มหาวิทยาลัยรังสิต

COURSE SPECIFICATION

College/Faculty: College of Biomedical Engineering
Program: Bachelor of Engineering in Biomedical Engineering, Curriculum Year B.E. 2568

SECTION 1 GENERAL INFORMATION

BME101 Introduction to Biomedical Engineering 1(0-3-2)
Co-requisite: –
Prerequisite: –
Semester: S/2569
Section: 11, 121

Course Type
☐ Preparatory/Foundation Course
☐ General Education Course
☑ Specific/Major Course
☐ Free Elective Course

Course Coordinator: Asst. Prof. Dr. Pichit Boonkrong	☑ Full-time Instructor	☐ Adjunct Instructor
Instructors: Assoc. Prof. Nantachai Thongpance	☑ Full-time Instructor	☐ Adjunct Instructor
Assoc. Prof. Dr. Nuttaphol Thanatchangsang	☑ Full-time Instructor	☐ Adjunct Instructor
Lect. Rawipon Chotikoolnan	☑ Full-time Instructor	☐ Adjunct Instructor
Asst. Prof. Dr. Pichit Boonkrong	☑ Full-time Instructor	☐ Adjunct Instructor
Dr. Lathika Tiaowongsuwan	☑ Full-time Instructor	☐ Adjunct Instructor
Lect. Anuchan Panaksri	☑ Full-time Instructor	☐ Adjunct Instructor
Prof. Dr. M.D. Chayanin Angthong	☑ Full-time Instructor	☐ Adjunct Instructor

Teaching Location ☑ On-site / Main Campus ☐ Off-site

SECTION 2 COURSE OBJECTIVES AND COMPONENTS

1. Course Objectives

1) To enable students to learn and understand the history, background, and various sub-disciplines of biomedical engineering.
2) To develop students' attitudes and sense of responsibility, preparing them for professional study in biomedical engineering at Rangsit University.

3) To enable students to gain real-world experience through observation and data collection in biomedical engineering research laboratories, including the processes and methods of applying biomedical engineering knowledge in practice, and to reflect upon and exchange ideas with peers and instructors in order to construct self-discovered conceptual frameworks about the profession.

4) To develop knowledge, skills, lifelong learning abilities, and the use of contemporary technology in the 21st century, in preparation for future study, practice, and professional careers.

2. Course Description

History and background of biomedical engineering; introduction to the interdisciplinary fields of biomedical engineering and their applications; principles of biomechanics; biomaterials; cellular and tissue engineering; prosthetics; biomedical devices; rehabilitation engineering; biomedical and health informatics innovation; clinical engineering; basic knowledge and skills regarding tools for computer modeling and animation necessary for solving biomedical engineering problems; ethics and professional conduct in the biomedical engineering profession.

3. Weekly Office Hours for Academic Consultation

Available: .....2..... hours/week

via e-mail

Facebook: College of Biomedical Engineering, Rangsit University

Line: Course Group

Social Media: as specified by the instructor

4. Course Learning Outcomes (CLOs):

1. Demonstrate knowledge of the history, significance, key principles, ecosystem, limitations, safety and hazard prevention, and the components of the various sub-disciplines of biomedical engineering.
2. Explain the application of relevant knowledge as a guideline for studying and developing technologies and devices for human health care.
3. Connect the role of engineering in medical diagnosis, treatment, and rehabilitation.
4. Explain the relationship between biomolecular principles and biomaterials, tissue engineering, and biomechanics.
5. Develop and create simple computer animations to illustrate an overview of biomedical engineering.

SECTION 3 STUDENT LEARNING OUTCOME DEVELOPMENT

The development of course learning outcomes according to the expected standard learning outcomes is as follows:

1. Linkage of CLOs with PLOs

This course focuses on the development of Program Learning Outcomes (PLOs) as follows: (Ref. RQF.2)

Table showing primary responsibility of CLOs toward PLOs (✓ = Primary relationship / responsibility)

CLO	PLO 1				PLO 2				PLO 3				PLO 4			
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3	3.4	4.1	4.2	4.3	4.4
1																
2					✓											
3					✓	✓										
4						✓										
5						✓		✓								

2. Alignment of CLOs with Standard Qualification Learning Outcomes (KSEC)

This course focuses on developing learning outcomes according to the Standard Qualifications (KSEC) as follows: (Reference: RQF.2)

Table showing alignment of CLOs with Standard Qualification Learning Outcomes (KSEC)

