Course Syllabus

College/Faculty **Biomedical Engineering** **Department** -

Curriculum **Biomedical Engineering Program, Year 2020 Edition**

Section 1 General Information

BME385	Principles of Design and Development of Biomedical Engineering Innovation	3(3-3-6)

Co-requisite Course(s) -

Prerequisite Course(s) -

Semester 2/2024

Section 02, 021, 12

Categorization of Course

☐ Preparation Course

☐ General Education Courses

■ Specific Requirement Courses

☐ Free Elective Courses

Course Responsible Assoc.Prof.Nuntachai Thongpance Instructor

1	Assoc.Prof.Nuntachai Thongpance	■ Lecturer
2	Dr.Thanate Angsuwattanakul	■ Lecturer
3	Mr.Rawipol Chotikulnan	■ Lecturer
4	Assoc.Prof.Preya Anupongongart	■ Guest Lecturer
5	Asst.Prof.Dr.Pichit Bunkrong	■ Lecturer
6	Project Advisee	■ Lecturers

Place ■ On Campus ☐ Off Cumpas

Date of preparation 23 December 2024

Section 2 Course objectives and course components

1. Objective of Course

1) Students demonstrate a basic understanding of designing and constructing the basic structure of components of medical devices and/or healthcare technology.

2) Students can analyze problems and requirements from real workplaces to develop research proposals for the development of medical device and/or healthcare technology innovations to solve problems.

3) Students can use basic programs related to designing and simulating the operation of medical devices designed for presentation appropriately.

4) Students demonstrate knowledge and skills in preparing documents for intellectual property registration or guidelines for publishing academic works in a manner appropriate for the research project.

2. Course Description

Principles, concepts and engineering processes in medical device design or health care technology; algorithm development; computer modeling to explain working principles or complex engineering mechanisms; principles and procedures for certification of intellectual property; registration standards and product development commercialization processes; applications for problem solving obtained from business establishments Biomedical engineering in which students have practiced by providing a project proposal. The projects to be presented to the project committee with expert lecturers in the program and workplace personnel as consultants.

3. Number of hours per week for advising and academic counseling for individual students

.....5.....hours/week

☑ e-mail :nuntachai.t@rsu.ac.th

☐ Facebook :……

☑ Line :……

☐ Others .....

4. Course Learning Outcomes: CLOs :

1. Students demonstrate a basic understanding of designing and constructing the basic structure of components of medical devices and/or healthcare technology.

2. Students can analyze problems and requirements from real workplaces to create a research project proposal for the development of medical device and/or healthcare technology innovations to solve problems.

3. Students can use basic programs related to designing and simulating the operation of the designed medical devices to be used for presentations and answering questions appropriately.

4. Students demonstrate knowledge and skills in preparing documents for applying for intellectual property registration or guidelines for publishing academic work in a manner appropriate for the research project.

5. Students demonstrate skills and knowledge in teamwork, project planning, applying for ethics in human research, and presenting and answering questions correctly and appropriately.

Section 3 Learning Outcomes

Development of the standard learning outcomes in the following:

1. Morals and Ethics

●	Expected Outcomes	Methodology	Assessment
1.2	Discipline, punctuality, and responsibility towards oneself and society.	1. Lecture and give examples of case studies on related issues 2. Indirectly teach by being strict about discipline, punctuality, or other related aspects 3. Organize a project-based teaching process by finding problems from real workplaces	Evaluated from students' punctuality in submitting assignments according to the assigned time frame and responsibility in the assigned duties.
1.3	Have leadership and followership, be able to work as a team and resolve conflicts and prioritize.	1. Lecture and give examples of case studies on related issues 2. Indirectly teach by being strict about discipline, punctuality, or other related aspects 3. Organize a project-based teaching process by finding problems from real workplaces	1. Evaluate from the assigned work 2. Evaluate from responsibility, participation in group work, presentation of work and report results
1.5	Apply biomedical engineering knowledge and the social-dharma approach that adheres to ethical standards and professional ethics as the main principle and holds correctness as the main principle to fully solve the dynamic technical and social problems in various fields of the 21st century with creativity, imagination, confidence and responsibility.	1. Lecture and provide case study examples on related issues 2. Indirectly teach by being strict about discipline, punctuality, and ethics 3. Organize a project-based teaching process by finding problems from real businesses to develop innovations to solve problems for those businesses	1. Evaluate from the work and performance of the assigned tasks. 2. Evaluate from the behavior and expression of students during group work.

