahidol University - Mahidol University	2013 2007
12	170990002xxxx	Instructor	Dr. Mayurachat Kaewmanee	- Doctor of Philosophy - Bachelor of Science	- Biomedical Science - Medical Technology	- Khon Kaen University - Mahidol University	2013 2006
13	110140020xxxx	Instructor	Dr. Nopmanee Konthong	- Doctor of Philosophy - Bachelor of Nursing Science	- Anatomy and Structural Biology - Nursing	- Mahidol University - Ramathibodi Hospital, Mahidol University	2013 2007
14	544089000xxxx	Instructor	Dr. Suphawadee Phababpha	- Doctor of Philosophy	- Medical Physiology	- Khon Kaen University	2013

No.	Identification Number	Academic Position	Name-Surname	Academic qualification	Major	Graduation	
						Institution	Year
15	130990010xxxx	Instructor	Dr. Ponsilp Zeekpudsa	- Doctor of Philosophy - Master of Science - Bachelor of Science	- Pharmacology - Pharmacology - Medical Technology	- Khon Kaen University - Khon Kaen University - Khon Kaen University	2013

3.2.2 Special Instructors and Eminent Persons who also Teach in This Program

No.	Identification Number	Academic Position	Name-Surname	Qualification	Major	Graduation	
						Institution	Year
1	xxxxxxxxxxxxx	Professor	Dr. Phadungsak Rattanadecho	- Post Doctoral Fellow - Doctor of Philosophy - Master of Engineering - Bachelor of Engineering	- Chem. Eng. and Material Sci. - Mechanical Engineering - Mechanical Engineering - Mechanical Engineering	- University of Minnesota Twin Cities, United States of America - Nagaoka University of Technology, Japan - Chulalongkorn University - King Mongkut's University of Technology Thonburi	
2	xxxxxxxxxxxxx	Assistant Professor	Dr. Nopporn Leepreechanon	- Doctor of Philosophy	- Power System Economics and Planning	- Royal Melbourne Institute of Technology (RMIT University), Australia	2002
3	310050325xxxx	Associate	Dr. Wanchai Pijitrojana	- Doctor of Philosophy	- Optoelectronics	- King's College, University of London,	

No.	Identification Number	Academic Position	Name-Surname	Qualification	Major	Graduation	
						Institution	Year
		Professor		<ul style="list-style-type: none"> - Master of Engineering - Master of Science - Bachelor of Engineering 	<ul style="list-style-type: none"> - Nonlinear Optics - Computer Technology - Telecommunication 	United Kingdom <ul style="list-style-type: none"> - University of Southern California, California, United States of America - Asian Institute of Technology - King Mongkut's Institute of Technology Ladkrabang 	
4	410060005xxxx	Associate Professor	Dr. Cattaleeya Pattamaprom	<ul style="list-style-type: none"> - Doctor of Philosophy - Master of Science - Bachelor of Engineering 	<ul style="list-style-type: none"> - Chemical Engineering - Chemical Engineering - Chemical Engineering 	<ul style="list-style-type: none"> - University of Michigan, United States of America - University of Michigan, United States of America - Chulalongkorn University 	2001 1997 1994
5	3100501086xxx	Instructor	Dr. Bunpot Sirinutsomboon	<ul style="list-style-type: none"> - Doctor of Philosophy - Bachelor of Engineering 	<ul style="list-style-type: none"> - Biological Systems Engineering - Chemical Engineering 	<ul style="list-style-type: none"> - University of California, United States of America - University of Michigan, United States of America 	2011 2005
6	1909900014xxx	Instructor	Dr. Sarut Ammatyothin	<ul style="list-style-type: none"> - Doctor of Philosophy - Dipl.-Ing - Bachelor of Engineering 	<ul style="list-style-type: none"> - Polymer Science - Surface Engineering - Material Engineering 	<ul style="list-style-type: none"> - Chulalongkorn University - University of Limoges, France - Kasetsart University 	2012 2008 2006

No.	Identification Number	Academic Position	Name-Surname	Qualification	Major	Graduation	
						Institution	Year
7	3749900007xxx	Instructor	Dr. Benjamaporn Tangnoravich	<ul style="list-style-type: none"> - Doctor of Philosophy - P/g Dipl. - Bachelor of Science 	<ul style="list-style-type: none"> - Physiology - Physiology - Physics 	<ul style="list-style-type: none"> - University of Queensland, Australia - University of Queensland, Australia - Silpakorn University 	<ul style="list-style-type: none"> 2002 1998 1995
8	310050178xxxx	Instructor	Pattarin Pirompnich, MD	<ul style="list-style-type: none"> - Certificate of Proficiency - Certificate of Proficiency - The Higher Graduate Diploma in Clinical Medical Sciences - Certificate of Proficiency - Bachelor of Medicine 	<ul style="list-style-type: none"> - Intensive and Critical Care Medicine - Pulmonary Medicine and Pulmonary Critical Care - Internal Medicine - Internal Medicine 	<ul style="list-style-type: none"> - Phramongkutklao Hospital - Phramongkutklao Hospital - Chiang Mai University - Chiang Mai University - Chulalongkorn University 	<ul style="list-style-type: none"> 2014 2013 2011 2011 2007

4. Elements of Field Experience (Training)

4.1 Learning Outcome Standards of Field Experience

- 1) Students are able to apply and integrate knowledge for practical performance.
- 2) Students are able to apply their professional skills and knowledge for research appropriately.
- 3) Students are able to work well in a team, play the roles of leaders and followers, think creatively, and solve immediate problems.
- 4) Students have thinking, analytical, and problem-solving skills by using participation, scientific, and research methods.

4.2 Duration

CMT463, CMT472, and CMT482 can be taken during Fourth Year - First Semester.

4.3 Time Management and Classroom Timetables

Full time of Fourth Year - First Semester

5. Regulations for Projects or Research

5.1 Brief Explanation

Students conduct, review, and analyze research under advisors' supervision. Students can select a research project of their choice. The project must have a clearly defined topic which has been approved by the academic advisors of the project. The project must receive research ethical approval. Advisors and students should negotiate at the beginning when they will meet, when work will be handed in, and what kind of assistance and feedback will be given. Students must present a complete plan of the project and write their completed research report prior to course completion.

5.2 Learning Outcome Standards

Students acquire knowledge and understanding in research procedures. Students can conduct preliminary research, write research papers, and present research results/learning outcomes while putting into practice their communication skills.

5.3 Duration

CMT456 can be taken during Fourth Year - Second Semester.

5.4 Number of credits

CMT456 (4 credits)

5.5 Preparation

- 1) Course coordinators prepared TQF 3 (Course Specifications) which identify objectives, development of learning outcomes, teaching plans, evaluation, and other details. Course coordinators are also responsible for directing and monitoring project implementations under advisors' supervision.
- 2) Appointing project advisors for student groups/individual students.
- 3) Advisors are responsible for giving students advice and guidance about selecting research topics based on students' interest as well as research procedures; study, research, and evaluate results.
- 4) Students write research reports, present research results to every advisor, listen to and assess advisors' suggestions.