2.1 Knowledge (K)

CLO	K1: Demonstrate knowledge and ability to apply interdisciplinary knowledge in basic sciences, medical sciences, engineering, and information technology to solve relevant biomedical engineering problems.	K2: Demonstrate knowledge and ability to apply fundamental biomedical engineering knowledge meeting standards required by the Engineering Council and/or professional qualification institutes; able to work in teams as a collaborator, team leader, and/or entrepreneur with creative problem-solving skills, owner mindset, and commitment to ethical and professional standards.	K3: Demonstrate knowledge and ability to apply specialized knowledge in invention and/or development based on R&D for biomedical engineering, medical devices, biomedical and health informatics innovation, clinical engineering, medical materials and tissue engineering; with lifelong learning skills and strong dedication to continuously acquiring new knowledge and skills for advanced study.
1	✓	✓	
2	✓	✓	
3	✓	✓	
4	✓	✓	
5	✓	✓	✓

2.2 Skills (S)

CLO	S1: Demonstrate interdisciplinary skills in basic sciences, medical sciences, engineering, and information technology to solve relevant biomedical engineering problems.	S2: Demonstrate fundamental biomedical engineering skills meeting standards required by the Engineering Council and/or professional institutes; able to work in teams as collaborator, leader, and/or entrepreneur with creative problem-solving and commitment to ethics and professional standards.	S3: Demonstrate specialized skills in invention and/or development based on R&D for medical devices, biomedical and health informatics, clinical engineering, medical materials and tissue engineering; with lifelong learning skills and strong dedication to continuously acquiring new knowledge and skills for advanced study.
1	✓		
2	✓	✓	
3	✓	✓	
4	✓	✓	
5	✓	✓	✓

2.4 Character (C)

CLO	C1: Show leadership, inquisitiveness, ability to work with others, acceptance and understanding of individual differences, respect for human rights and dignity.	C2: Have a positive attitude toward working in the biomedical engineering system; a perspective on health care problems grounded in biomedical engineering; awareness of public benefits and social justice.	C3: Have empathy, selflessness, public-mindedness, and social responsibility.
1	✓	✓	
2	✓	✓	
3	✓	✓	
4	✓	✓	
5	✓	✓	✓

3. Teaching Strategies and Learning Outcome Assessment

1. Knowledge

PLOs	CLOs	Teaching Method	Assessment Method
PLO2.1	CLO2: Explain the application of relevant knowledge as a guideline for studying and developing technology and devices for human health care.	1) Use professional case studies to analyze and apply knowledge 2) Learn from experts or professionals with real-world experience 3) Use problem-based learning to develop systematic thinking	1) Short quizzes 2) Case study analysis assignments 3) Final examination
PLO2.1, PLO2.2	CLO3: Connect the role of engineering in medical diagnosis, treatment, and rehabilitation.	1) Organize learning activities in real environments, research labs, and/or health systems 2) Learn through direct experience in research labs and BIS Center 3) Use clinical case studies to integrate engineering, medical, and healthcare knowledge	1) In-class discussion and Q&A 2) Learning reflection journals 3) Final examination
PLO2.2	CLO4: Explain the relationship between biomolecular principles and biomaterials, tissue engineering, and biomechanics.	1) Flipped classroom learning through digital media 2) Group discussion activities to analyze and connect knowledge 3) Use visual models, animations, and concept visualization	1) Short quizzes 2) Assignments/worksheets 3) Final examination

2. Skills

PLOs	CLOs	Teaching Method	Assessment Method
PLO2.2, PLO2.4	CLO5: Develop and create simple computer animations to illustrate an overview of biomedical engineering.	1) Project-based learning through developing BME animation media 2) Team-based learning activities 3) Practical training in AI and multimedia production	1) Animation project assessment 2) Presentation 3) Rubric-based evaluation 4) Peer assessment

3. Ethics

PLOs	CLOs	Teaching Method	Assessment Method
PLO2.1, PLO2.4	CLO1–CLO5: Demonstrate responsibility and practice according to ethical principles, safety standards, and professional codes related to biomedical engineering in learning and work.	1) Discuss case studies on ethics and safety in biomedical engineering 2) Discuss the impact of medical devices and health technology on patients and society 3) Integrate ethical principles, responsibility, and professional standards into animation projects	1) Reflection journals on ethics and safety 2) Behavior and responsibility assessment during group work 3) Rubric evaluation on ethics, responsibility, and professional standards

4. Character

PLOs	CLOs	Teaching Method	Assessment Method
PLO2.4	CLO2–CLO5: Demonstrate responsibility, interpersonal skills, and ability to communicate and collaborate with others in developing biomedical engineering work.	1) Team-based learning activities 2) Collaborative learning activities 3) Presentation and reflection activities	1) Peer assessment 2) Teamwork rubric evaluation 3) Behavioral assessment on responsibility, communication, and participation