2. Knowledge

●	Expected Outcomes	Methodology	Assessment
2.1	Have knowledge and understanding of important principles and theories in the content studied.	1. Lecture and provide case study examples on related issues. 2. Indirectly teach by being strict about discipline, punctuality, and ethics. 3. Organize a project-based teaching process by finding problems from real businesses to develop innovations to solve problems for those businesses.	1.Evaluation from the oral presentation of the project topic by the project topic examination committee. 2.Evaluation from dissertation report, Chapter 1.
2.3	Be able to analyze, design, install, improve systems, tools or work in biomedical engineering to meet the requirements and needs.	1. Lecture and provide case study examples on related issues. 2. Indirectly teach by being strict about discipline, punctuality, and ethics. 3. Organize a project-based teaching process by finding problems from real businesses to develop innovations to	1.Evaluation from the oral presentation of the project topic by the project topic examination committee.

		solve problems for those businesses.	2.Evaluation from dissertation report, Chapter 1.
2.4	Be able to follow academic progress and evolution in biomedical engineering and understand the impact of medical tools and healthcare technology.	1. Lecture and provide case study examples on related issues. 2. Indirectly teach by being strict about discipline, punctuality, and ethics. 3. Organize a project-based teaching process by finding problems from real businesses to develop innovations to solve problems for those businesses.	1.Evaluation from the oral presentation of the project topic by the project topic examination committee. 2.Evaluation from dissertation report, Chapter 1.

3. Cognitive Skills

●	Expected Outcomes	Methodology	Assessment
3.1	Demonstrate critical and systematic thinking.	Organize the teaching process using projects as the basis for learning by assigning tasks related to innovation development to real workplaces where students go out to practice, so that students can plan and implement design and construction to solve such problems.	1.Evaluation from the oral presentation of the project topic by the project topic examination committee. 2.Evaluation from dissertation report, Chapter 1.
3.2	Able to search, interpret and evaluate information or biomedical engineering technology for creative problem solving.	Organize the teaching process using projects as the basis for learning by assigning tasks related to innovation development to real workplaces where students go out to practice, so that students can plan and implement design and construction to solve such problems.	1.Evaluation from the oral presentation of the project topic by the project topic examination committee. 2.Evaluation from dissertation report, Chapter 1.
3.3	Able to collect, study, analyze and summarize issues and needs in medicine and health care correctly.	Organize the teaching process using projects as the basis for learning by assigning tasks related to innovation development to real workplaces where students go out to practice, so that students can plan and implement design and construction to solve such problems.	1.Evaluation from the oral presentation of the project topic by the project topic examination committee. 2.Evaluation from dissertation report, Chapter 1.
3.4	Able to apply knowledge and skills to problem solving and actual work in biomedical engineering appropriately.	Organize the teaching process using projects as the basis for learning by assigning tasks related to innovation development to real workplaces where students go out to practice, so that students can plan and implement design and construction to solve such problems.	1.Evaluation from the oral presentation of the project topic by the project topic examination committee. 2.Evaluation from dissertation report, Chapter 1.