5.6 Evaluation Procedure

- 1) Course coordinators identify course evaluation criteria, prepare course evaluation forms, and explain them to project advisors.
- 2) Project advisors evaluate student learning outcomes according to evaluation forms.
- 3) Students present their learning outcomes and are evaluated by every advisor in the course who attends the presentation.
- 4) Course coordinators gather overall scores from project advisors and evaluate students according to identified criteria.

Section 4 Learning Outcomes, Teaching Strategies, and Evaluation

1. Development of Students' Special Characteristics

Special Characteristics	Strategies and Activities Conducted
Achieving professional competencies and high ethical standards	<p>1 Developing student learning ability and methods in order to help them understand the curriculum's objectives. Students receive training in problem-based learning (PBL) and self-directed learning (SDL). They will be further educated while taking Medical Sciences and Renal Science in the second and third years.</p>
	<p>2 The curriculum and every course emphasize the development of cognitive skills as learning outcomes. Students determine specific learning objectives and planning, and are enthusiastic to acquire knowledge and skills for life-long self-improvement. These are the program's required qualifications of clinical technologists.</p>
	<p>3 Every course has a specific time for students' self-study.</p>
	<p>4 Instilling professional ethics and moral values in students by interweaving them into every clinical technology course.</p>
	<p>5 Providing courses emphasizing on medical ethics and humanized healthcare continually in every academic year (from the first to the fourth year).</p>

2. Development of Learning Outcomes in Each Domain

2.1 General Education Courses at Thammasat University

2.1.1 Ethics and Morals

(1) Expected Ethical and Moral Learning Outcomes

Students develop the following qualities:

- 1) Honesty and integrity
- 2) Fairness
- 3) Personal responsibility and responsibility towards society
- 4) Self-discipline
- 5) Ethical values and codes of conduct
- 6) Volunteering spirit

(2) Teaching Strategies Employed to Develop Ethical and Moral Learning

- 1) Learning through role playing and case studies related to ethical and moral issues
- 2) Integrating ethics and morals into lecture and discussion
- 3) Individual assignments
- 4) Group assignments
- 5) Case studies to encourage students' ethical and moral analysis and discussion
- 6) Adding moral lessons to ethics-related courses
- 7) Setting up activities to encourage ethical and moral establishment
- 8) Hands-on learning
- 9) Launching projects aimed at establishing self and social responsibility
- 10) Setting up activities to encourage responsibility both inside and outside the classroom
- 11) Portfolios
- 12) Case studies of excellent models of different careers
- 13) Launching projects to encourage students' volunteering spirit
- 14) Allocating specific hours for activities to develop students' volunteering spirit

(3) Evaluation Strategies for Ethical and Moral Learning

- 1) Students, peers, and the instructor him/herself perform three evaluations:

- Pre-course evaluation
 - Mid-course evaluation
 - Post-course/activity evaluation
- 2) Students evaluate their own opinions and others' opinions.
 - 3) Evaluation form
 - 4) Students use journals to record their experiences inside and outside the classroom
 - 5) Participation and self-development before and during the course
 - 6) Assignments
 - 7) Completion of assigned tasks on time
 - 8) Punctual class attendance and assignment submission
 - 9) Class observation
 - 10) Participation and self-development

2.1.2 Knowledge

(1) Expected Knowledge Learning Outcomes

- 1) Students gain a full understanding of the principles and theories.
- 2) Students develop analytical skills.
- 3) Students are able to apply knowledge, principles, and theories appropriately.
- 4) Students are able to integrate knowledge and sciences appropriately.

(2) Teaching Strategies Employed to Develop Knowledge Learning

- 1) Lecture/discussion on knowledge theories
- 2) Instructors integrate interrelated knowledge of various sciences into their teaching.
- 3) Implementation of educational technologies
- 4) Mind mapping
- 5) Root cause analysis/problem solving
- 6) Emphasis on problem-based learning
- 7) Reports/projects
- 8) Brainstorming and knowledge application

- 9) Self-study of relationships among different sciences

(3) Evaluation Strategies for Knowledge Learning

- 1) Reports and presentations
- 2) Testing
- 3) Reports/research
- 4) Assignment submission and presentation
- 5) Report presentation and case study analysis
- 6) Exercises
- 7) Testing and report writing
- 8) Testing students' conceptual understanding
- 9) Report writing and presentation
- 10) Testing students' conceptual understanding
- 11) Report writing and presentation

2.1.3 Cognitive Skills

(1) Expected Cognitive Skills Outcomes

- 1) Students are able to search for information systematically.
- 2) Students are able to analyze problems, evaluate alternatives, and suggest problem-solving methods and decision outcome appropriately.
- 3) Students are able to think creatively and positively.
- 4) Students are enthusiastic about learning and are knowledgeable about changes to ensure continuous self improvement.

(2) Teaching Strategies Employed to Develop Cognitive Learning

- 1) Student-centered teaching that emphasizes problem solving
- 2) Encouraging students to summarize what they learned
- 3) Brainstorming
- 4) Role playing
- 5) Holding at least one activity/course to encourage students' problem analysis skills and resolution suggestion.
- 6) Problem-based learning planning

- 7) Problem-based learning
- 8) Project-based learning
- 9) Holding activities *to* encourage creativity
- 10) Lecture/discussion
- 11) Learning through positive attitude exchange from the point of view of students and society
- 12) Providing opportunities for students to discuss their opinions
- 13) Assignment
- 14) Self study

(3) Evaluation Strategies for Cognitive Learning

- 1) Analysis and problem solving
- 2) Systems thinking
- 3) Report presentation
- 4) Case study analysis
- 5) Projects/tasks
- 6) Test of systems thinking, connections, and reasons
- 7) Participation in problem analysis and resolution
- 8) Students, peers, and the instructor him/herself perform three evaluations:
 - Pre-course evaluation
 - Mid-course evaluation
 - Post-course/activity evaluation
- 9) Reports
- 10) Report/project presentation

2.1.4 Interpersonal Skills and Responsibility

(1) Interpersonal Skills and Responsibility Outcomes

- 1) Students respect other people's opinions and differences.
- 2) Students develop strong leadership skills and a proper sense of self-confidence.

- 3) Students are responsible for assigned tasks.
- 4) Students are emotionally mature, able to adjust themselves, able to control their emotions, and able to endure hardships.
- 5) Students exercise their rights to freedom without disturbing others and demonstrate good citizenship.