SECTION 4 TEACHING PLAN AND ASSESSMENT

1. Teaching Plan

Week	Topic / Details	CLO	Learning Activities and Materials Used	Hours	Instructor
1 9/6/69	History, Background, Significance, and Overview of Biomedical Engineering	CLO1	1. Brainstorming activity: "What is Biomedical Engineering?" 2. Mind mapping to connect knowledge 3. Learning reflection	3	Assoc. Prof. Nantachai and team
	Interdisciplinary and Role of Biomedical Engineers	CLO1, CLO2	1. Study case studies on the role of biomedical engineers 2. Career pathway analysis activity 3. Group discussion	3	Assoc. Prof. Nantachai and team
2 15/6/69	Principles of Biomechanics, Biomaterials, and Prosthetics	CLO1, CLO4	1. Pre-study through digital media 2. Visual aids, models, and case studies 3. Group discussion	3	Asst. Prof. Nattaphol and team
	Green Hospital and Sustainable Environmental Management	CLO1, CLO3, CLO4	1. Lecture 2. Brainstorm to design Carbon Footprint reduction plans 3. Knowledge sharing and idea presentations: "Dream Green Hospital"	3	Lect. Anuchan and team
3 22/6/69	Exploring the World of Biomedical Engineering (Clinical Engineering, Medical Devices, Entrepreneurship)	CLO2, CLO3	1. Academic seminar by biomedical engineers 2. Ideas and experience sharing by experts 3. Q&A and knowledge exchange	3	Alumni of College of Biomedical Engineering, Rangsit University
	Technology Literacy and Preparation for Biomedical Engineering Students	CLO1, CLO2, CLO3, CLO4	1. Content review game 2. Summary mind map 3. Group discussion	3	Prof. Chayanin, Dr. Lathika, Asst. Prof. Pichit

4 7/7/69	Biomedical Engineering Laboratory Visit 1	CLO1, CLO2, CLO3, CLO4	1. Lab orientation by senior students 2. Hands-on practice with equipment, chemicals, biomaterials, or simulation programs at activity stations 3. Brainstorming and integrative knowledge summary	3	Lab instructors, Asst. Prof. Pichit and team
	Biomedical Engineering Laboratory Visit 1 (continued)	CLO1, CLO2, CLO3, CLO4	1. Lab orientation by senior students 2. Hands-on practice with equipment, chemicals, biomaterials, or simulation programs at activity stations 3. Brainstorming and integrative knowledge summary	3	Lab instructors, Asst. Prof. Pichit and team
5 14/7/69	Biomedical Engineering Laboratory Visit 2	CLO1, CLO2, CLO3, CLO4	1. Lab orientation by senior students 2. Hands-on practice at activity stations 3. Brainstorming and integrative knowledge summary	3	Lab instructors, Asst. Prof. Pichit and team
	Biomedical Engineering Laboratory Visit 2 (continued)	CLO1, CLO2, CLO3, CLO4	1. Lab orientation by senior students 2. Hands-on practice at activity stations 3. Brainstorming and integrative knowledge summary	3	Lab instructors, Asst. Prof. Pichit and team
6 21/7/69	Group Project: BME Animation 1	CLO5	1. Data integration and brainstorming 2. Story design and storyboard development 3. Production and critical presentation	3	Lect. Rawipon and team
	Group Project: BME Animation 1 (continued)	CLO5	1. Data integration and brainstorming 2. Story design and storyboard development 3. Production and critical presentation	3	Lect. Rawipon and team
7 23/7/69	Group Project: BME Animation 2	CLO5	1. Data integration and brainstorming 2. Group-based project development 3. Application of software	3	Lect. Rawipon and team

			for animation and conceptual presentation		
	Group Project: BME Animation 2 (continued)	CLO5	1. Data integration and brainstorming 2. Group-based project development 3. Application of software for animation and conceptual presentation	3	Lect. Rawipon and team
8 4/8/69	Oral Project Presentation	CLO1–CLO5	1. Project presentation and academic communication 2. Q&A and questioning 3. Reflective and critical peer evaluation	3	All instructors
	Final Examination: Comprehensive review of semester content	CLO1–CLO5	1. Multiple choice examination	3	All instructors
Total	**45**				

2. Learning Assessment Plan

PLO	CLO	KSEC Assessed	Quiz/In-class Activities 15%	Case Study/Reflection 15%	Participation & Learning Behavior 10%	Animation Project & Presentation 35%	Final Exam 25%	Total	Assessment Weeks
PLO2.1	CLO1, CLO2	K1, K2, S1, S2, E1, E2, C1, C2	5	4	2	5	4	20	1–8
PLO2.1, PLO2.2	CLO3	K1, K2, S1, S2, E1, E2, C1, C2	5	4	2	5	7	23	3–8
PLO2.2	CLO4	K1, K2, S1, S2, E1, C1, C2	5	4	3	5	7	24	4–8
PLO2.2, PLO2.3, PLO2.4	CLO5	K1, K2, K3, S1, S2, S3, E1, E2, C1, C2, C3	–	3	3	20	7	33	7–8
Total			**15**	**15**	**10**	**35**	**25**	**100**	

Assessment Notes:

• **Quiz/In-class Activities:** Measures foundational knowledge, comprehension, and ability to connect course knowledge.