4. Transaction Skills and Responsibility

●	Expected Outcomes	Methodology	Assessment
4.1	Able to provide assistance and facilitate problem solving in various situations in the group, both in the role of a leader or in the role of a team member.	Organize the teaching process using projects as the basis for learning by assigning group work related to innovation development to real workplaces where students go out to practice, so that students can plan and practice designing and creating to solve the said problems.	1.Evaluation from the oral presentation of the project topic by the project topic examination committee. 2.Evaluation from dissertation report, Chapter 1.
4.3	Responsible for continuous development of learning, both personal and professional, learning about one's own emotional state, learning to work with others, learning techniques for asking for help or requesting information to use in work.	Organize the teaching process using projects as the basis for learning by assigning group work related to innovation development to real workplaces where students go out to practice, so that students can plan and practice designing and creating to solve the said problems.	1.Evaluation from the oral presentation of the project topic by the project topic examination committee. 2.Evaluation from dissertation report, Chapter 1.
4.4	Able to take the initiative in expressing issues in resolving situations, both personal and public, and expressing an appropriate stance for both oneself and the group.	Organize the teaching process using projects as the basis for learning by assigning group work related to innovation development to real workplaces where students go out to practice, so that students can plan and practice designing and constructing to solve the said problem, and present it to the project committee for consideration and approval of the project topic during the project and when the project is complete.	1.Evaluation from the oral presentation of the project topic by the project topic examination committee. 2.Evaluation from dissertation report, Chapter 1.

5. Numerical Analysis, Communication and Information Technology Skills

●	Expected Outcomes	Methodology	Assessment
5.1	Have skills in using the necessary tools currently available for work related to biomedical engineering.	Organize the teaching process using projects as the basis for learning by assigning group work related to innovation development to real workplaces where students go out to practice, so that students can plan and practice designing and constructing to solve the said problem, and present it to the project committee for consideration and approval of the project topic during the project and when the project is complete.	1. Evaluation from the oral presentation of the project topic, including the results of the computer simulation of the project proposal by the project topic examination committee. 2. Evaluation from the writing of the thesis report, Chapter 1
5.2	Be able to introduce problem-solving issues using mathematical information or applied statistics to related problems creatively.	Organize the teaching process using projects as the basis for learning by assigning group work related to innovation development to real workplaces where students go out to practice, so that students can plan and practice designing and constructing to solve the said problem, and present it to the project committee for consideration and approval of the project topic	1. Evaluation from the oral presentation of the project topic, including the results of the computer simulation of the project proposal by the project topic examination committee. 2. Evaluation from the writing of the

		during the project and when the project is complete.	thesis report, Chapter 1
5.3	Be able to use appropriate language and communication effectively both orally and in writing, choosing appropriate forms of presentation media.	Organize the teaching process using projects as the basis for learning by assigning group work related to innovation development to real workplaces where students go out to practice, so that students can plan and practice designing and constructing to solve the said problem, and present it to the project committee for consideration and approval of the project topic during the project and when the project is complete.	1. Evaluation from the oral presentation of the project topic, including the results of the computer simulation of the project proposal by the project topic examination committee. 2. Evaluation from the writing of the thesis report, Chapter 1
5.4	Be able to use technology, tools, equipment, software or the Internet for research, in communication to support work, such as interaction, expressing opinions, coordinating work, receiving and sending work.	Organize the teaching process using projects as the basis for learning by assigning group work related to innovation development to real workplaces where students go out to practice, so that students can plan and practice designing and constructing to solve the said problem, and present it to the project committee for consideration and approval of the project topic during the project and when the project is complete.	1. Evaluation from the oral presentation of the project topic, including the results of the computer simulation of the project proposal by the project topic examination committee. 2. Evaluation from the writing of the thesis report, Chapter 1