(2) Teaching Strategies Employed to Develop the Learning of Interpersonal Skills and Responsibility

- 1) Group project assignment
- 2) Problem-based learning experience
- 3) Extra-curriculum activities that help students develop leadership skills
- 4) Cooperative learning
- 5) Teaching self reliance
- 6) Student-centered teaching
- 7) Providing opportunities for students to express their opinions
- 8) Lecture/discussion by using the impact of loss of freedom and rights as examples
- 9) Problem-based learning experience by focusing on problems in students' communities
- 10) Teaching and training students to respect the rights of others, individual differences, equality, and rules

(3) Evaluation Strategies for the Learning of Interpersonal Skills and Responsibility

- 1) Behaviour observation
- 2) The ability to play the role of leaders and followers in various situations
- 3) Students' self evaluation
- 4) Authentic assessment of student learning outcomes
- 5) Participation, acceptance, and the right to freedom of opinion and expression
- 6) Assigned tasks/reports

2.1.5 Numerical Analysis, Communication, and Information Technology Skills

(1) Learning Outcomes for Numerical Analysis, Communication, and Information Technology Skills

- 1) Thai and foreign language skills
- 2) Information technology skills and effective application of information technology in communication
- 3) Calculation skills
- 4) Mathematical and statistical analysis skills, and data collection and presentation

(2) Teaching Strategies Employed to Develop the Learning of Numerical Analysis, Communication, and Information Technology Skills

- 1) Lecture/discussion
- 2) Hand-on learning from real-life situations
- 3) Self study
- 4) Report presentation
- 5) Work presentation by using various information technologies and communication
- 6) Practice calculation skills and techniques by using examples
- 7) Setting up situations for simulation projects
- 8) Mathematical and statistical case studies for data collection and presentation
- 9) Research

(3) Evaluation Strategies for the Learning of Numerical Analysis, Communication, and Information Technology Skills

- 1) Assigned tasks/projects
- 2) Communication, listening, speaking, reading, and writing skills
- 3) Presentation/understanding skills
- 4) Test results
- 5) Report writing/projects

2.2 Specific Courses of Bachelor of Science Program (Clinical Technology)

2.2.1 Ethics and Morals

(1) Ethical and Moral Outcomes

- 1) Students demonstrate professional ethical standards.
- 2) Students demonstrate personal and professional honesty and integrity and are able to maintain public and patients' trust.
- 3) Students' behaviors show respectable personality.
- 4) Students take responsibility for assigned patients and tasks.
- 5) Students understand patients' needs and limitations. Students understand that all patients deserve of equal treatment regardless of their race, religion, culture, gender, age, and financial status.
- 6) Students respect patients' rights by telling them the truth, keeping their secrets, and giving priority to their benefits and safety.

(2) Teaching Strategies Employed to Develop Ethical and Moral Learning

Morals, professional ethics, awareness of patients' rights, and human dignity are integrated into the curriculum. Teaching strategies or methods are as follows.

- 1) Analysis of ethical dilemmas
- 2) Group discussion
- 3) Practice in simulated situations
- 4) Role modeling
- 5) Case studies

(3) Evaluation Strategies for Ethical and Moral Learning

- 1) Analysis
- 2) Behaviour observation
- 3) Self evaluation
- 4) Peer evaluation
- 5) Assigned tasks

2.2.2 Knowledge

(1) Expected Knowledge Learning Outcomes

- 1) Basic medical sciences
- 2) Necessary knowledge and skills in clinical technology to perform their job responsibilities
- 3) Necessary knowledge and understanding in law, rules, and regulations to perform their job responsibilities
- 4) Principles of epidemiology, clinical epidemiology, biological statistics, medical informatics, and evidence-based medicine
- 5) Principles of social sciences, humanities, and behavioral science necessary for attitude improvement and understanding towards their fellow men and society
- 6) Basic principles of quality system and patient safety

(2) Teaching Strategies Employed to Develop Knowledge Learning

Encouraging student-centered learning by using various teaching methods that are consistent with the program's objectives and learning outcomes. Emphasizing on real-life situations practice.

- 1) Lecture
- 2) Group discussion
- 3) Self-directed learning
- 4) Bedside teaching
- 5) Individual assignment

(3) Evaluation Strategies for Knowledge Learning

- 1) Objective test
- 2) Modified subjective test
- 3) Performance test
- 4) Assigned tasks

2.2.3 Cognitive Skills

(1) Expected Cognitive Skills Outcomes

- 1) Students are aware of their capability to determine their learning objectives and are able to develop themselves comprehensively in every necessary aspect.
- 2) Students are able to think creatively, plan, and seek a way to improve their knowledge, skills, attitudes, and behaviors continuously and regularly.
- 3) Students develop analytical skills by using professional and other related knowledge.
- 4) Students are able to use information and evidence in basic medical sciences and clinical technology for references and are able to solve problems by applying critical thinking methods.
- 5) Students are able to choose an effective problem-solving method corresponding to changing situations and health contexts.
- 6) Students understand the importance of quality development, are able to perform their duties regularly and continuously, gain knowledge from daily performances, and understand knowledge management system.

(2) Teaching Strategies Employed to Develop Cognitive Learning

- 1) Group discussion
- 2) Self-directed learning
- 3) Laboratory study
- 4) Research projects
- 5) Simulated situations
- 6) Clinical practice

(3) Evaluation Strategies for Cognitive Learning

- 1) Objective test
- 2) Modified subjective test
- 3) Performance test
- 4) Analytical results

- 5) Observation of students' activity participation
- 6) Assigned tasks

2.2.4 Interpersonal Skills and Responsibility

(1) Interpersonal Skills and Responsibility Outcomes

- 1) Students can adjust themselves professionally and interact with others creatively.
- 2) As a health care team member, students are able to work in a team appropriately in accordance with the contexts and situations.
- 3) Students have the responsibility to fulfill their duties, and participate in professional, organizational, and social developments.

(2) Teaching Strategies Employed to Develop the Learning of Interpersonal Skills and Responsibility

- 1) Small group learning
- 2) Clinical practice
- 3) Community experience
- 4) Role modeling

(3) Evaluation Strategies for the Learning of Interpersonal Skills and Responsibility

- 1) Behaviour observation
- 2) Self evaluation
- 3) Peer evaluation
- 4) Assigned tasks

2.2.5 Numerical Analysis, Communication, and Information Technology Skills

(1) Learning Outcomes for Numerical Analysis, Communication, and Information Technology Skills

- 1) Students possess language and computer skills suitable for work performance.
- 2) Students are able to study and manage information, analyze problems, summarize reasons, and give an appropriate presentation.
- 3) Students are able to communicate effectively and possess skills in speaking, listening, reading, writing, presentation, and non-verbal communications.
- 4) Students possess communication skills in specific situations and skills needed for breaking bad news and dealing with medical mistakes.
- 5) Students possess listening skills and understand feelings and concerns of patients and their relatives. Students are able to answer questions, explain, offer medical advice, and give patients the opportunity to participate in their health care decisions appropriately.
- 6) Students write medical records systematically, correctly, and continually based on international standard guidances.

(2) Teaching Strategies Employed to Develop the Learning of Numerical Analysis, Communication, and Information Technology Skills

- 1) Self-directed learning
- 2) Research projects
- 3) Simulated situations
- 4) Clinical practice
- 5) Information search and presentation by using information technology

(3) Evaluation Strategies for the Learning of Numerical Analysis, Communication, and Information Technology Skills

- 1) Performance test
- 2) Observation of students' activity participation
- 3) Assigned tasks
- 4) Presentation

2.2.6 Psychomotor Domain

(1) Learning Outcomes for Psychomotor Domain

- 1) Students are able to ask patients about their past medical history inclusively, perform primary physical examination appropriately, and observe manners of patients and their relatives.
- 2) Students have the ability to examine and interpret test results by using basic equipment and laboratory tests. Students are also able to prepare necessary medical equipment for patients with respiratory tract diseases, nephropathy, and nervous system diseases while taking into account the worthiness and suitability.
- 3) Students have equipment maintenance skills and can perform necessary medical procedures properly.
- 4) Students have necessary knowledge and understanding on organizational visions, obligations, and plans.
- 5) Students are able to plan, control, examine, give advice, and suggest resolution methods and improvement of assigned responsibilities.