• **Case Study/Reflection:** Measures analytical thinking, learning reflection, and understanding of the biomedical engineer's role.

• **Participation & Learning Behavior:** Measures responsibility, collaboration with others, and individual character.

• **Animation Project & Presentation:** Measures application of knowledge, creative skills, communication, teamwork, ethics, and responsibility.

• **Final Examination:** Measures achievement in knowledge and comprehension of the overall field of biomedical engineering.

Additional Assessment Conditions:

• Students will be evaluated only if they attend at least 80% of total class hours.

• Students who score below 50% will be considered to have failed the course (Grade F).

Grade Criteria:

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

Grievance Conditions:

• Students may file grievances regarding teaching, learning, and course assessment through their academic advisor or year-level advisor.

• Students may file grievances through the program director or dean.

• Students may file grievances through the university's official grievance channels using the complaint form from the college secretariat.

SECTION 5 TEACHING AND LEARNING RESOURCES

1. **Main Textbooks and Documents:**

• Nantachai Thongpan. Lecture Notes for BME101: Introduction to Biomedical Engineering. College of Biomedical Engineering, Rangsit University, 2568.

• Rawipon Chotikoolnan. Teaching Document on Animation Design Fundamentals. College of Biomedical Engineering, Rangsit University, 2566.

• Rawipon Chotikoolnan. Teaching Document on Digital Media Production Process. College of Biomedical Engineering, Rangsit University, 2566.

• Rawipon Chotikoolnan. Teaching Document on Fundamentals of 3D Animation Creation. College of Biomedical Engineering, Rangsit University, 2566.

• Enderle, J. D., & Bronzino, J. D. Introduction to Biomedical Engineering. 3rd ed. Academic Press/Elsevier, 2011.

2. **Supplementary Documents and Information:**

• Chuchat Pintaviroch et al. Fundamentals of Biomedical Engineering. Biomedical Engineering Association, 2555.

• Bronzino, J. D., & Peterson, D. R. Biomedical Engineering Fundamentals. 2nd ed. CRC Press/Taylor & Francis, 2014.

• Poonsakdee Thanapanpanich. 3ds Max for Beginners. Nonthaburi: Lucky Books, 2561.

• Somrak Pariyawatee. Creating Multimedia Online 2D Animation Learning Materials. Bangkok: SE-ED Education, 2560.

3. **Recommended Documents and Information:**

• Elsevier/ScienceDirect website and database for biomedical engineering books and articles.

• CRC Press/Taylor & Francis website and database for Biomedical Engineering Fundamentals.

• Academic journal databases in biomedical engineering: ScienceDirect, IEEE Xplore, SpringerLink, and PubMed.

• Websites of related professional associations: IEEE Engineering in Medicine and Biology Society (EMBS) and Thai Biomedical Engineering Association.

• Licensed online learning resources for digital media creation, animation, and 3D modeling.

SECTION 6 COURSE EVALUATION AND IMPROVEMENT

1. **Strategies for Student Evaluation of Course Effectiveness:**

☑ Student teaching effectiveness evaluation
☑ Course evaluation questionnaire
☑ Group discussion between instructors and students
☑ Reflection from student behavior
☑ Suggestions via online channels created by instructors for student communication
☐ Other: ..... (specify)

2. **Strategies for Learning Management Evaluation:**

☑ Instructor evaluation form
☑ Student reflection
☑ Examination results
☑ Verification of learning outcome assessment results
☑ Evaluation by the Academic Standards Committee
☑ Teaching observation by co-instructors
☐ Other: ..... (specify)

3. **Mechanisms for Improving Learning Management:**

☑ Teaching and learning seminars
☑ Classroom and non-classroom research
☑ Other: Curriculum design process using Backward Curriculum Design (BCD) (AUN2.2)

4. **Process for Verifying Student Learning Outcomes:**

☑ A committee within the department reviews student learning outcome assessments, including examination papers, grading methods, and behavioral scoring.
☑ Verification of grading of student work by departmental and faculty committees.
☑ Verification of grading through random sampling of student work by instructors or other qualified persons not in the program.
☐ Other: ..... (specify)

5. **Course Effectiveness Review and Improvement Planning:**

☑ Update the course annually based on recommendations and verification results from item 4.
☑ Update the course annually based on student evaluation of instructors.
☐ Other: ..... (specify)