Section 4 Lession Plan and Assessment

Week	Topics/Description	Activity and Media	Hours	Instructor
1 (10/01/68)	Engineering principles, concepts and processes in the design of medical devices or healthcare technologies, standards, processes and testing methods, including commercial product development processes.	1. Lecture to provide knowledge 2. Assign students to present the topic to be designed related to the biomedical engineering project 1 3. Evaluate the results in the following subjects: - Medical problems and needs - Related biomedical engineering principles Used in problem solving Creating Gant Chart and/or Pert Diagram 4. Computer, Power point	5	Assoc.Prof.Nuntachai Thongpance
2-3 17,24/01/68	Algorithm development	1. Lecture and provide knowledge 2. Assign students to write the algorithm of the project that will be carried out, which is related to the implementation of the biomedical engineering project 1 3. Evaluate the results in the matter - Correctness and appropriateness of the algorithm structure and/or block diagram in various parts of the project 4. Computer, Power point	10	Dr. Thaneate Angsuwatanakul
4-7 31/01,7,14,21/02/68	Computer modeling to describe the working principles or mechanisms of complex engineering principles.	1. Assign students to design and create in various parts, including testing methods in various dimensions of the project, related to the regulations and standards related to the biomedical engineering project 1 by creating a computer model.	20	Asst. Prof. Rawipol Chotikunnan

Week	Topics/Description	Activity and Media	Hours	Instructor
		2. Describe and practice designing and creating a medical device model that students use in their project using a computer. 3. Evaluate the results in the following matters: - Correctness and appropriateness of principles, techniques for designing, testing and creating a medical device model using a computer. 4. Computer, Power point		
8: 24-28/02/68 : Term-Break				
9-11 (7,14,21/03/68)	Intellectual property registration process	1. Lecture 2. Teach by letting students practice writing patent application forms for the projects that the students do 3. Evaluate the results in the matter - Correctness and appropriateness of writing patent application forms 4. Computer, Power point	15	Assoc. Prof. Preya Anupongongart
12 (28/03/68)	Ergonomic principles related to design	1.Lecture and knowledge 2.Assign exercises on medical device design using ergonomic principles 3.Evaluation on medical device design principles using ergonomic principles 4.Computer, Power point	5	Assoc.Prof.Nuntachai Thongpance
13-15 4,11,18/04/68	Basic principles of research methodology and literature review	1. Lecture 2. Teach by letting students practice on the research project methodology and literature review 3. Evaluate the correctness and appropriateness of the research project methodology and literature review presented by students 4. Computer, Power point	15	Asst. Prof. Dr. Pichit Boonkrong
16 25/04/68	Review and meet with your advisor	Students meet with their advisors to consult and review and verify the correctness and appropriateness of 1. Correctness of the research project methodology, Chapter 1 2. Correctness of the documents according to the thesis writing form, Chapter 1 3. Correctness of the intellectual property registration form 4. Correctness and appropriateness of the design and creation of Animation to present for oral examination 5. Correctness and appropriateness of the method and content of the oral examination presentation 6. Computer, Power point	5	All advisors
17	Final exam for oral presentation of assigned medical device design	1. Students present the results of designing medical devices related to the implementation of the biomedical engineering		All Lecturers

Week	Topics/Description	Activity and Media	Hours	Instructor
	project.	project 1. 2. Evaluate the results in the following topics: 2.1 Process, methods and presentation skills 2.2 Identifying problems and origins in various dimensions of the designed medical devices correctly and comprehensively 2.3. Designing structures, block diagrams in various parts of the medical devices related to the identified problems correctly and appropriately 2.4 Designing testing methods in various dimensions of the medical devices designed in relation to relevant regulations and standards correctly and appropriately 2.5 Correctness and appropriateness of principles, techniques, design, testing and modeling of medical devices using computers correctly and appropriately 2.6 Planning the design project by creating Gant Chart and/or Pert Diagram correctly and appropriately 2.7 Patent/patent application form 3. Computer, Power point		
รวม			75	