(2) Teaching Strategies Employed to Develop Psychomotor Domain

- 1) Clinical practice
- 2) Simulated situations

(3) Evaluation Strategies for Psychomotor Domain

- 1) Performance test
- 2) Behaviour observation
- 3) Clinical practice

3. Curriculum Mapping

Five learning outcome standards indicated in the table have the following meanings.

2.1 General Education Courses

2.1.1 Ethics and Morals

- 1) Honest and integrity

- 2) Fairness
- 3) Personal responsibility and responsibility towards society
- 4) Discipline
- 5) Ethical values and codes of conduct
- 6) Volunteering spirit

2.1.2 Knowledge

- 1) Students gain a full understanding of the principles and related theories.
- 2) Students develop analytical skills.
- 3) Students are able to apply knowledge, principles, and theories appropriately.
- 4) Students are able to integrate knowledge and sciences appropriately.

2.1.3 Cognitive Skills

- 1) Students are able to search for information systematically.
- 2) Students are able to analyze problems, evaluate alternatives, and suggest problem-solving methods and decision outcome appropriately.
- 3) Students are able to think creatively and positively.
- 4) Students are enthusiastic about learning and are knowledgeable about changes to ensure continuous self improvement.

2.1.4 Interpersonal Skills and Responsibility Outcomes

- 1) Students respect other people's opinions and differences.
- 2) Students develop strong leadership skills and a proper sense of self-confidence.
- 3) Students are responsible for assigned tasks.
- 4) Students are emotionally mature, able to adjust themselves, able to control their emotions, and able to endure hardships.
- 5) Students exercise their rights to freedom without disturbing others and demonstrate good citizenship.

2.1.5 Numerical Analysis, Communication, and Information Technology Skills

- 1) Thai and foreign language skills
- 2) Information technology skills and effective application of information technology in communication

- 3) Calculation skills
- 4) Mathematical and statistical analysis skills, and data collection and presentation

2.2 Specific Courses in Clinical Technology

Six learning outcome standards indicated in the table have the following meanings.

2.2.1 Ethics and Morals

- 1) Students demonstrate professional ethical standards.
- 2) Students demonstrate personal and professional honesty and integrity and are able to maintain public and patients' trust.
- 3) Students' behaviors show respectable personality.
- 4) Students take responsibility for assigned patients and tasks.
- 5) Students understand patients' needs and limitations. Students understand that all patients deserve of equal treatment regardless of their race, religion, culture, gender, age, and financial status.
- 6) Students respect patients' rights by telling them the truth, keeping their secrets, and giving priority to their benefits and safety.

2.2.2 Knowledge

- 1) Basic medical sciences
- 2) Necessary knowledge and skills in clinical technology to perform their job responsibilities
- 3) Necessary knowledge and understanding in law, rules, and regulations to perform their job responsibilities
- 4) Principles of epidemiology, clinical epidemiology, biological statistics, medical informatics, and evidence-based medicine
- 5) Principles of social sciences, humanities, and behavioral science necessary for attitude improvement and understanding towards their fellow men and society
- 6) Basic principles of quality system and patient safety

2.2.3 Cognitive Skills

- 1) Students are aware of their capability to determine their learning objectives and are able to develop themselves comprehensively in every necessary aspect.
- 2) Students are able to think creatively, plan, and seek a way to improve their knowledge, skills, attitudes, and behaviors continuously and regularly.
- 3) Students develop analytical skills by using professional and other related knowledge.
- 4) Students are able to use information and evidence in basic medical sciences and clinical technology for references and are able to solve problems by applying critical thinking methods.
- 5) Students are able to choose an effective problem-solving method corresponding to changing situations and health contexts.
- 6) Students understand the importance of quality development, are able to perform their duties regularly and continuously, gain knowledge from daily performances, and understand knowledge management system.

2.2.4 Interpersonal Skills and Responsibility

- 1) Students can adjust themselves professionally and interact with others creatively.
- 2) As a health care team member, students are able to work in a team appropriately in accordance with the contexts and situations.
- 3) Students have the responsibility to fulfill their duties, and participate in professional, organizational, and social developments.

2.2.5 Numerical Analysis, Communication, and Information Technology Skills

- 1) Students possess language and computer skills suitable for work performance.
- 2) Students are able to study and manage information, analyze problems, summarize reasons, and give an appropriate presentation.
- 3) Students are able to communicate effectively and possess skills in speaking, listening, reading, writing, presentation, and non-verbal communications.
- 4) Students possess communication skills in specific situations and skills needed for breaking bad news and dealing with medical mistakes.

- 5) Students possess listening skills and understand feelings and concerns of patients and their relatives. Students are able to answer questions, explain, offer medical advice, and give patients the opportunity to participate in their health care decisions appropriately.
- 6) Students write medical records systematically, correctly, and continually based on international standard guidances.

2.2.6 Psychomotor Domain

- 1) Students are able to ask patients about their past medical history inclusively, perform primary physical examination appropriately, and observe manners of patients and their relatives.
- 2) Students have the ability to examine and interpret test results by using basic equipment and laboratory tests. Students are also able to prepare necessary medical equipment for patients with respiratory tract diseases, nephropathy, and nervous system diseases while taking into account the worthiness and suitability.
- 3) Students have equipment maintenance skills and can perform necessary medical procedures properly.
- 4) Students have necessary knowledge and understanding on organizational visions, obligations, and plans.
- 5) Students are able to plan, control, examine, give advice, and suggest resolution methods and improvement of assigned responsibilities.

Curriculum Mapping

● Main Responsibilities ○ Minor Responsibilities

Courses	1. Ethics and Morals						2. Knowledge				3. Cognitive Skills				4. Interpersonal Skills and Responsibility					5. Numerical Analysis, Communication and Information Technology Skills			
	1	2	3	4	5	6	1	2	3	4	1	2	3	4	1	2	3	4	5	1	2	3	4
General Education Courses																							
TU100 Civic Education			●	●				●		●	●			●	●		●			●	●		
TU101 Thailand, ASEAN, and the World			●	○				●	●	●	●	●		●	○		●				●		●
TU102 Social Life Skills			●	○				●		●	●		●	○	●		○	●			○		○
TU103 Life and Sustainability			○	●			●	●		●	●	●			○		●				●	●	○
TU050 English Skill Development	○	○	●	○	○	○	●	○	●	○	○	○	○	●	○	●	●	○	○	●	○		
TU104 Critical Thinking, Reading, and Writing	○		●	○			●	●			●		●		●	○	●	○		●			
TU105 Communication Skills in English	○		●	○			●		●	○	○			●	○	●	●			●	○		
TU106 Creativity and Communication	○		●	○			●	●	○	●	○		●	●	●	●	○			●	○		
TU116 Man and Arts : Visual Art, Music and Performing Arts	●	●	●	●	●	●	●	●	●	●	●	○	○	●	○	○	●	○	●	●	●		
TU122 Law in Everyday Life	●	●	●	●	○	○	●	●	●	○	●	●	○	○	○	○	○	○	●	●	○		
TU155 Elementary Statistics	○		○	○	○		●	●	●	○	●	●	○	○	○		○				○	●	●
TU156 Introduction to Computers and Programming	○	○	●	○	○	○	●	○	●	○	○	○	○	●	○	●	●	○	○	●	○		

Curriculum Mapping

● Main Responsibilities ○ Minor Responsibilities

Courses	1. Ethics and Morals						2. Knowledge						3. Cognitive Skills						4. Interpersonal Skills and Responsibility			5. Numerical Analysis, Communication and Information Technology Skills						6. Psychomotor Domain				
	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	1	2	3	4	5	6	1	2	3	4	5
Basic science and medical science course																																
SC111 Biology 1				○			●	○					○	○	○						○	○	○						○			
SC123 Fundamental Chemistry				○			●	○					○	○	○						○	○	○	○					○			
SC125 General Organic Chemistry				○			●	○					○	○	○						○	○	○	○					○			
SC136 Physics				○			●	○					○	○	○						○	○	○						○	○		
CMM217 General Anatomy and Physiology	○	○		○			●	○					○	○	○	●	○		○	○	○	○	○						○			
CMT250 Medical Biology	○	○		○			●	○					○	○	○	●	○		○	○	○	○							○			
CMM221 Patient Assessment	○	●	○	○	○	○	○	○	○		●	●		○		○	○		○	○	○	○	○	○	●	○	○	○	○			
Professional courses																																
CMT210 Mathematics for Clinical Technology				○				●	●	○						○			○	○	●			○	○							
CMT211 Engineering Graphics for				○			○	○					○	○	●	○	○				○	○	○	○					○			

Courses	1. Ethics and Morals						2. Knowledge						3. Cognitive Skills						4. Interpersonal Skills and Responsibility			5. Numerical Analysis, Communication and Information Technology Skills						6. Psychomotor Domain				
	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	1	2	3	4	5	6	1	2	3	4	5
Clinical Technology																																
CMT212 Biomaterials	○	●	○	○	○	○	●	●	●	●	○	○	●	●	●	●	○	○	●	●	○	●	●	●	●	○	○	●	●	●	○	○
CMT221 Biomechanics for Clinical Technology	○						○	○					○	○	●	○	○				○		●						○			
CMT230 Fundamentals of Electrical Engineering for Clinical Technology				○			○	○					○	○	●	○	○				○	○	○	○				○				
CMT231 Electronic Devices and Circuits for Clinical Technology				○			○	○					○	○	●	○	○				○	○	○	○				○				
CMT232 Digital and Microprocessor for Clinical Technology				○			○	○					○	○	●	○	○				○	○	○	○				○				
CMT333 Measurement and Instrumentation for Medical Applications				○			○	○					○	○	●	○	○	○			○	○	○	○				○				
CMT234 Signals and Systems for Medical Applications				○			○	○					○	○	●	○	○				○	○	○	○				○				
CMT235 Basic Electrical Engineering Laboratory for Clinical Technology 1				○			○	○					○	○	●	○	○				○	○	○	○				○				

Courses	1. Ethics and Morals						2. Knowledge						3. Cognitive Skills						4. Interpersonal Skills and Responsibility			5. Numerical Analysis, Communication and Information Technology Skills						6. Psychomotor Domain				
	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	1	2	3	4	5	6	1	2	3	4	5
CMT236 Basic Electrical Engineering Laboratory for Clinical Technology 2				○			○	○					○	○	●	○	○				○	○	○	○	○					○		
CMT241 Fluid Mechanics for Clinical Technology				○			○	●					○	○	●	●	○				○	○	○	●	○					○		
CMT313 Facility and Infrastructure for Hospital	○	○	○		○		○	●	●			○			●		○		○				●	●	●					○	○	●
CMT342 Mass Transfer for Clinical Technology	○							●					○	○	●	●	○			○	○		●								○	
CMT343 Heat Transfer for Clinical Technology	○							●					○	○	●	●	○			○	○		●								○	
CMT351 Anatomy and Physiology for Clinical Technology	○	○		○			●	○					○	○	○	●	○		○	○	○		○	○						○		
CMT352 Professional Ethics for Clinical Technology	●	●	●	●	●		●	○		○	○	○							○	○	○				○	●		○				
CMT353 Introduction to Human				○			●	●				●	○	○	○	○					○	○	○							○		

Courses	1. Ethics and Morals						2. Knowledge						3. Cognitive Skills						4. Interpersonal Skills and Responsibility			5. Numerical Analysis, Communication and Information Technology Skills						6. Psychomotor Domain					
	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	1	2	3	4	5	6	1	2	3	4	5	
Diseases																																	
CMT360 Hemodialysis and Peritoneal Dialysis Machine				○				●				○	○	○	○	○				○	○	○	○	○			○		●	●			
CMT361 Advance in Hemodialysis for clinical technology	●	●	○	●	○	●	●	●				●	●	○	●	●	○	○	○	○	●		●	●	○	○		○	●	●		○	
CMT362 Bioelectric Impedance Analysis				○				●				○	○	○	○	○				○	○	○	○	○			○		●	●			
CMT370 Mechanical Ventilation and Oxygen Devices	●	●	●	●	○	●	●	●	○			●	●	○	●	●	○	○	○	○	●		●	●	○	○		○	●	●		○	
CMT371 Hemodynamic and Respiratory Monitoring	●	●	○	●	○	●	●	●	○			●	●	○	●	●	○	○	○	○	●		●	●	○	○		○	●	●		○	
CMT380 Flow Hemodynamic Ultrasonography	○	○	○	○	○	○	○	○	○			○	○	○	○	○	●	○	○		○		○	○	○	○	○	○	○	○	○		○
CMT381 Machine for Nervous System	○	○	○	○	○	○	○	○	○			○	○	○	○	○	●	○	○		○		○	○	○	○	○	○	○	○	●		○

Courses	1. Ethics and Morals						2. Knowledge						3. Cognitive Skills						4. Interpersonal Skills and Responsibility			5. Numerical Analysis, Communication and Information Technology Skills						6. Psychomotor Domain						
	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	1	2	3	4	5	6	1	2	3	4	5		
CMT454 Seminar	○	○					●	●	○	○	○	○	○	○	○	○	○	○	○	○	○	●	●	●				○	○					
CMT455 Journal Club	○	○					○	○	○	●	○	○	○	○	○	○	○	○	○	○	○	●	●	●					○					
CMT463 Clinical Experience in Dialysis Unit	○	○	○	○	○	○		●	○		○	○	●	●	○	○	○	●	●	●	●	○	○	○	○	○	○		●	●	○	○		
CMT472 Clinical Experience in Respiratory Care Unit	●	●	○	●	●	●	●	●	●	●	○	●	●	●	●	●	●	○	○	●	●	●	●	○	●	●	○	●	●	●	●	●	○	●
CMT482 Clinical Experience in Nervous System Unit	○	○	○	○	○	●			○	○	○	○					○	○	○	○	○	○	○	○	○	○	○	○	○	○				
CMT456 Research Project and Review	○	○	○	○	○	●	○	○	○	●	○	●	○	○	○	●	●	●	●	●	●	●	●	●				○	○	○				

Section 5 Evaluation Criteria

1. Regulations of Evaluation Criteria

1.1 Grading must conform to Undergraduate Study Regulations of Thammasat University (Revised 1997) and its Amendments, items 12, 13 and 14.