2. Assessment Planning

Methods for measuring and evaluating learning outcomes	Week	Learning Outcome (%)																	Total proportion of measurement and evaluation (%)
		1.2	1.3	1.5	2.1	2.3	2.4	3.1	3.2	3.3	3.4	4.1	4.3	4.4	5.1	5.2	5.3	5.4	
Responsibility, honesty, academic ethics	All	5	5	2.5								2.5	2.5	2.5					20
Process, methods and skills of presentation and question-answering and teamwork	16														5	5	5	5	20
Problem solving, knowledge and ability to analyze problems to make proposals related to the problems and origins in various dimensions of the project correctly, comprehensively and appropriately, including the ability to plan the project correctly and appropriately, have initiative and creativity, in line with the Digital Transformation era.	16				5	5	5	5	5	5	5								35
Ability to track academic progress in biomedical engineering and writing a dissertation chapter 1	16						5										2.5	2.5	10
Knowledge and skills in creating computer-based project models accurately and appropriately.	16																5	5	10
Knowledge and skills in preparing for intellectual property registration	16								2.5								2.5		5
Total learning outcomes score		5	5	2.5	5	5	10	5	7.5	5	5	2.5	2.5	2.5	5	5	15	12.5	100
Proportion of learning outcomes		12.5			20			22.5				7.5			37.5				100

Grading

Grade	Score
A	80-100
B+	75-79
B	70-74
C+	65-69
C	60-64
D+	55-59
D	50-54
F	0-49

Section 5 Learning and Teaching Resources

1. Main Textbooks and Documents

1 . Claudio Becchetti, Alessandro Neri (2 0 1 3) . Medical Instrument Design and Development: From Requirements to Market Placements. A John Wiley & Sons, Ltd., Publication.

2. Lecture documents from the teachers responsible for teaching each topic.

2. Supplementary Textbooks

1. Peter Ogrodnik (2019).Medical Device Design 2nd Edition Innovation from Concept to Market.. Elsevier.UK. Academic Press.

2. Prof. Dr. Chusak Wechaphaet (1983). Medical equipment, design principles and applications; Siriraj.

3. Important Documents and information

Thesis Writing Form: https://bme.rsu.ac.th

Section 6 Assessment and Improvement of Course Operation

1. Course assessment strategies by students

Evaluated using standardized online assessments in the Rangsit University Intranet system.

2. Course assessment strategies

1) The responsible teacher/course instructor asks for opinions and suggestions from other instructors after planning the teaching strategies for the course.

2) Asking students about the effectiveness of learning from the methods used, using questionnaires or discussions with student groups during the semester by the instructor.

3) Evaluating students' learning from their behavior, expression, activities, and exam results.

3. Teaching Development

After the evaluation of teaching in Item 2, teaching has been improved by organizing brainstorming activities and find more information on how to improve teaching as follows:

3.1 Teaching and learning meetings between instructors in the course.

3.2 Use the results of learning assessment as information to improve teaching to be up to date and in line with the current national development situation.

4. Verification of the Achievement of Students

- ☐ Discuss with students
- ☐ Investigate from student behaviors
- ■ Grading and evaluation of learning outcome
- ☐ Comprehensive knowledge examination
- ☐ Learning outcome report
- ☐ Class evaluation / peer evaluation
- ■ Others: This course will verify student achievements in various aspects as summarized below.

1. The instructor in charge of the course assesses the consistency of the examination. to the learning outcomes according to the curriculum standard framework
2. The Standards Oversight Committee assesses the consistency of the examination with the objectives of the course.
3. Moral and ethical aspects Verification is based on behavior in the area of fraud in the examination.
4. Verification in all courses, both theory and practice, project work must be consistent with the learning assessment strategy. It is the responsibility of instructors to issue examinations or set up examination mechanisms and procedures.
5. Teaching plans are evaluated in relation to exam evaluation. Assessment of teaching and learning achievement from exam results by the program committee and/or the expert committee from within the institution.
6. There is verification from test scores. or assignments Teachers are assessed. and evaluation of teaching and learning by students.
7. The college Committee approves the assessment results of the course.

5. Conducting a review and planning to improve course effectiveness

From the assessment results and verify the achievement and effectiveness of the course, there is a plan to improve teaching and course details. to achieve more quality by improving the teaching of subjects in every semester or based on recommendations and results of verification of achievement standards.