1.2 Eight levels of grades are specified as follows:

Grade	A	B+	B	C+	C	D+	D	F
Point	4.00	3.50	3.00	2.50	2.00	1.50	1.00	0.00

1.3 Evaluation criteria and resit examination should follow the Announcement of Chulabhorn International College of Medicine.

2. Verification of Student Learning Achievement

2.1 Verification of Student Learning Achievement before Graduation

- 1) Course Sub-Committee examines grading results of tests, reports, and other assigned tasks and brings these results to the evaluation meeting of Sub-Committee according to the Announcement of Chulabhorn International College of Medicine.
- 2) Evaluation Sub-Committee of Chulabhorn International College of Medicine, composed of eminent persons in medicine, verifies grading results of tests, reports, and other assigned tasks and reports these results to the Curriculum Administrative Committee in every semester and academic year.
- 3) Committee of Chulabhorn International College of Medicine verifies learning achievements and learning outcome standards in every academic year.

2.2 Verification of Student Learning Achievement after Graduation

- 1) Graduate performances and professional achievements are further evaluated after graduation. The results will be used for improving the curriculum in the future. Verifications are performed by graduates, employers, and external eminent persons.
- 2) The institution gathers information about graduates' academic works, socially beneficial activities, or honor awards.

3. Graduation Requirements

Students will be nominated for the Bachelor's Degree after they meet the following requirements:

- 3.1 Having completed all the required courses in the curriculum with a minimum of 142 credits and 200-hour internship/training.
- 3.2 Achieving a grade point average of at least 2.00 (out of 4.00).
- 3.3 Having met other conditions imposed by Chulabhorn International College of Medicine and Thammasat University.

Section 6 Instructor Development

1. Preparation for New Instructors

- 1) University-wide and Faculty-wide Orientation for New Instructors:
 - The policies of Thammasat University and Chulabhorn International College of Medicine
 - University's instructors' four obligations (teaching, research, public service, and arts and cultural preservation)
 - University's instructors' rules, regulations, and benefits
- 2) Every new instructor needs to be well-informed and educated about educational planning, research, ethics and morals, being an advisor, and quality assurance.

2. Knowledge and Skills Development for New Instructors

2.1 Developing Instructional Management, Assessment, and Evaluation Skills

- 1) Organizing special seminars to enhance instructors' knowledge and understanding in clinical technology.
 - Curriculum development
 - Instructional management
 - Management of different and various teaching methods, especially student-centered teaching.
 - Measurement and evaluation
 - Use of educational technology and innovation such as e-learning and instructional media production
- 2) Organizing special seminars for instructors in order to encourage them to conduct research, develop their knowledge and teaching ability, provide support for academic work publications, and increase their academic motivation.
- 3) Holding a workshop seminar for instructional development and evaluation.

2.2 Academic and Professional Development

- 1) Encouraging instructors to further their studies to enhance their qualifications.
- 2) Encouraging instructors to attend training programs or seminars concerning professional practice and other academic fields.

- 3) Encouraging instructors to do academic work so that they can be promoted to a higher level.
- 4) Encouraging instructors to conduct research in professional fields and increase their academic motivation.
- 5) Encouraging instructors to participate in activities that provide academic services to society.

Section 7 Curriculum Quality Assurance

1. Curriculum Management

- 1.1 The faculty announces policies and procedures on instructional management and outcome evaluation of graduate quality assurance.
- 1.2 The faculty appoints Administrative Committee of Bachelor of Science Program in Clinical Technology (International Program). They are responsible for planning, managing, and giving advice and guidance for instructors responsible for the curriculum, Evaluation Sub-Committee, and Course Sub-Committee by aiming for effective instructional management and objective achievement.
- 1.3 Course Sub-Committee coordinates with instructors on instructional management and learning outcome evaluation conforming to Program Specifications and Course Specifications. They are all responsible for evaluating instructional management outcomes and further development.
- 1.4 Evaluation Sub-Committee is responsible for managing evaluation, investigating examination results, comprehensive medical examination, resit examination, and presenting these results to the Curriculum Administrative Committee.
- 1.5 Instructors responsible for the curriculum, Course Sub-Committee, and instructors gather useful information for a special seminar which is held at the end of every academic year. The seminar's goals are to review, improve, and develop the curriculum.
- 1.6 Academic Services Office at Chulabhorn International College of Medicine supports Chulabhorn International College of Medicine in every area, for example, instructional management, instructional resource management, student evaluation, instructional management evaluation, and educational quality assurance.

Objectives	Implementation	Evaluation
1. The curriculum meets educational standards and is up-to-date.	1. A committee is appointed to develop and improve the Bachelor of Science Program in Clinical Technology (International Program) and ensure that the program meets Thailand Qualifications Framework for Bachelor's Degree Level and Professional Standards for The Art of Healing in Clinical Technology of Clinical Technology Committee B.E.	1. The faculty's curriculum is approved by the University Council, Clinical Technology Committee, and OHEC.
2. Duly completed Course Specifications	2. Course Sub-Committee prepares TQF 3 and TQF 4 by coordinating with the Curriculum Administrative Committee. They must be consistent with professional standards for persons engaging in the medical practice in the branch of Clinical Technology of Clinical Technology Committee, and Medical Competency Assessment Criteria for Clinical Technologist's License B.E.	2. Duly completed TQF 3 and TQF 4
3. Graduates have satisfied all specific requirements of the program.	3.1 Every committee, instructors, and all concerned parties fulfill their responsibilities by aiming to produce high-quality graduates with required qualifications. 3.2 Graduate evaluation	3.1 Number of graduates who receive a Bachelor of Science degree in Clinical Technology (International Program) and Clinical Technologist's License 3.2 Results of graduate evaluation
4. The curriculum quality is evaluated regularly.	4.1 Performing quality assurance and using the results for continual development of instructional management. 4.2 Conducting curriculum evaluation every 4 year	4.1 Good evaluation results from quality assurance 4.2 Results from curriculum evaluation are used for improving and developing the curriculum.

2. Instructional Resource Management

2.1 Budget management

The faculty has allocated both government budget and income budget for the purchase of textbooks, instructional media, electronic databases for education, computers, information media, models, and educational materials.

The faculty has also allocated budget for instructor and personnel development. The faculty aims to provide academic supports by encouraging instructors to pursue further education and attend both domestic and overseas academic seminars.

2.2 Existing Instructional Resources

2.2.1 Provision of Academic Resources and Textbooks

Thammasat University has an extensive collection of textbooks and provides database search service. Students are able to search for information on the Internet. Students also have access to documents, textbooks, journals, and audio-visual equipment at Nongyao Chaiseri Library at Thammasat University, Rangsit Campus, which provides the following instructional resources.

1. 26,234 Thai books and 24,897 English books

2. 40 Thai journals and 156 English journals

3. 2,025 Electronic books

4. 5,064 Electronic journals

5. Computers for the library's users

- Number of computers for Internet searching: 40

- Number of computers for bibliographic searching: 13

6. Audio visual equipment

- Number of televisions with video player for student groups: 3

- Number of televisions with video player for individual students: 6

- Number of televisions with VDO/DVD player for individual students: 3

- Number of microform readers: 1

- Number of projection booths: 2

2.2.2 Classrooms and Laboratories

Instructional locations and equipment are available at Chulabhorn International College of Medicine at Thammasat University, Rangsit Campus and Bumrungrad International Hospital.

2.2.3 Availability of Teaching and Learning Resources

Chulabhorn International College of Medicine provides instructional media, for example, multimedia projectors, computers, Internet system, and laboratory equipment.

1) A list of health sciences databases

- Annual Review: Online databases of full-text annual reviews published by Annual Reviews. The collections cover 32 topics including Biomedical Sciences, Physical Sciences and Social Sciences.
- The Cochrane Library: Database of evidence-based medicine and systematic analyses established to support medical research and practice
- CINAHL Plus with Full Text: Database of periodical indexes and full-text journals covering Nursing and Allied Health Sciences.
- McGraw-Hill's "Access Medicine": Databases of electronic books and multimedia covering basic sciences, health sciences, and every area of specialized medical sciences with supporting information for medical practices and services.
- McGraw-Hill's "Access Surgery": Databases of electronic books and multimedia covering Surgery and Medical Sciences with supporting information for medical practices and services.
- MD Consult Core Collection: Database of integrated medical information. It offers journals and textbooks on many areas of Specialized Medical Sciences.
- Nature (journals in Nature Publishing Group): It offers 8 journals covering sciences and medical sciences including Nature Biotechnology, Nature Cell Biology, Nature Genetics, Nature Immunology, Nature Materials, Nature Medicine, Nature Neuroscience, and Nature Structural and Molecular Biology.
- OVID: Bibliographic databases of electronic journals from medical sciences association and over 50 publishers, for examples, Lippincott Williams & Wilkins, Taylor & Francis. In the years that the Library subscribes to OVID, students will have total access to over 240 journal articles on science, technology, and medicine.
- Oxford Journals: Over 180 electronic journals published by the Oxford University Press. The collections cover life sciences, mathematics,

physical sciences, medicine, social sciences, humanities, and law.

Subscribers receive access to the online journals dating back to 1996.

- SAGE Journals Online: The collection covers Humanities, Social Sciences, Science, Technology, and Medicine. Electronic access is provided to journal backfile back to 1999. SAGE Journals Online provides the complete text of each journal article. Subscribers can access the collection on the HighWire Press platform.
 - ScienceDirect: It covers over 1,800 journal articles on Sciences and Medicine published by Elsevier Science, Academic Press, and other publishers. The collection offers over 6.2 million review articles and shows almost every article with full text dating back to 1995.
 - Thieme Electronic Book Library: Atlases in sciences and medical sciences of Thieme Publishing House.
 - UpToDate: A comprehensive electronic clinical database. UpToDate covers primarily internal medicine and 14 subspecialties, including obstetrics, gynecology, and pediatrics. Completely updated by providing new search box, “what’s new,” drugs & drug interactions database, patient information topics, and graphics.
 - Web of Science: a comprehensive interdisciplinary, bibliographic and abstract database. Web of Science also provides citation and reference databases, covering science, social sciences, and humanities from over 9,200 journals with information dating from 2001-present.
 - Wiley Online Library: It offers electronic journals on medicine, science, health, engineering, computer and technology, business, economics, finance, and accounting, social sciences, behavioral science humanities, arts, and law.
- 2) Asking for cooperation with skills labs at Academic Resource Center, the Faculty of Medicine, which has model manikins, microscopes, and computers. Internet service is available.
 - 3) Self-directed learning room (SDL room) at Chulabhorn International College of Medicine, and the Lecture Building 5 provide Internet service.

- 4) Providing computers and iPads for students for information searching. The number of computers provided for academic personnel and academic supporting personnel is in a 1:1 ratio. Wireless Internet connections are available in the lecture hall.
- 5) For technology equipment and facilities for research and practice, Thammasat University Hospital and Bumrungrad International Hospital have treatment rooms for the diagnosis and treatment of kidney problems and research laboratories for developing and supporting research capacity.

2.3 Provision of Additional Teaching and Learning Resources

- 1) Administrators plan the procurement and acquisitions of and follow-up on the use of instructional resources of Chulabhorn International College of Medicine.
- 2) Instructors and Student Committee can recommend textbooks and instructional media for purchase to Chulabhorn International College of Medicine, administrators, and the university libraries.
- 3) Chulabhorn International College of Medicine allocates an appropriate amount of budget for the curriculum.
- 4) Self-study rooms at Chulabhorn International College of Medicine are well equipped with books, computers, Internet, and instructional media.

2.4 Resource Sufficiency Evaluation

Personnel responsible for educational and technological resources coordinate in following up and assessing students and instructors' use of instructional resources and their satisfaction for further improvement.

Objectives	Implementation	Evaluation
1. Providing sufficient textbooks, journals, and learning media 2. Providing sufficient classrooms, laboratories, skills labs, and self study rooms 3. Providing network system, computers, iPad and effective Internet services	1. Library conducts surveys that measure sufficiency and satisfaction of library resources. 2. Course and Chulabhorn International College of Medicine Subcommittees conduct surveys that measure teachers and students' satisfaction with instructional resources 3. Students and teachers inform Chulabhorn International College of Medicine or the library of their resource needs. 4. The faculty plans and manages instructional locations and conducts satisfaction surveys. 5. The faculty provides network system, computers, iPad, information technology resources, and Internet services for students and personnel effectively and sufficiently.	1. Satisfaction survey results with textbooks, journals, and learning media 2. Satisfaction survey results with instructional locations 3. Satisfaction survey results with network system, information resources, and Internet

3. Instructor Management

3.1 Instructor Recruitment

New instructor recruitment procedure must conform to the criteria imposed by Thammasat University and Chulabhorn International College of Medicine.

- 1) Academic qualification specification of new instructors
- 2) Announcement for new instructors who possess required qualifications
- 3) Searching for applicants' background and qualifications from trustworthy and fair sources
- 4) Personality test
- 5) Appointment of interview panels
- 6) Nominating applicants who passed the primary selection to the University for screening before presenting qualified applicants for final approval.
- 7) The university's administrative committee considers, scrutinizes, and chooses appropriate applicants.

3.2 Teachers' Participation in Curriculum Planning and Review

- 1) Instructors evaluate students while coordinating with Course Sub-Committee in evaluating instructional management at the end of the courses and presenting evaluation results in the department meeting for consideration.
- 2) Instructors and Course Sub-Committee, who are responsible for the curriculum, attend seminars on curriculum and instructional management at the end of academic years in order to review and improve the curriculum in the next year.

3.3 Special Instructor Appointment

- 1) Appointment of part-time special instructors should be limited to courses that need experts or specialists and there is no full-time instructor who can teach these courses, or there are not enough full-time instructors.
- 2) Medical instructors who also teach at Thammasat University Hospital and Bumrungrad International Hospital will be appointed as special instructors.
- 3) Chairperson of Course Sub-Committee emphasizes the need for special instructor appointment with Associate Dean for Academic Affairs for further consideration and screening before submitting the selected instructors to the Dean who will appoint them according to the university's regulations.

4. Management of Instructional Support Personnel

4.1 Qualification Specification

Qualifications are specified according to Chulabhorn International College of Medicine's needs and must align with University Regulations. For positions with high responsibility or with specific qualifications, a bachelor's degree is a minimum eligibility requirement.

4.2 Knowledge Enhancement and Skills Development

- 1) The aim of human resource management is to develop supporting personnel in various aspects. Chulabhorn International College of Medicine is directly responsible for providing budget support.
- 2) Training, field study outings, knowledge sharing activities are organized to enhance knowledge and experiences.
- 3) The faculty offers master's scholarships. Supporting personnel development committee is responsible for screening applications and selecting the most qualified candidates.
- 4) Each organization holds its annual field trip or a study visit.

5. Student Support and Counselling

5.1 Providing Advice to Students with Academic Problems or Other Concerns

- 1) Providing guiding documents on the curriculum and university life on the orientation day.
- 2) Each student is assigned an advisor who is there to give the student guidance in making academic and other decisions.
- 3) Students with academic problems or other concerns can set up an appointment with their advisor and Associate Dean for Academic Affairs and Associate Dean for Student Affairs.
- 4) Holding career advising sessions for fourth-year students of Clinical Technology Program.
- 5) A graduation ceremony or activity is organized for the program's fourth-year students before graduation.

5.2 Student Appeals

- 1) In case of any queries concerning grade results, students have the right to file an appeal to inspect their answer sheets, scores, and course evaluation criteria.
- 2) Student appeals should be conducted in accordance with Thammasat University's Regulations on Student Disciplines 2004, Section 4.

6. Labor Market, Social Needs and/or Employer Satisfaction with Graduates' Performance

- 1) Employment rate/further academic pursuit of graduates: 100%
- 2) The score of overall employer satisfaction of graduates' performance must be over 3.51 from 5.0 (maximum satisfaction).

7. Key Performance Indicators

Key Performance Indicators	Year 1	Year 2	Year 3	Year 4	Year 5
1) At least 80% of full-time instructors of the program participate in curriculum planning, following up, and reviewing the curriculum implementation.	✓	✓	✓	✓	✓
2) TQF 2 (Program Specifications) are consistent with Nation Qualifications Framework or qualification standards for different branches (if any).	✓	✓	✓	✓	✓
3) TQF 3 (Course Specifications) and TQF 4 (Field Experience Specifications) (if any) are prepared for every course before the beginning of each semester.	✓	✓	✓	✓	✓
4) TQF 5 (Course Reports) and TQF 6 (Field Experience Reports) are prepared for every course within 30 days after the end of each semester.	✓	✓	✓	✓	✓
5) TQF 7 (Program Reports) are prepared within 60 days after the end of academic years.	✓	✓	✓	✓	✓
6) Learning Outcome Standards are verified according to TQF 3 and TQF 4 (if any) in at least 25% of courses in each academic year.	✓	✓	✓	✓	✓
7) Improving instructional management, teaching strategies, or evaluation of learning outcomes by using evaluation results reported in TQF 7 last year.		✓	✓	✓	✓
8) Every new instructor (if any) must attend orientation or receives guidance on instructional management.	✓	✓	✓	✓	✓
9) Every full-time instructor is provided academic and/or professional developments at least once a year.	✓	✓	✓	✓	✓
10) Number of instructional supporting personnel (if any) provided academic and/or professional developments must be not less than 50% per year.	✓	✓	✓	✓	✓
11) The average satisfaction score of fourth-year students/graduates with the curriculum quality must be not less than 3.5 from 5.0 (maximum satisfaction).				✓	✓
12) The score of employer satisfaction of graduates' performance must be over 3.5 from 5.0 (maximum satisfaction).					✓

Section 8 Curriculum Evaluation and Development

1. Evaluation of Teaching Effectiveness

1.1 Evaluation of Teaching Strategies

- 1) Students in every course are required to complete the instructional management evaluation forms. The evaluation results will be presented in annual seminars on instructional management at the end of the courses and academic years.
- 2) Course instructors and instructors at Chulabhorn International College of Medicine attend a meeting at the end of the courses and academic years. The meeting is held for sharing knowledge on instructional management and considering improvement methods.
- 3) Student learning outcomes, including knowledge, skills, and attitudes, are evaluated by various evaluation tools. Strengths and limitations of evaluation processes are analyzed for further improvement.

1.2 Evaluation of Teaching Skills and Strategic Plan Implementation

- 1) Students are required to evaluate instructors' performance in every aspect, including teaching methods, punctuality, and clarification of course objectives, course evaluation criteria, and use of instructional media.
- 2) Evaluations are conducted by the instructors themselves and their colleagues.
- 3) Evaluations are conducted by eminent persons in education when instructors apply for academic positions or when instructors are considered for employment contract extension.

2. Overall Program Evaluation

The following evaluation procedures provide feedback on program quality:

- 2.1 Overall program evaluations are conducted by student representatives, especially fourth-year students.
- 2.2 Overall program evaluations are conducted by new graduates.
- 2.3 Evaluations are conducted in a meeting or seminar of instructors responsible for the curriculum, Curriculum Committee, instructors, and academic service officers.
- 2.4 Evaluations are conducted by eminent persons by using Program Reports.
- 2.5 Evaluations are conducted by graduates or other concerned parties.

3. Program Implementation Evaluation (According to Program Specifications)

Evaluation of key performance indicators as imposed in Program Reports, Section 7, Number 7 are conducted by instructors responsible for the curriculum, the Curriculum Administrative Committee, the College Committee, and Committee on Evaluation of Higher Education Quality, which includes academic experts within and outside the university.

4. Review of the Evaluation Results and Improvement

- 4.1 Information from Program Reports is presented to instructors responsible for the curriculum.
- 4.2 Instructors responsible for the curriculum and full-time instructors of the program summarize annual performance, review Program Reports, and present them to College Committee.
- 4.3 Full-time instructors of the program attend a meeting for reviewing program's performance and feedback from all parties involved. The meeting results will be used for revising and improving educational management and curriculum.